System Innovation as Synchronization

innovation attempts
in the Dutch traffic management field

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"Unhappily, the limitations on our 'initiative' in any situation are seldom equally apparent from within and from without." (Vickers, 1965, 14)

A4 Leiderdorp (Min. V&W)

1.0 Introduction: Systemic problems

By the end of July 2007, the Dutch national news bulletin featured an item on what has become the most famous highway of the Netherlands, the A4 (NOS, 2007a). Connecting the two mainports of Amsterdam and Antwerpen, this highway serves an important access function in the congestion-ridden and densely populated Randstad metropolitan area[1]. Its famous, or rather infamous, status the road derives from the situation displayed in figure 1.1: Remarkably, it is interrupted at three sections. Plans to have the road segments connected have been around for decades: The most northern missing link has been subject to debate even since the 1950s, yet was dismissed for its adverse effects on the surrounding natural area 'Midden Delfland'. In 2008 decision-making on this case was temporarily halted, pending further research on possible adverse effects[2].

Figure 1.1 A4 Highway and its 'missing links'. (Rijkswaterstaat)

The news bulletin did not concern one of these missing links, however. It involved the segment between Leiden and the Burgerveen intersection, appearing prominently on the 'congestion charts'. Recognizing it as a bottleneck in the national road network, the Ministry of Transport and Water Affairs therefore sought to add a lane in both directions. As usual, the measure was not decided upon, let alone implemented, overnight. Intensive negotiations with local authorities yielded a package deal including additional measures to dampen adverse effects, and in 2006 the construction works could actually start. One year later, the news bulletin stated the works to be terminated immediately however, due to a verdict of the Court of Appeal for administrative law: NO_x emissions could be expected to exceed emission ceilings, even in case of a reduced 80 km/h speed limit. Except for the northern part of the stretch already built, the old 2-lane situation would therefore be maintained - unless it be demonstrated convincingly that reconstruction would be possible within the confines of air quality standards. Unsurprisingly in the light of widespread concerns for congestion, the news caused dismay about the failure to solve the bottleneck situation. On the other hand, Friends of the Earth[3] were satisfied to see their appeal to the 2005 Air Quality Act being acted upon, protecting citizens from excessively polluted air.

Eventually the Transport minister enjoyed his finest hour in September 2009, cutting the first sod. The lane addition would be implemented with the road below ground level. Dressed in construction worker's gear, the minister presented the project as a symbol for

[1] The function of the road, and the definition of the problem, are not naturally given but accorded. See Ch.5 for a more elaborate account of the accessibility problems sketched here.

[2] In September 2010, the Transport minister was proud to announce a breakthrough in providing for the Midden Delfland segment.

[3] 'Milieudefensie' in Dutch. See also Ch.4 for their actions to combat traffic-related health hazards.

a decisive approach to tackle bottlenecks in the highway network. The special Urgency Act served to break through administrative deadlocks, and speed up decision-making on infrastructural measures[4]. As the minister indicated, the Leiden-Burgerveen expansion decision-making process could learn us a lot about contemporary implementation problems in road construction: The earlier verdict against road enlargement only added to the picture of the A4 as a never-ending Babylonian project, a landmark of governmental impotence.

The difficulty to implement this seemingly straightforward road construction may be remarkable, yet ongoing decision-making on the A4 should not be mistaken for a mere lack of decisiveness. The 'implementation problems' were by no means exceptional: A4 history suggests a more general difficulty to reconcile transport ambitions with environmental standards and protection of spatial quality. Other than pinpointing administrative inertia, the lesson drawn here is that the cumbersome lane addition was only an instance of a more general problematic, reasserting itself over and over again. In other words, instead of slipping into discussions about the resolution of incidental local bottlenecks, it is suggested to consider these bottlenecks as manifestations of an even more challenging *systemic* problem.

'*There are structural, systemic societal problems'.* This proposition is at the basis of the KSI research program[5] through which this research project was funded. It incites a search for ways to better understand and meet these particularly persistent problems, perceived to occur not only in the mobility domain. *How can they be detected and diagnosed? What is required for their resolution? And, considering their encompassing, compounded and enduring nature, how can their resolution by the many actors involved be governed?* In the following it is exposed how these and related questions have been raised throughout the process of rapid modernization, giving rise to heated debates and contested practices. Especially the attempted responses through holistic planning have met with fierce criticisms: Nevertheless there is a recent resurgence of holistic approaches to systemic problems. The quest for system innovation, the focal point for this study, is a most prominent example of these.

This introductory chapter serves to specify research aims and questions for investigation of system innovation. The system innovation debate is provided with a historical canvas through Karl Mannheim's influential account of 'reconstruction'. This holistic approach to societal planning he developed already in the 1930s. Later reflection on the practice and theory of planning brought forward several flaws of his 'reconstruction' however: Acknowledgement of the polycentric makeup of society had planners understand that identification of 'systemic' problems' is neither obvious nor innocent, and that planned resolution of those is difficult **(1.1)**. The antitheses to reconstruction were not the end of history, however: The current quest for system innovation and societal transitions to sustainability can be considered as a revitalization of 'reconstruction'. The concept of 'transition management' illustrates how this is done by thinking through society for its complexity **(1.2)**. Critics have pointed out several tensions in the attempted synthesis, however. On the one hand suspicions have been raised that transition management is merely hiding its social engineering traits, rather than parting with those. On the other

[4] http://www.verkeerenwaterstaat.nl/actueel/videos/spoedaanpakwegenvanstart.aspx, accessed 21/03/2010

[5] Knowledge network on System Innovations and Transitions.

hand, reflection on system innovation practice has yielded observations, questions and research agendas that allow for targeted refinements. 'System innovation in the making' is indeed a promising avenue for further research, approaching the quest for system innovation critically without abandoning it altogether **(1.3)**. Following the calls for research into the contextual embedding of system innovation initiatives, the 'transcendental temptation' is taken up as a challenge. The research aim is to gain understanding of the reception of transformative initiatives, and of the scope for situated actors to foster the emergence of system innovation. The 'immanent' approach taken implies a shift of perspective, conceiving of contextual embedding as a 'two-way street'. Following the emergence of system innovation through the eyes of many, careful observation can then inform a strategic handling of innovation attempts' selection environments **(1.4)**. Having established research aims and research approach, the empirical focus is specified. Revisiting the introduced systemic mobility problems through the subsequent theoretical discussion, the traffic management action field is selected as a particularly interesting mobility subsystem **(1.5)**. The final section outlines the strategy to answer the research questions. However promising in the light of recent recommendations, the shift towards an immanent perspective may go at a price: The focus on situated agency may insightfully raise attention to the various system understandings of actors, but relinquishes a substantive understanding of the 'system' to be innovated. This somewhat relativistic attitude bears research challenges that will have to be dealt with in theory, methodology and the investigation process itself **(1.6)**.

1.1 Mannheim's 'reconstruction': A holistic approach to systemic problems - and its flaws

The quest for system innovation signals a new way of dealing with urgent societal challenges, but it also constitutes in many ways a *re*invention. In order to develop a good understanding of its strengths, its tensions and also its spirit, it is instructive to briefly revisit some of its ancestors first. A most inspiring example is Karl Mannheim's epic 'Man and Society in an Age of Reconstruction' (Mannheim, 1940).

How to solve structural, systemic problems (such as those of the A4 case)*?* Mannheim raised this question already before the rapid economic development of the post-WW II era. He signaled that modernizing society started to face problems of as yet unknown proportions, and of an essentially different nature than before. The stage of development reached he perceived to have several structural characteristics. Crucially, he perceived society to harbor more and more interdependencies. These interdependencies, and the concomitant 'increasing density of events', made it more vulnerable to disturbances (50). The capacity to deal with this vulnerability he found to be lagging behind, however: Essentially, Mannheim diagnosed the modernization process to be plagued by 'maladjustments' between interdependent societal sectors and actors. *"At the present stage of development the successful organization of society cannot be left to chance. Prevailing trends cannot be successfully influenced or even deflected in the spirit of 'muddling through'. There is no reason why, as the pressure of circumstances increases and the menace to democratic civilization becomes more and more evident, our habits of thought should not be transformed. If we are to direct the social forces effectively we must not remain absorbed in the continued pursuit of short-run interests. The new form*

of policy can only succeed at a much higher level of consciousness, a consciousness with a taste for experiment." (Mannheim, 1940, 7).

These 'maladjustments' required specific measures, he stressed. 'Rational direction' would be indispensible. 'Muddling through' would not do, not matching the structural nature of the 'prevailing trends'. As a necessary antidote to the systemic problems of modern societies he envisaged a holist approach of societal planning, while steering clear of the totalitarianism that was on the rise in his time[6]. This 'reconstruction' he described as *'replacing the wheels of a train while it is in motion, rather than rebuilding a house on new foundations'* (12). He argued for a way of thinking beyond the one-dimensional, linear focus on control of singular institutions: 'Planned thinking', involving the deliberate regulation and intelligent mastery of the *relationships between institutions* (152). Society thus conceived of as a changing composite whole, he would assess the recurring implementation problems of A4 construction as results from 'maladjustment' between separately governed societal needs. Adequate responses would critically require planning.

Mannheim's 'planned thinking' shared the positivist belief in rationality as a way out of authoritarianism and chaos: Against the cruelty and irrationality of ideologically-driven rule, scientific reason was the antidote[7]. Beside this shared commitment to rational direction, he did not share the positivist belief in analytical decomposition of society into facts. This approach of meticulous measurement and survey-before-plan he valued, but eventually he considered it to fall short. Instead, the planner's task would crucially involve the identification of the main driving forces in a given situation, the 'principia media' (178). Comprehensive grasp of these principia media the planner need not aspire to, he stressed however. His holistic approach was modest: *"The essential attitude of the planning age seems to be a synthesis of these two types of approach. Once more it displays the courage to intervene in the interplay of fundamental forces; on the other hand it inherits something of the humility of the religious mind in that it does not pretend to act as a creator of these forces, but rather as a strategist, who only watches over the factors at work in society in order to detect the new possibilities which are coming to the surface at the proper moment, and to reinforce them at those points where vital decisions must be made."* (190). This strategic attitude marked Mannheim's 'reconstruction'; holistic, but without aspirations to encompassing control. He further emphasized that planned thinking was about coordination, not about homogenization. In the end, it would be up to the planner to make this subtle but politically essential difference (263).

Responding to the growing interdependencies of 'mass society', Mannheim's plea for 'reconstruction' became a planner's bible. (And as it is treated here, it was a pioneering work in the quest for solutions to systemic societal problems). As mentioned, the holistic approach differed from positivist approaches that atomized the world into an object ready for 'social engineering'. Since their pre-WWII development both planning approaches have undergone heavy criticisms and amendations, however. By now, 'social engineering' has become a pejorative expression: The social, unlike the

[6] Mannheim resisted the idea that, ultimately, the structural problems should be solved by nothing less than a revolution (see also Unger, 2001), and establishment of a radically new order. Mannheim strongly rejected the communist way of tackling structural problems.

[7] This faith in scientifically secured societal progress and the associated critical spirit has been immortalized in the works of Sir Karl Popper.

technical, is not something to be *engineered*. And even when Mannheim was fairly modest in his claims about the possibilities for holist planning, subsequent analyses have given ground for even less optimism about the scope and feasibility of comprehensive planning. To contemporary readers, his metaphor of 'replacing the wheels of a train in motion' may still appear as mechanistic, insufficiently responsive to societal complexity and plurality:

Just as Mannheim responded to perceived changes in the nature of societal problems, later diagnoses led others to reconsider his planned 'reconstruction'. In 1973 Rittel & Webber signaled a new kind of societal problems to have emerged: *"But now that these relatively easy problems have been dealt with, we have been turning our attention to others that are much more stubborn. The tests for efficiency, that were once so useful as measures of accomplishment, are being challenged by a renewed preoccupation with consequences for equity."* The assertion of more pressing 'stubborn' problems roughly coincided with Mannheim's analysis. But they continued: *"The seeming consensus, that might once have allowed distributional problems to be dealt with, is being eroded by the growing awareness of the nation's pluralism and the differentiation of values that accompanies differentiation of publics. The professionalized cognitive and occupational styles that were refined in the first half of this century, based in Newtonian mechanistic physics, are not readily adapted to contemporary conceptions of interacting open systems and to contemporary concerns with equity. A growing sensitivity to the waves of repercussions that ripple through such systemic networks and to the value consequences of those repercussions has generated the recent reexamination of received values and the recent search for national goals."* (Rittel & Webber, 1973, 156). Similar to Mannheim, they considered the methods to deal with the 'relatively easy problems' insufficient to deal with the 'stubborn' ones. For the latter, they coined the term 'wicked problems':

'Wicked' problems Rittel & Webber distinguished from 'tame' problems by their elusiveness to efficiency-led approaches, the many interdependencies between societal systems preventing such 'Newtonian' approaches from being effective - similar to Mannheim's emphasis on interdependencies and 'maladjustments'. Yet moreover, they also noted the 'waves of repercussions' accompanying intervention in systemic problems. Interventions could create problems *by themselves*. The 'wicked problems' cast doubts on the planner's ability to grasp of the 'principia media' at work in a certain situation: The very problem was that the problems were essentially ill-defined, relying upon 'elusive political judgment for resolution' (160). The assertion of 'wicked' problems further emphasized the shaky knowledge basis for intervention. The main thrust of the assertion, however, resided in the emphasis on political judgment. To be sure, this political dimension to planning was not altogether neglected by Mannheim, as testified by his distinction between coordination and homogenization. Thirty years later however, the desired non-homogenizing coordination proved to be far more problematic. Society had changed: Rising material standards, individualization, and democratization had superseded Mannheim's 'mass society'. In a diversified and individualized society, the public was generally more inclined to assert its own views on the needs for coordination. Rittel & Webber indicated the very diagnosis of problems to be contested, and in need of argumentation (see also Fischer & Forester (1993) on this 'argumentative turn').

Apart from Rittel & Webber's emphasis on the 'wickedness' of many societal problems, the ground for Mannheim's 'reconstruction' was further eroded through various other accounts. Either on the basis of evaluation of planning practices or through reflection on its underlying assumptions, the very holistic approach became identified as flawed. It became held practically impossible, and even if it were, politically unfeasible: Noteworthy is Herbert Simon's work in behavioural decision-making theory, showing practical rationality to be unavoidably bounded. In an insightful overview Meadowcroft (1997) also discusses Hayek, Wildavsky and Lindblom as providers of crucial 'meta-critiques of planning': Comprehensive planning would inevitably fail for its too high hopes on coordinating dispersed knowledge, for its misguided belief in progress, for its unrealistic requirements regarding knowledge of causal mechanisms, for its impossible aim to transcend conflicting goals, for its impossible aspiration for complete analysis, and for its lack of attention to the actual shaping of planning on the ground (Meadowcroft 1997, 431-439, see also Grin, 2010, 223/224). On top of the empirical implementation studies that showed disenchanting accounts of planning in vivo, there were furthermore the critical-theoretical attacks on planning as a vehicle for systematic oppression – its appeals to rationality and progress being challenged as smokescreens for vested interests and elitist visions (Adorno & Horkheimer (1981), Young (1990)).

Taking these criticisms together, not much was left of Mannheim's plea for 'reconstruction'. In a last effort to save rational planning from the fire, planning theory moved from an object-centered to a decision-centered approach (Faludi, 1986). Instead of searching to establish 'principia media' in systemic problems, i.e. in the object of planning, attention shifted to the problem of decision-making under uncertainty. Planning became subject-oriented, or rather, *subjects*-oriented, responding to what public administration and political science research had asserted as a new reality for planning: Society had essentially become more dynamic, diverse and complex. The 'polycentric' condition challenged a political ontology in which government agencies dominated political life. The new order was identified to be made up of policy networks, a variety of both public and private actors clustering around certain policy issues (Kickert et al. (1997), Kooiman (2003), Koppenjan & Klijn (2004)). A significant consequence of the polycentric shift was that the substance of planning, such as Mannheim's 'maladjustments', tended to evaporate in the dynamics of the multi-actor interactions – all with their particular perceptions on the problem to be solved, and on its resolution. All in all, this age of 'networked deliberation' was a culmination point in a steady divergence away from holist 'reconstruction'. The following table summarizes this history:

Aspect / Planning approach	**'Reconstruction' (1940)**	**'Wicked problems' (1973)**	**'Networked deliberation' (1990s)**
Holism/ Comprehensiveness	holism required	holism required, but hardy possible	holism impossible, not required
Knowledge of 'principia media'	crucial, but limited	limited (bounded), not crucial (ambiguity)	very limited, not important
Planning Subject	planner	against technocratic planning	polycentric society, networks
Substance/nature of problems	systematic problems, 'maladjustments'	wicked, ill-defined	process prevails

Figure 1.2 'Reconstruction' and its criticisms/modifications

1.2 The quest for system innovation and societal transitions: 'Reconstruction' revitalized

1.2.0 Reconstruction' beyond repair?

Considering the diminished scope for planned solutions to systemic problems, Mannheim's venture may seem beyond repair. Commenting on the stage here described as 'networked deliberation', also Meadowcroft (1997) sees little scope for 'reconstruction' towards sustainable development – the issue he signals to revive attention to systemic problems. *"What does this new governance literature suggest about the project of planning for sustainable development? At first glance the obvious conclusion would appear to be that- in a more turbulent and complex social and political context, where the steering capacity of national governments is being eroded, where policy is increasingly being made, and services provided, by 'self-organising' networks, and where transnational decision-making is of growing significance – the quest for sustainable development will still be more elusive than suggested by the most pessimistic of traditional planning sceptics."* (443).

The flaws to 'reconstruction' could not kill its spirit, nor did societal changes completely undermine its (sophisticated) application. In the first place, the flaws of planning spurred a quest for new kinds of governance and planning to incorporate the painful lessons learned. The turn to decision-oriented, argumentative planning and the acknowledgement of an increasingly differentiated, dynamic and complex world led to 'new governance' (Meadowcroft, 1997) and a 'second generation of planning' (Voß et al., 2009, 279). Key characteristics of this broad set of steering approaches are the thorough rejection of blueprint planning, precaution against the unintended side-effects of development plans, a co-evolutionary rather than linear-determinist model of societal development, participation of stakeholders and non-experts, network deliberation, and organization of learning processes. They typically presuppose a diverse and polycentric society, rejecting the homogenizing view of a 'mass society': Problems and solutions are accorded provisional status, to be negotiated amongst shareholders and stakeholders. And as problem resolution takes place within dynamics that can be grasped to only a limited degree, a key quality of planning becomes to maintain flexibility under deep uncertainty. These characteristics echo Mannheim's humble spirit vis-à-vis the possible knowledge and mastery of principia media – they do indicate a fundamental break with positivist 'social engineering', however.

In the second place, new systemic problems were perceived, and this is what incited the revitalization of holist 'reconstruction'. These problems concerned other societal challenges than the societal disintegration feared by Mannheim. Otherwise they were similar in the structural, deep-rooted nature accorded to them. The systemic problems gaining particular attention were related to the unsustainable development of modern societies: Unlikely to preserve the means to cater for the needs of future generations, and insufficiently keeping development within environmental constraints. Concrete examples of these sustainability challenges are the depletion of critical resources such as fossil fuels, the pollution of air, water and soil, the marginalization of populations, climate change, and the introduction of incontrollable and long-term risks. As has been stressed by various authors however, sustainability concerns ongoing development, and

the associated substantive problems will change. Even for that reason alone[8] the systemic problems gathered under the 'sustainability' umbrella are hard to enumerate as distinct and clearly-bounded problems. In fact, this ill-defined character is what they have in common. They transgress geographical boundaries, often involve both state and market failure, unfold over long time frames, and can often be traced back to actions that once constituted problem *resolutions*.

As Meadowcroft (1997) indicated above, the combination of only more elusive systemic problems and decreasing scope for comprehensive planning seems to offer little hope. Yet beyond this bleak assessment, he argues why the scope for revitalized 'reconstruction' may actually have widened: *"…-the quest for sustainable development will be still more elusive than suggested by the most pessimistic of traditional planning skeptics. Yet this does not necessarily follow. For it can be argued that the essential character of the* environmental problems *that lie at the core of the challenge of sustainable development* corresponds more closely with these emerging patterns of governance *than they ever did with the hierarchical, sovereignist, conceptions which have dominated twentieth century politics."* (443). In other words, a historic match may have been reached between the complex shape of the systemic problems at hand, and the complex institutional constellation through which to address them.

Acknowledgement of these twin 'complexities', i.e. of the objects and the subjects of planning, is at the basis of the quest for system innovation this thesis seeks to contribute to. Strikingly similar to Mannheim and Rittel & Webber's reflections on contemporary problems, this quest starts from the idea that conventional problem-solving will fall short in the face of systemic problems. This would amount to 'reformist tinkering' (Unger, 2001), or to 'rearranging the deck chairs while the Titanic is sinking'. Instead of incremental system *improvement*, the quest for system innovation urges for more radical changes, or even for societal transitions. In the following it is exposed how these notions were developed through an elaborate synthesis between different bodies of knowledge, with the developing complexity theory as a crucial integrator. While acknowledging ongoing development in these separate strands and the existence of other integrative attempts, the exposition focuses on the concepts of sustainability transitions **(1.2.1)**, system innovation **(1.2.2)** and on transition management as the 'revitalized reconstruction' to deal with these challenges **(1.2.3)**.

1.2.1 Sustainability transitions

From the 1990s onwards, the awareness mounted that the densely populated and highly industrialized Netherlands were facing problems that seemed to persist. Next to the mobility sector as introduced in the opening section, several other societal sectors seemed to be suffering from such 'persistent' problems (Dirven et al. (2002), Rotmans (2003), Meadowcroft (1997)): Energy, agriculture, healthcare, water management. These systemic problems are '*rooted deeply in our societal structures and need to be addressed at that structural level'* (Rotmans et al., 2007, 16). Characteristics shared by this special class of problems are the following: Lasting for decades, limited steering capacity, lengthy debates over incremental changes, governed by a stable, fixed group of actors and institutions, unacknowledged complexity, supplier dominance over end-users, 'economism', and lack of a coherent long-term vision (Rotmans (2006), Rotmans et al.

[8] Moreover, as will become clear throughout this thesis, what is sustainable, and what is not, is susceptible to widely varying interpretations.

(2007)). Resolution of these deep-rooted systemic problems would ultimately require entire 'societal transitions': A transition is a structural change of a societal (sub-)system that is the result of a co-evolution of economic, cultural, technological, ecological and institutional developments at different scale-levels. Such shift from one dominant constellation to another generally takes one or two generations, involving a fundamental change in the structure, culture and practices that make up the societal system's 'regime' (Rotmans (2006, 11), Rotmans & Loorbach (2010, 108-109)).

Conceptualizing systemic problems in terms of transitions, the interactions between 'principia media' can be untangled with a finesse that Mannheim would have envied. His approach to societal dynamics as a 'changing whole' is specified, conceiving of them as a *complex* whole, or rather as a layered patchwork of complex wholes. This enables the analyst to make use of the advances in the developing complexity paradigm, originally developed in the realm of the natural sciences but later applied to various social phenomena as well (Heylighen et al., 2007). Complexity theory yielded a new grammar for the description of dynamic constellations of 'principia media': Offering 'building blocks' to decompose the seemingly inextricable, it promised to lay bare 'hidden order' (Holland, 1995) behind the whimsical and typically nonlinear behavior of 'changing wholes'[9].

Complexity theory is particularly apposite to study systemic problems and their possible transition to a new, more sustainable state, Rotmans & Loorbach (2010, 114-125) explain. Especially the theory of complex adaptive systems (CAS) is suitable, as it theorizes how multiple separate changes yield higher-order changes. CAS consist of multiple components or agents adapting themselves to other agents and changing conditions. Their overall adaptive behavior results from the many decisions made by essentially diverse agents. This overall adaptation involves a constant variation of new system components and new relations between them, and of selection upon this variation to ensure overall evolutionary fitness. Three more specific features of CAS help describe systemic change: *Co-evolution* indicates how the evolutions of two or more systems become intertwined, to the extent that the evolution of the separate systems is irreversibly altered. *Emergence* occurs when new and coherent structures arise out of lower-level interactions, with behaviors that cannot be immediately traced back to the components' behaviors alone. *Self-organization* is the ability of systems to develop a new structure out of their own, rather than as a result of outside control. These mechanisms describe how interactions between and within systems give rise to new and sometimes counterintuitive structures through feedback mechanisms. They thus indicate not only the limits to comprehensive systems understanding, but also the poverty of reductionist approaches that seek to understand the whole by focusing on separate components' behaviors: However fallible, holism comes forward as the only choice. Accounting for the limits to comprehensive analysis, CAS conceptualization thus accommodates criticisms charging holist planning with overblown knowledge claims.

The CAS conceptualization leads to a picture of systems with dynamic equilibrium as the normal state: Their adaptive components produce continuous changes, yet the overall system keeps these in check by tending towards a particular 'attractor', a relatively steady preferential state (Rotmans & Loorbach, 2010, 121). This equilibrium allows for controllable optimization within bounds, for reliable 'business-as-usual'

[9] Mannheim did seem to have a basic appreciation of the relevance of emergence and co-evolution, but did not theorize these complex dynamics profoundly.

operations. Yet eventually internal changes and external changes from the system's environment will undermine this dynamic equilibrium. The constellation can then be maintained at the price of internal tensions, but the system starts moving towards another attractor: The relatively long period of dynamic equilibrium is followed by a short period of instability and chaos, a systems crisis. *"In systems terms a crisis is not negative but rather an opportunity to shake up and transform the system. The system reorganizes itself, creates a renewed structure and develops itself towards a new attractor on the way to a new dynamic equilibrium and the cycle begins again, with a higher degree of complexity"*. (121). This shift between dynamic equilibria, with relatively long periods of stability interrupted[10] by sudden crises, indicates a transition. Typical are the changing speeds of change: A slow start in the predevelopment phase, as it is difficult to break away from the status quo. Once the initial take-off comes into effect, a process of acceleration follows. Eventually, the pace of development slows down, when a new dynamic equilibrium stabilizes. Figure 1.3 displays the resulting S-shaped curve. Plotted on the y-axis is the development of social systems, as the 'sustainability transitions' founders adapted the basic pattern.

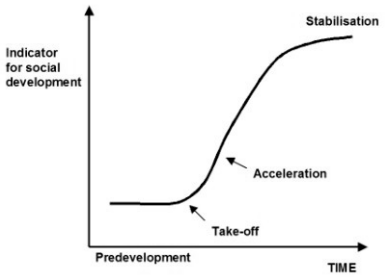


Fig. 1.3 Transition curve (Rotmans et al., 2001, 3)

The 'transition' concept originated in biology and population dynamics, a typical example being the demographic transition from high to low fertility rates. Before it was elaborated into a model for systemic change and intervention, the concept had also been used as a model for technological innovation. This earlier work on 'socio-technical coevolution' (Kemp (1994), Rip & Kemp (1998), Geels (2005), Geels & Schot, (2007)) was pivotal in bridging the gap between the abstract systems model and the real-life world of technological transformations and systemic sustainability problems. Most importantly, it specified mechanisms and patterns to account for the non-linear accelerations and stabilizations. An early influential contribution was made by Dosi (1982), with his assertion of 'technological paradigms', yielding discontinuous development. Similar to Kuhn's description of scientific development, Dosi argued technological development to be structured by generally stable but sometimes suddenly changing rules. This focus on structuring societal rules, sometimes transforming through the behaviors they govern, mobilized social theory for transitions research.

This yielded a multi-level model of societal transitions[11], as displayed in figure 1.4. The model conceptualizes transitions as co-evolving changes occurring on different structuration levels. The dynamic equilibrium of societal systems is described through the layered interplay of more and less stable rules: The possible transition of a 'regime', the dominant structures, cultures and practices constituting systemic problems in particular sectors, amounts to a radical transformation in these three dimensions of rules. The regime is seen to co-evolve with the higher-order rules of rather determinist 'landscape' developments, and with the lower-order, emergent rules of various 'niches'. Similar to CAS, maintaining overall stability by dampening the fluctuations of ongoing

[10] See also Gersick (1991) on the 'punctuated equilibria paradigm'.

[11] It was developed along the lines of Braudels distinction between 'longue durée', 'conjonctures' and 'faits divers' Geels (2005, 73/74).

changes, these lower-order 'niches' are not easily institutionalized at the 'regime' level: Crucially, the landscape pressure 'from above' and the 'niche' perturbations 'from below' have to mutually enforce to push the regime to a new order. The model thus conceptualizes how dominant practices stabilize and 'lock-in' into societal path dependencies, but also theorizes their lock-*out* (Geels, 2005, 8). The latter being of particular interest for their aim to resolve systemic problems, the basic transitions model was further elaborated for specific interaction patterns between the three levels: Transition phases and transition patterns (Rotmans & Loorbach, 2010, 131-139), and transition pathways (Geels & Schot, 2007).

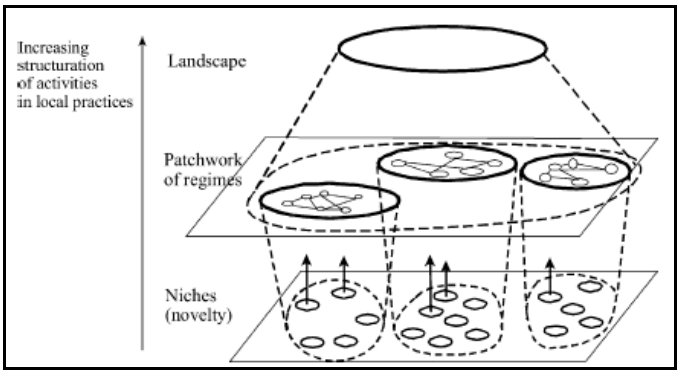


Figure 1.4 Multiple levels as a nested hierarchy. (Geels, 2004, 913)

1.2.2 System innovation

The quest for system innovation almost equals the ambition to bring about sustainability transitions. The latter indicate radical transformations in the dominant structures, cultures and practices that constitute a societal system's 'regime'; similarly, the former indicates encompassing systemic renewal. The two concepts are therefore often treated interchangeably, yet they need to be distinguished. Not only did the founders of the framework indicate a difference in aggregation level, it is also important to realize that transitions are *processes* and system innovation rather denotes *activities* that fuel these encompassing processes.

Transitions are long-term structural transformations in huge systems, such as the mobility system, the energy system or the agricultural system. If they take place at all, this will result from a multitude of mutually reinforcing changes. As explained through complex adaptive systems, the systems to undergo transitions are composite and layered systems, and several changes in their subsystems are therefore required for overall transition. These lower-order changes in subsystems are called system innovations. As described by Rotmans (2003, 2006), system innovations are *"…organization-transcending innovations that drastically alter the relationship between the companies, organizations and individuals involved in the system. A system is defined here as a coherent set of components which influence each other in a particular direction, for instance an economic sector, a trade sector, a societal domain, or a town or region. The systems level is therefore the overarching level at which individuals, companies and organizations have organized themselves. Innovations further take place within system innovations on a smaller scale, in terms of products, services, processes and projects. In this way, a cascade of innovations can clearly be discerned; transitions arise from a*

number of congregating system innovations, which in turn result from project, product and process innovations and vice versa." (Rotmans, 2006, 11). The 'system' in 'system innovation' thus denotes an intermediate level between transitions on the one hand, and the local level of separate and rather one-dimensional innovations in technologies, behavior or regulation on the other (Kemp & Loorbach (2006, 107), Kemp & van den Bosch (2006))[12].

Transitions resulting from several system innovations, it further transpires that the two concepts denote somewhat different categories. Transitions being large-scale developmental processes, system innovations are rather the concrete innovation activities that fuel these processes. As cited above with the 'cascade' of innovations, system innovations can be considered a special category of innovation – more close to the actual innovat*ing* by actors. Such verb-form does not exist for transition; one would rather say that systems *undergo* a transition. This distinction indicates related but different research foci.

A final specification with regard to the system innovation concept is its distinction from system *improvement*. Improvement implying change, it could also be considered innovation, yet the founders of the sustainability transitions framework clearly juxtapose the terms. The idea underlying the distinction is that transitions are structural transformations into new constellations, rather than incremental changes that rather reproduce (Geels & Schot, 2007) the system's regime. The distinction is similar to that between radical and incremental change, or between reformism and revolution. Recapitulating how 'regimes' tend to be continuously exposed to landscape pressures and emerging niches, they have three basic reactions: 1. Fighting these off, 2. Accommodating these, and 3. Actively contributing to further innovation. As indicated by Rotmans & Loorbach (2010, 133), the second response yields system improvement while the third amounts to system innovation.

1.2.3 Transition management

The above juxtaposition against system improvement clarifies how the quest for system innovation and transitions reinvigorates Mannheim's holist ambitions. Complexity theoretical insights enriched with several social-theoretical strands yields a powerful framework through which to grasp Mannheim's 'principia media'. Yet beyond the complexity of the *object* of planning, the complexity arising from its many *subjects* should be taken into account as well. In this regard ever new concepts are being invented (see Voß et al., 2009, Grin, 2010), but a most prominent and integrated response to the challenge is given through the framework of transition management (Rotmans (2003), Meadowcroft (2005), Loorbach, (2007)).

As indicated by Meadowcroft (1997), transition management (TM) is particularly interesting for its mediation between sustainability complexity and governance complexity. In fact, the distinction between the two complexities is dissolved, as transition management is conceived of as a part of the co-evolutionary processes it seeks to bend towards more sustainable states. In the words of Loorbach (2007a), a key developer of transition management: *"Transition management is an intrinsic part of*

[12] By contrast, de Bruijn et al. (2004, 3) explicitly define system innovations as comprehensive, long-term and transformative innovations that can take place at different aggregation levels. The indicated hierarchy of innovation types will be taken up again when demarcating research area and research objects. It is important to note that the levels mutually define each other.

transition theory as it conceptualizes the role of agency in transitions and can be used to analyze possibilities for influencing. Transition management therefore necessarily builds on an understanding of transitions from a complex system perspective as basis for development of governance strategies". (18). The key of the approach is to modulate, i.e. selectively reinforce, the ongoing innovation production present in complex adaptive systems, and use transition-dynamic insight to seize the opportunities for development in sustainable direction: Its developers describe TM as goal-oriented modulation (Kemp & Rotmans, 2004, Kemp et al., 2006). A basic strategic consideration is that such modulation yields the most leverage when a system is approaching a new attractor – this is how substantive insights into a system's state and development patterns can be capitalized on, informing intervention with a sense of timing (Rotmans, 2003, Rotmans & Loorbach, 2010). While emphasizing that system understanding is crucial for targeted and effective system innovation (Rotmans & Loorbach, 2010, 142), transition management also acknowledges that full understanding is impossible. This awareness of irreducible complexity it shares with other 'reflexive governance' approaches.

Transition management takes into account the flaws to holistic planning, treating its systemic analyses and representations as tentative models in need of argumentation. The gap between the model and the represented social reality is identified as a crucial challenge (Rotmans & Loorbach, 2010, 124/125), to be taken up by subjecting these models to deliberation in participative arrangements. This is why its developers present TM as a form of 'reflexive governance'. It involves knowledge integration, anticipation of long-term systemic effects, adaptivity of strategies and institutions, iterative participatory goal formulation and interactive strategy development (Kemp & Loorbach, 2006, 103, 110-111). Each of these elements mark clear breaks with the rather objectivist planning approaches discussed earlier: The step from systemic insight to intervention is not taken lightly. As Loorbach (2007a, 60-75) has worked out in more detail, the TM intervention repertoire has actually been shaped through a confrontation between complex systems insights and sociological and governance insights on societal and steering complexity. The latter, generally focusing on certain aspects of societal complexity, could then be used to refine and operationalize the abstract guidelines derived from complexity theory – as pieces of a systemic puzzle.

Understanding transitions as multilevel, multiphase and multipattern phenomena, transition management developed principles for intervention through an assembly of governance wisdom. Its long-term orientation set it apart from what earlier was described as 'new governance': *"In pluricentric societies control cannot be exercised from the top. Control is distributed over various actors with different beliefs, interests and resources. Influence is exercised at different points, also within government, which consists of different layers and silos, making unitary action impossible. The distributed nature of control calls for cooperation and network management. Current modes of network management are not equipped for long-term structural change. They are too little concerned about long-term substantive ends and too much with the process itself. We need another form of network management, which is concerned with expressing long-term aims and the management of transition processes."* (Kemp et al., 2006, 6). The challenge to combine networked deliberations with substantive sustainability goals was met through a cyclical approach - preventing the substantive goals from freezing into blueprints, and ensuring adaptiveness and reflexivity. However important the

articulation of future visions, TM proponents insist that sustainability is no fixed end state[13].

The TM cycle, characterized as an approach of 'learning, searching and experimenting' (Loorbach, 2007a, 87), consists of activities addressing all the transition model's levels. They range between the strategic activity of constructing long-term visions and the operational activities of conducting experiments and innovative projects. Even when meant as an iterative process, the cycle has a clear starting point: The strategic level of (I) envisioning alternative futures and new 'attractors' for the societal system to move towards. An understanding of the systemic problems at hand is considered prerequisite for promoting the long-term challenge of sustainable development (117). Transition visions are not the planner's prerogative, however, nor are they objectively given. They are developed iteratively, in settings with a diversity of actors. So-called transition arenas are set up specifically to develop 'baskets' of multiple visions (Rotmans, 2003). In accordance with the complexity theoretical insight that innovation tends to stem from small outsider nuclei, these arenas should be composed primiraily of societal 'forerunners' – innovative, forward-looking individuals able to think relatively independently from 'incumbent' regime structures (Loorbach, 2007a).

The next stage involves (II) the development of coalitions and transition agendas. This activity cluster descends to the tactical level: *"The change in perspective, captured in the new discourse, should be further translated to and made concrete within various networks, organizations, institutions at a less abstract level."* (Loorbach, 2007a, 119). This concretization involves not so much the outsider 'frontrunners', but rather the actors that have a stake in shaping the new direction. They should have both the authority and the maneuvering space within their organizations to do so. Instruments to guide this concretization are transition images and transition agendas – the latter constituting a frequently updated compass, as well as an articulation of learning objectives. On this basis it will be possible to (III) mobilize actors, and execute projects and experiments.The transition agendas should be taken up by a broad array of societal actors; they are to be to guided by it, and provide feedback on the basis of experiences with innovative practices. A specific instrument to stimulate systemic variety is the concept of transition experiments (Loorbach, (2007a, 122), Kemp & van den Bosch (2006), van den Bosch (2010)). Through deliberate, i.e. vision-guided, variation, these experiments help test, develop and connect 'niches'. This is related to 'strategic niche management', focusing on the ways in which these bottom-up arrows in the multi-level model could be reinforced (Schot et al. (1994), Kemp et al. (1998), Schot & Geels (2008). The cycle is 'closed' through (IV) the stage of evaluation and adaptation. This stage involves monitoring, both in the sense of observing proceedings and of joint learning and 'reframing'. This closure of the cycle emphatically prepares for a new and revised one: By itself this cyclical, iterative way of connecting governance activities underlines how reflexive usage of systemic analysis is built-in.

To conclude, the quest for system innovation and transitions revitalizes Mannheim's reconstruction on two related aspects: First, through a complexity-based understanding of societal 'principia media', and second, through a governance approach that emphatically situates systemic insights in a polycentric context. Still, as already implied

[13] A paradigmatic example is the earlier transport system causing the streets to be filled with horse excrements (Kemp et al. 2006, 2). At the time, the advent of the automobile could be interpreted a move towards sustainability, but by now, the assessment has changed.

by its complexity-theoretical assumptions, the step from transition theory to concrete actions for system innovation is no more straightforward than the step from 'principia media' to 'reconstruction'. This gives a preliminary explanation for the many criticisms raised against transition management as a model for system innovative action. The next section engages with the signaled tensions in order to specify research aims.

1.3 The quest for system innovation and its tensions

1.3.0 Introduction

Transition management can be considered a revitalized form of 'reconstruction', accommodating post-WWII planning experiences[14]. Underpinned by an elaborate framework theorizing developmental discontinuity, its ambitious holism is combined with reflexive commitments and a sense of contingency. Combining the seemingly irreconcilable in an area of longstanding and intensive study, it seems too good to be true, however. Unsurprisingly therefore, the TM synthesis has met with criticisms pinpointing latent tensions. First, suspicions have been raised that transition management is merely hiding its social engineering traits, rather than parting with those. After discussing these charges of 'transcendentalism' **(1.3.1)**, recent reflections on system innovation practice are addressed **(1.3.2)**. The arguments are weighed in the concluding subsection. This leads to a position that takes the signaled transcendental temptation as a serious pitfall, but not as a fatal defect. Other than the distanced critiques that tend to abandon the quest for system innovation, the growing attention to 'system innovation in the making' is taken up as a promising avenue for further research – especially so when studied in 'immanent' fashion **(1.3.3)**.

1.3.1 The transcendental temptation

Planning-historically, the TM synthesis into holism with polycentric commitments seems too good to be true. Various authors have pinpointed cracks and tensions in this grand unification. They converge in their suspicions that the abstract CAS mechanisms are elaborated into social-systemic analyses and intervention prescriptions too easily – ironing out the very societal complexity the exercise was supposed to deal with. A prominent articulation of these suspicions was put forward by Shove & Walker (2007, 2008). They observe that the 'systems in transition literature', i.e. transitions analysis, has as its "*…core task to figure out how currently dominant sociotechnical regimes might be dislodged and replaced and how new configurations might become mainstream"*, yet that in these analyses themselves, *"…there is no assumption that better understanding will necessarily enhance the capacity to manage. This is to be expected in that the challenge is to understand the coevolution of complex systems in which the role of self-styled systems builders is necessarily constrained and in which the outcome of deliberate intervention is inherently unpredictable. One consequence is that studies of systems in transition are typically distanced, even voyeuristic, making few claims about how individuals and organisations can, might, or should act to affect the processes in question or to steer trajectories towards predefined, normative goals."* (Shove & Walker, 2007, 764). The authors essentially raise the question whether the complexity-theoretical basis to intervention into 'principia media' is *too solid*, whether the 'typically distanced, even voyeuristic' perspective of transition theory keeps

[14] Revitalized, understood as incorporating an enriching sequence of 'Bestimmte Negationen' (Hegel, 1847).

transition management in an 'intellectual grip' (768). Duineveld et al. (2007) express similar suspicions. They treat transition management even as a 'mechanistic' approach that falsely represents transitions as complex machines – only waiting for interventionists to find out which buttons to push (18). TM on that account exemplifies the tendency in policy advice to jump too easily from analysis to prescription. This all too smooth move from knowledge to action they 'hypothesize' to follow from clever marketing, from equally self-interested concealing of possible dirty hands, or from insufficiently critically and independently conducted action research (23-26).

The above charges suggest that, backed by system-dynamic insights, TM is prone to become too self-confident about its interventions. It is 'unmasked' as essentially a 'social engineering' approach. It can *'...too easily obscure its own politics'*, as Shove and Walker conclude, overestimating the scope for consensus (2007, 768). Less depreciative but no less critical, other authors have raised similar points and questions about the moves from analysis to action, and from the abstract to the concrete. Not rhetorically but rather inquiring, these contributions bring forward questions like: *Who governs?, Whose 'system' counts?, Whose sustainability gets prioritised?* (Smith & Stirling, 2008), *How are the transition visions articulated and changed?* (Berkhout, 2006), *How can sustainability and progress be treated with better appreciation of their directionality?* (Stirling, 2009). Similar questions have been raised with respect to the analytical handling of the multi-level transitions model: *What system is being studied, and how to account for the attendant demarcation issues? What are these socio-technical 'regimes' made of? How to distinguish starting and end points of transitions? How to distinguish between 'incremental' and 'radical' innovation paths?* (Genus & Coles, 2008). *What other transition patterns can be distinguished, next to the overemphasized pattern of niche cultivation?* (Berkhout et al., 2004).

Meadowcroft (2005), reviewing several of these challenges, therefore concludes that it would be advisable to *"...maintain an open textured notion of transition, while focusing efforts on change within specific sub-systems. The 'levels' issue is less likely to be resolved through an appeal to some general theory of socio-technological change, than it is by exploring the detailed physiognomy of the particular socio-technological systems that are judged problematic from the point of view of the environment."* (20). This plea to avoid overly abstract and rigid system understandings summarizes elegantly what these critical inquiries converge onto. The insufficient concreteness about transition politics, the lacking reflexivity towards system understandings, the altogether nebulous combination of pluralistic governance commitments and holist analysis – all of these questions and allegations warn how the quest for system innovation is prone to relapse into technocratic reliance on the 'helicopter view'. Phrased parsimoniously, they signal the *temptation* to overemphasize systems-theoretical certainties as a way to transcend practical uncertainties and ambiguities: *The quest for system innovation entails a transcendental temptation.*

As acknowledged by some of the critics and exposed in the previous section, most of these tensions have actually informed the development of transition management: The step from knowledge to action was guided by reflexive governance insights, Kemp & Loorbach (2006) and Loorbach (2007) explain extensively. Furthermore, Rotmans & Loorbach (2010) stressed the crucial challenge to bridge the gap between the abstract models and the complex social reality these are to describe. This testifies awareness of the transcendental temptation. The severe charges by Shove & Walker therefore

prompted a response. Especially as they felt some of the criticisms to be misguided about their very mission to avoid blueprint-planning, Rotmans & Kemp (2008) sought to set straight the debate. Somewhat unfortunately, their concise response remained largely limited to exposition of general principles, however. And as far as they came up with the concretizations they were dared to provide, these made the charges of obscurity no less difficult to ward off. Regarding the suspicions of technocratic 'transition managers', they explained the transition activities as follows: *"The above activities are undertaken by a variety of players, without a clear hierarchy and without a clear demarcation of who is inside and who is outside 'the system'. These players are not so much 'transition managers' but each of them plays a particular role in the transition game."*. Transition management revolving around niche-regime interplay, it involves both insiders and outsiders, after all. *"So the everyday politics of transition management forms a tangled ball with no clear management structure (Loorbach, 2007). It involves negotiated processes by a multitude of actors, each with their own interests and beliefs, and connected with each other in various ways."* (1007). Considering this not particularly specific account, Shove & Walker (2008) could maintain their charges of politics concealed. Their response concludes that the TM model is both instructively highlighting *"…the dynamic nature of systemic change,* and *simultaneously obscuring correspondingly fluid and contested matters of boundary making and definitional power."* They wonder whether this obscurity betrays a double face (1014).

1.3.2 Challenges of system innovation 'in the making'

Some critics charged transition management of 'transcendentalism'; others were curious how the lure of the ivory tower could be withstood in actual quests for system innovation, and in concrete empirical analyses. Especially this curiosity has been met through various empirical accounts and analyses of system innovation 'in the making'. A good overview of the state of the art was provided by Voß et al. (2009). As guest editors to a special issue they sought to engage with TM practice, and identify specific challenges. Noting some transition management tensions to be of a fundamental nature, they cautiously considered that these could 'undermine confidence in the possibility for success' (282). They singled out three key issues emanating from these tensions: 1.The politics of social learning, 2. the contextual embedding of policy design, and 3. the dynamics of the design process itself. Taken together, these interrelated issues cover much of the contested ground discussed under the 'transcendental temptation', and help specify directions for further research.

A most interesting contribution to the special issue is Rotmans & Kemp (2009), describing their experiences with promoting the transitions framework as a basis for Dutch energy policy. Through this inside account, actually providing some of the concretization Shove & Walker (2008) still found wanting, the challenges of system innovation in the making become clearer: The overarching framework could not be insurrected from scratch, but had to be fit in with ongoing policies[15]. The activities the authors undertook for this they describe as 'transitioning'. Already at an early stage they found this to be far from straightforward: Several policy makers considered the suggested approach too academic, and even once they had given the 'go' sign, they still insisted the concepts be cast into manageable 'rules of thumb': *"Whereas the policy makers wanted to reduce the complexity of transition management to easily digestible*

[15] 'Fixing the wheels of a train while it is motion', Mannheim would express the challenge; see section 1.1.

chunks, we argued that there are no simple do's for transition management, in order to avoid any implied suggestion of social engineering, blueprint thinking and planning." (Rotmans & Kemp, 2009, 309). In the end the transition advocates did give in however, understanding that also the more skeptical quarters of policymakers had to be convinced of the concepts' practical relevance. Looking back on the process, they saw themselves engaged in a process of co-producing (314) a shared frame of reference – a framework simultaneously allowing its various adopters to customize it somewhat to personal and institutional preferences. *"Our conclusion is that the concept of transition served as a boundary concept for scientists and policy makers. We all crossed boundaries and accepted the trespassing by others. We all got something out of it. For policy makers, it was a useful concept which allowed government to orient its innovation policies and energy policies more towards long-term structural change in a co-ordinated manner. VROM*[16] *wanted to get into energy (being the domain of EZ*[17]*) and wanted to use the concept for that, whereas for EZ it served multiple aims: creating new business in sustainable energy, be more proactive and be a partner of business on the topic of energy innovation."* (318). Getting the transition concepts accepted had involved a combination of factors, they indicated: The openness of these concepts, but also the brokering efforts of 'ambassadors' and the presence of not directly transition-related policy needs to play into. They also stressed the importance of the open discussions and joint meaning construction, collectively moving between abstract concepts and empirical evidence (320).

The other accounts in the special issue allow for comparison of 'transitioning' experiences. Generally speaking, these analyses pay even more explicit attention to the tensions that come up in these processes. Kern & Howlett (2009), for example, underline that it is 'fraught with risks', prone to produce ineffective or even failed transitions (393). Their analysis shows how the attempt to 'transitionize' Dutch energy policy did not so much yield the theorized replacement of the incumbent 'regime' or a recasting of previous policy into the advocated long-term framework, but rather a changing 'policy mix'. This typically layered mix of old and new goals and instruments, some attributable to the transition management impulses, others stemming from more short-termist responses to liberalization and market pressures, they consider to constitute a transition outcome as yet neglected in transition management literature: The sources of this emergent incoherence (403) better be investigated thoroughly, they stress, its avoidance requiring considerable efforts in refining and tuning (404).

The challenge to avoid the emergence of incoherent policy mixes proved no less severe in the 'transitioning' of a Dutch innovation program on sustainable mobility. Focusing on the reception and operationalization of transition management guidelines in a few of the program's projects, Avelino (2009) observes how the individuals involved struggled even to create such mixes in their projects in the first place. The abstraction of many transition management concepts often withheld actors from using them. Furthermore, in cases the concepts did seem to touch ground, actors often appeared to use them more out of obligation than out of intrinsic motivation to take a radically different approach. The case studies show insightfully how and why the actors targeted for transitioning often became trapped between the demands of day-to-day management on the one hand, and the ambition to think and act 'out of the box' on the other. This struggling in the

[16] The Ministry of Environment and Spatial Planning.
[17] The Ministry of Economic Affairs.

'twilight zone between orders' (Teisman & Edelenbos, 2004) manifested in shallow, 'thin application' of transition management principles (376), in pragmatic disjunctions between system improving and system innovative development tracks, in clashes between short-term and long-term oriented participants, and in silent disagreements about the content of the program's espoused goal, sustainable mobility. All in all these observations led Avelino to recommendations much in line with those of Kern & Howlett, pleading to gain understanding of '*why* people are not being the innovative, risktaking, and long-term oriented individuals that others want them to be' (384).

That transitioning is a deeply political process also speaks from Heiskanen et al. (2009) and Hendriks (2009). Both indicate how the emerging 'policy mix' between transition elements and other elements may be understood in terms of CAS dynamics, but can also to a large extent be retraced to concrete and identifiable visions and interests of purposive actors. Hendriks (2009) pinpoints how the outcomes of the 'transition arenas' have everything to do with the dominance of vested interests and the relative absence of outsiders in those. In this respect these arenas are no different from networked governance in general, she holds, and face similar challenges of accountability, legitimacy and inclusion. Analyzing the 'democratic storylines' espoused in the transitioning of Dutch energy policy, she observes that the dominant view stressed the need to gather sufficient expertise for technological innovation (350-352). These emphases on expertise and output legitimacy detracted from concerns for input legitimacy – in line with common views holding democratic myopia as an obstacle to sustainable development. The observations of Heiskanen et al. (2009) show similarly how in the Finnish context the initially alien transition concepts were appropriated selectively. Analyzing two cases of introducing transition management concepts, they notice how part of the concepts 'link up' with existing structures, while others 'bounce off'. Typically, instead of wholesale adoption or rejection, either the top-down or the bottom-up elements of the framework 'got lost in translation' (422). This leads them to assert the paradox that *"...transition management should engage a broad group of actors (rather than only experts), but grasping the implications of the model takes time and challenges actors to question their existing operating logics."* (424). Simplified and selective adoption are therefore likely: The authors suggest to further open the 'black box', and gain understanding of the political processes through which transition management is embedded in new contexts (425).

Commenting on the above accounts in their editorial synthesis, Voß et al. (2009) instructively indicate a recurring theme: Transitioning is 'not a one-way street' (288). They signal how transition management apparently changes in the hands of its adopters, and in the contexts in which it is embedded. Moreover, their overview reveals how most authors treat these changes with suspicion, framing them as 'deformations', 'capture', 'dilution' or as 'technocratic' appropriations. Expressed more neutrally, Heiskanen et al. (2009) speak of 'hybridizations'. Meadowcroft (2009) stresses that, whether deformative or enriching, these changes should come as no surprise, however. *"When have policy directions—even those that officially espouse change, openness, and participation—entirely escaped the orbit of economic and political power? It is entirely understandable that transition-management-in-practice looks a bit more like policy-as-usual than would be recommended by transition-management-in-theory."* (336). This sobering statement Meadowcroft insightfully feeds back to transition management theory: He reminds that the practice of system innovation inevitably involves intervention into nested, mutually interpenetrating systems. This messiness cannot be navigated through abstract

distinctions between system improvement and system innovation, he stresses. The transformative potential of allegedly 'incremental' solutions will remain unclear (331/332), and even if it were clear and agreed upon, it would not be immediately decisive in concrete processes of collective choice. The systemic insights provided by transition theory, in other words, should not eclipse the more concrete choices and politics involved in system innovation in the making (337).

1.3.3 Facing the tension

Many of the above tensions may appear familiar to the reader. Indeed, as also Voß et al. (2009) observe, the criticisms can be seen as echoes of earlier planning debates – albeit on the plane of transformative change and 'designing procedural arrangements for societal learning' (285). Considered against this historical background, the system innovation debate can be seen as a new stage in a quite continuous dialectical development. In this dialectics, with the 'transcendentalist temptation' towards technocratic holism on the one end and the rather relativist impulse to stay true to polycentric commitments on the other, the debate can understandably become very heated: Not only analytical insights but also ideological convictions are at stake. Understanding this dimension to the discussion helps appreciate the critiques. It warns against reproduction of historically founded but unfortunate antagonisms: Entrenched reasoning will yield repetitions-of-moves, instead of fruitful dialectics.

A first positioning in the debate is therefore that the charges of 'transcendentalism' and 'social engineering' will not be taken as the definitive unmaskings that they appear to be. The Shove & Walker vs. Rotmans & Kemp debate never really became a debate: The first could fairly easily pinpoint inconsistencies in the transition management synthesis and formulate nagging questions about its abstract concepts. While leaving their opponents with a formidable burden of proof, they themselves had little ground to defend however. The reality status of systemic problems, the legitimization for the quest for system innovation, after all, they largely left unaddressed[18]. Inversely, the latter responded rather defensively – restating abstract principles more than highlighting how these are deployed and balanced. Tragically, such response of keeping the ranks closed is only incited, the more fierce the attacks become. Duineveld et al. (2007) may thus have provided several insightful observations of 'transcendentalist' tendencies, but their allegations of 'social engineering' and concealed interests discredit more than they enlighten. Especially where they challenge the 'mechanistic representations' of TM, the critique itself is targeting abstract models rather than their usage. When remaining abstract, the discussion of tensions loses energy in demolishing straw men.

As Avelino (2011) discusses, the aforementioned two critiques are typically deconstructive contributions. They reveal the hidden assumptions behind the edifice of transition theory and management concepts. She also notes that this job finds easy targets in transition management literature, and that the criticisms themselves could be taken apart in similar fashion (16/17)[19]: Less easy and more fruitful would it be to move beyond deconstruction, towards a stance that at least aims to use its concretizations to inform the quest for system innovation. A second positioning in the debate is that such stance will indeed be more productive – yet this informing need not amount to complete reconstruction of the deconstructed. Also in line with Meadowcroft's recommendation

[18] This could be considered the 'relativist' temptation.

[19] This does not detract from the relevance of the critical questions raised, however.

not to get lost in abstract systems, the approach will be to investigate first what the 'systems' engaged with are made of, and only then to consider system diagnoses and intervention strategies. His 'open-textured notion of transitions' will be maintained. The empirical 'deconstruction exercises' will be used to inform the quest for system innovation, but not so much to actually mend or erect general transition management principles. The charges of 'transcendentalism' are too serious to ignore.

As spoke from Rotmans & Kemp (2009), not only skeptics but even staunch transition advocates appreciate that the quest for system innovation involves continued confrontation of the abstract and the concrete. More interesting than verification or falsification of particular transition principles is therefore the exploration of their various deployments. A third positioning in the debate is therefore to follow the calls to further open the 'black box' of contextual embedding. The insights gained promise to enable a more strategic handling of the selection environments of system transformative initiatives (Voß et al., 2009, 293).

Finally, the discussed analyses of contextual embedding reveal a strikingly negative appreciation of the changes occurring in the process of 'transitioning'. In the hands of adopters the innovative thrust is frequently noted to be 'diluted', 'deformed' or 'captured' by incumbent 'regime' actors – the quest for innovation better anticipate this 'resistance to change' and the 'barriers' insurrected by dominant actors. These negative appreciations implicitly treat contextual embedding as a one-way street, however: System innovative initiatives are either adopted or rejected, it seems, and if they are not adopted this reveals the unwilling adopters' 'resistance to change'. A fourth positioning in the debate is therefore that contextual embedding better be studied as a bidirectional process. Such symmetrical approach reflects the critiques concerning implicit system understandings, and especially Meadowcroft's powerful argument against preconceived notions of 'system innovation' and 'system improvement'. The same applies to dichotomous schemes of innovators versus conservatives, outsiders versus incumbents, or dominators versus oppressed.

This approach thus emphatically seeks to avoid the transcendental temptation, refusing to side with the system innovative 'sender' and upholding polycentric commitments. On the other hand it remains committed to informing the quest for system innovation. This creates a constant tension[20] that has to faced. The outlines of this somewhat paradoxical 'immanent approach' are developed in the next subsection.

1.4 An immanent approach to system innovation

As yet the stated need for an immanent perspective on system innovation has been defined primarily by what it is not. It takes distance from the 'transcendental' temptation to assume a helicopter view, an objectifying 'ideal observer' position towards society and its systemic problems. Scott (1998) has described convincingly how such views have repeatedly overseen conditions on the ground. On the other hand, the signals of system pathologies are strong reminders of the usefulness of helicopters; they help observe the linkages between local contexts.

[20] Pel & Teisman (2009). One of the founders of transition management expressed both the ambidextrous attitude and the transcendentalist temptation in his inaugural address: 'Between dream and reality lies complexity' (Rotmans, 2006). The utopian, transcendentalist ring is unmistakable here, and so is the reflection on the discrepancy between dream and reality.

The aforelying challenge is to specify the advocated immanent approach into research questions sufficiently bounded to allow for clear answers. Recapitulating the positionings in the system innovation debate, the aim is to move beyond abstract critiques on abstract concepts, open the 'black box' of system innovation, and inform action. This informing will not serve to insurrect transition theoretical or transition management principles, however: Somewhat at a distance from these integrated frameworks, it is to gain understanding of the more broadly defined activity of system innovation[21]. Especially promising is the topic of 'contextual embedding' of system innovation attempts, responding to the signaled tensions of system innovation. Yet as mentioned, recent work on contextual embedding still seems to give in to the transcendental temptation. Through the apparent preoccupation with and negative appreciations of 'capture' by 'incumbents', a one-way street view shines through. By contrast, the immanent approach entails a two-way street conceptualization.

The added value of a two-way street approach resides in greater analytical openness. 'Contextual embedding' implying the confrontation of different actors and the transgression of contexts, analytical understanding could be enhanced by avoiding to side with the sending actors and the originating contexts. As several authors argued, such lateral thinking is closely linked to the vocabulary often used to describe system innovation processes. Description is seldom or never neutral and matter-of-fact. These 'fluid and contested matters of boundary making and definitional power' (Shove & Walker, 2008, 14, see section 1.3.1) are manifestly involved in identification of transition phases, in distinctions of 'regime' from 'niche' players, of 'radical' and 'incremental' innovation, of 'frontrunners' and 'laggards'. As Stirling (2009, 2011) notes insightfully, these notions share an underlying 'race-metaphor'. They presuppose a singular trajectory, on which system innovation achievements are treated as scalars rather than vectors. These analytical concepts may thus insightfully elicit the dynamics constituting a singular transition S-curve, but are less sensitive to capturing the ambiguities of plural, divergent and incoherent system innovation processes. What is more, unidirectional notions do not sit well with the more dynamic concept of sustainable development itself: This is why transition arenas are supposed to generate *'baskets'* of visions (see section 1.2.3). This is an important reason to maintain plural understandings of 'diverse transformations' (Stirling, 2009, 2011), or 'open-textured notions of transitions' as Meadowcroft (2005, 2009) argued compellingly[22].

The immanent approach thus focuses on contextual embedding, while upholding a vector understanding of system innovation achievements. The hard follow- up question is then how open-textured the understanding of system innovation can be: How to study contextual embedding of *system* innovation attempts without assumptions about underlying systemic problems, or about relevant constellations of actors and institutions? If the immanent approach is to pertain to system innovation research, it cannot remain entirely free-floating: System innovation is a special category of innovation. It is a lower-order phenomenon compared to transitions, and is more encompassing and transformative than regular product, process or administrative

[21] See section 1.2 for the difference between 'transitions', 'system innovation', and 'transition management'. Research into system innovation can be distinguished from the strongly aggregating research into transition pathways and large-scale transformations.

[22] This also speaks to the recommendations for transitions and system innovations research expressed in Grin et al. (2010), especially the fourth on definitional choices, the fifth on normative plurality and, as will become more clear later, the sixth on translations in niche-regime interaction (332-334).

innovations. It will therefore be important to maintain and connect to at least some of the transition concepts. The research questions are to be kept relatively open, inciting emphatically explorative research, only bounded by open-textured concepts with vector-like properties.

The key questions about systemic problems raised upfront were the following: *How can they be detected and diagnosed? What is required for their resolution? And, considering their encompassing, compounded and enduring nature, how can their resolution by the many actors involved be governed?* Grin et al. (2010) formulate similar key questions for transitions research: *How to understand transitions? How to influence them?* As indicated with the aim to move beyond deconstruction, this coupling of analysis and practical instruction is maintained. The shift towards an immanent perspective yields several subtle rephrasings:

1. Investigations are focused on system innovation, rather than transitions. This narrows down the empirical scope towards relatively local and bounded processes: Transitions are understood as higher-order change processes, resulting from several system innovations.

2. System innovation is broadly conceived of as an evolutionary process. Instead of projecting a particular teleological transition, the empirical focus is kept open towards 'diverse transformations' (Smith, 2009, 2011). This also implies that distinctions between system innovation and system improvement can only be made a posteriori. Yet in keeping with common understandings of system innovation, it is defined as organization transcending, as multidimensional i.e. concerning cultures, structures and practices, and as a phenomenon involving 'cascades' of innovations (see 1.2.2).

3. System innovation is investigated specifically for the phenomenon of 'contextual embedding'. Yet instead of unidirectionally phrased questions after embedding, anchorage or upscaling of system innovation initiatives, a more open approach is taken. Attention will go out to the more general issue of the reception, processing and negotiation of innovation initiatives. Approached bidirectionally, these initiatives need not be marginal 'niches' attempting to fight their way into regime structures. The endogenous renewal of dominant structures generates novelty as well, and the birectional *interplay* between these levels is accorded prevalence over the bottom-up or top-down processes in separation. The immanent approach is sensitive to the often indicated plurality of potential 'transition contexts' (Berkhout et al. (2004), Meadowcroft (2005), Grin & van Staveren (2007), Grin (2010, 232)).

4. The focus is on system innovation *'in the making'*. This is a different research interest than charting system innovation dynamics through observation from the helicopter. It also conveys a focus on situated practices of actors expected to entertain different system understandings. Considering their immersion in the systems they seek to change, the introductory quotation is taken to heart: ***"****Unhappily, the limitations on our 'initiative' in any situation are seldom equally apparent from within and from without."* (Vickers, 1965, 14). This implies an analytical focus on situated actors, and instructions for action that likewise address actors immersed in the systems they seek to change - lacking a helicopter view.

5. As transpired through recent work on system innovation in the making, the launching of innovation in a multi-actor environment is no sine cure. Less than wholehearted adoption is to be expected, the various case studies demonstrate clearly.

The attention to this difficulty of innovation in networked settings (Rammert, 1997) is reflected in the consequent focus on innovation *attempts*.

The main research questions are therefore:

How can innovation attempts evolve into system innovations?

How can actors within these systems guide these innovation processes?

These open-textured questions will be answered through explorative and interpretive empirical investigations. The processes to be observed can be conceived of as follows: An actor wages an innovation attempt, and the initiative is received in various ways. An evolutionary innovation process then unfolds in which the intended innovation spreads and is selected upon in particular ways, and more or less coherent changes emerge that can eventually be assessed in transition-theoretical terms. Following the emergence of system innovation through the eyes of many, careful generalization can then inform a strategic handling of innovation attempts' selection environments. To catch it in a simple metaphor: Whereas transitions resemble huge rivers of change, resulting from many innovation streams coming together, these questions rather focus on the emergence and meandering of these little streams. This 'cascading' of innovation streams is studied 'uphill', from 'micro' to 'macro' (Pel et al., 2012). What can be established on the level of the 'bigger streams' is therefore of particular concern. This generates a third question of a theoretical-methodological nature:

How can the immanent approach be elaborated into a research set up that adequately deals with micro-macro linkage?

Having developed the theoretical focus in terms of research aims and questions, the following section introduces the empirical focus. The selection of the empirical field is guided by the ambition to study 'diverse transformations' rather than 'integrative transitions'.

1.5 System innovation in the traffic management field

The above questions on system innovation 'in the making' cannot be answered through deductive reasoning alone. It will critically require investigations fine-grained enough to capture the plural understandings involved. If mounting the helicopter at all, it should not climb too high. The empirical scope needs to be narrowed from the large societal systems studied in transition studies to the level of system innovation in their subsystems.

The introductory systemic mobility problems serve as a point of departure for zooming in. The A4 highway illustrated the particularly persistent difficulty to reconcile mobility ambitions with concerns about adverse side-effects. These side-effects (pollution, noise, traffic casualties, emission of greenhouse gases, consumption of space, congestion) being so difficult to contain, mobility is generally considered a major sustainability challenge. Accordingly, the mobility system is often identified to be in need of transition. Moreover, it is particularly notorious for the systemic nature of its problematic, the co-evolution between its components yielding a self-reinforcing dynamic that seems impossible to withstand. A well-known example of these positive feedbacks is the land-use – transportation cycle: The advent of the car facilitated suburbanization, which in turn spurred an enormous increase in car mobility (Newman & Kenworthy, 1999, Wegener & Fürst, 1999). Others have indicated that beside this

spatial-behavioral cycle, there is even a more encompassing dynamic towards an increasingly car-dependent[23], hyper-mobile society (Urry, 2004, Jeekel, 2011). Analyzing these phenomena as deep-rooted causes underlying persistent mobility problems in the Netherlands, Rotmans (2003, 198) thus diagnosed a 'downward spiral' in mobility, with innovation of separate system components typically inviting rebound effects: Cleaner cars allowing for heavier cars, financial incentives being absorbed rather than acted upon, and congestion abatement inviting only more demand for travel. From the viewpoint of societal transitions, it would be advisable to intervene at the level of the systemic feedbacks.

Investigating innovation in mobility subsystems, transition theory raises the question whether and how these lower-order innovations contribute to overall transition. They generally won't, it is expected (see Geels et al., 2012 for extensive discussion): The deeply entrenched 'regime' of car dependency and hypermobility will absorb these changes rather than be pushed towards a new system attractor. What is more, many mobility subsystems display typically incremental innovation. An often cited example is congestion abatement, frequently used to exemplify how system improvement may constitute 'pseudo-solutions' that even exacerbate systemic problems (Rotmans, 2003, Rotmans & Kemp, 2007, Loorbach 2007b, see also Pel, 2012). The argued self-defeating nature of congestion abatement is based on the observation that the gained capacity invites only more traffic to pour in: It amounts to 'draining with the tap flowing'. By contrast, other accounts are rather enthusiastic about the increasingly inventive ways to increase road capacity through fine-tuned traffic management: Ramp metering, scenarios for diversion of traffic in case of incidents, coordination across jurisdictions, improved information provision to drivers, dynamic speed regimes and occasional use of extra lanes. These measures are then applauded for their congestion-solving within capacity constraints. The pressures for infrastructure expansion,- a highly controversial alternative, as the A4 case illustrated, - are then released through a 'smarter', more efficient organization of traffic flows. This shift from building for demand to using existing capacity could also be considered a regime shift (Ministry of Transport, 2005, 2007, see also Goodwin, 2012 for analysis in terms of transitions).

The 'traffic management subsystem' is therefore a particularly interesting subsystem to investigate. In systemic terms it can arguably be characterized as 'draining with the tap flowing', but also as draining to prevent overflow and/or problematic installation of additional reservoirs. As such it can be considered a test site for the system innovation vs. system improvement debate (Pel (2012), Pel & Boons, 2010)). Remembering Meadowcroft (2009), the 'transformative potential' of the allegedly incremental traffic management innovations may be not so clear – similar to his intriguing example of carbon capture & sequestration. Moreover, the relevance of traffic management for sustainable mobility may well involve more than the efforts towards congestion abatement only. In this respect it will pay to follow Stirling (2009, 2011), and remain attentive to the 'diverse transformations' going on in the subsystem. *Will these add up into a coherent system innovation, or system improvement? Or will they yield a confusing mixture of divergent trends?* In turn this analysis could shed more light on a striking phenomenon in Dutch 'sustainable mobility' discourse, namely the silent

[23] Cohen (2010) pinpoints that the rapid growth in personal aviation tends to be overlooked in these analyses. His analysis only compounds to the assertion of self-reinforcing and systemic mobility problems, however.

disagreements about what this means and entails (Avelino, 2009). The black box of system innovation in traffic management is thus particularly worthwhile opening up.

1.6 Introduction to further chapters

After introducing the quest for system innovation and reviewing current debate, an immanent approach to study 'contextual embedding' has been argued for. The traffic management mobility subsystem is a particularly interesting field for such research. The central research questions will be answered through the situated actions and emergent innovations in this field:

How can innovation attempts evolve into system innovations?

How can actors within these systems guide these innovation processes?

The following preview specifies the theoretical, methodological, empirical and analytical steps towards the answers:

In **Chapter 2** the immanent approach is elaborated into a theoretical framework. First the basic idea that system innovation is a two-way street is refined. Observations about failing, warped or changed innovations have yielded a host of theoretical lenses, yet truly bidirectional conceptualization proves difficult to arrive at. Next, Luhmann's theory of 'self-referential systems' is invoked to organize these observations. This meta-theoretical framework directly links these phenomena to the complex conditions under which system innovation is to unfold: The tentative nature of innovation becomes understandable. Societal complexity poses evolutionary pressures for systems of meaning to develop. These systems cope with complexity self-referentially, channeling it into particular categories and communication channels. Societal evolution thus conceived of as interplay between self-referential systems, preliminary insights are gained into the emergence of system innovation. This abstract conceptualization has its downside in obscuring the agency of situated actors, however. For the desired specification of self-referential operations, the notion of 'translation' holds the key. The concept shares Luhmann's fundamentally polycentric outlook. Developed in the sociology of innovation, it focuses on the concrete interplay of innovators, recipient actors as well as the innovations themselves. It is therefore particularly well equipped to unpack the phenomena of modified innovation and hybridization.

The theory of self-referential systems setting the evolutionary stage for the translations framework, the latter gains primacy for its more fine-grained approach. As recent calls for theoretical multiplicity in system innovation research remind, a certain theoretical synthesis is worthwhile to explore, however. After all, the aim was to gain understanding not only of the emergence of small innovation streams, but also of their merging into broader rivers of change and *system* innovation: *How can the immanent approach be elaborated into a research set up that adequately deals with micro-macro linkage?* This question is answered by 'stretching' the translations framework. This involves, first, a focus on aggregated clusters of actors and translations, retaining some of Luhmann's attention to systems of meaning. Second, the construction of a translations typology serves systematic comparison, beyond insightful description. Third, a nested-case research design enhances the view on *system* evolution and intersecting innovations, also reflecting elements of Luhmann's meta-theory.

The adapted translations framework is elaborated methodologically in **Chapter 3**. As an open-textured framework still meant to generate systemic insights, it bears an inherent tension that needs to be handled throughout the investigative process. A guiding concept in this regard is 'grounded systems research'. Methodological elaboration involves first the specification of what translations look like, through what sources they are observed, and how an innovation's circulation through a network of actors is charted. This detective-like work is facilitated by focusing on a diversity of translators, triangulating between translators' stories, various documentations, and field observations. A second issue is the development of generic translation-dynamic insight. This progressive development of patterns is guided by 'sensitizing concepts' as captured in a translations typology. Third, the 'nested-case' research design is pivotal for the fruitfulness of the immanent approach. It enables a combination of depth and extensiveness, retaining the virtues of translation tracing, while enhancing generic insight through comparative analysis and analysis of co-evolution between sequences. The traffic management 'mobility subsystem' is roughly circumscribed as an action field that interpenetrates with others. Four cases are selected as 'diverse transformations': These are based on different visions to change the traffic management action field, address different dimensions of system innovation, and are undertaken by actors in different positions. Innovation attempts are selected such that their translation sequences have a certain potential to intersect. In order to enhance comparative analysis and clarify case interpretation, the chapter concludes with a concise format for case analysis.

The chapters 4-7 contain case analyses according to the developed methodology and case format. Through these accounts the theoretical attention to 'diverse transformations' comes to life. **Chapter 4** describes the '80 km/h zones', born out of the ambition to reduce traffic-related health hazards and comply with environmental regulations. **Chapter 5** describes the shift to network-oriented traffic management and mobility policy. **Chapter 6** describes the 'Shared Space' approach that was motivated by concerns about *too much* management of traffic. **Chapter 7** describes the attempt to develop an integrated travel information chain, so as to enhance travelers' 'informed choice'.

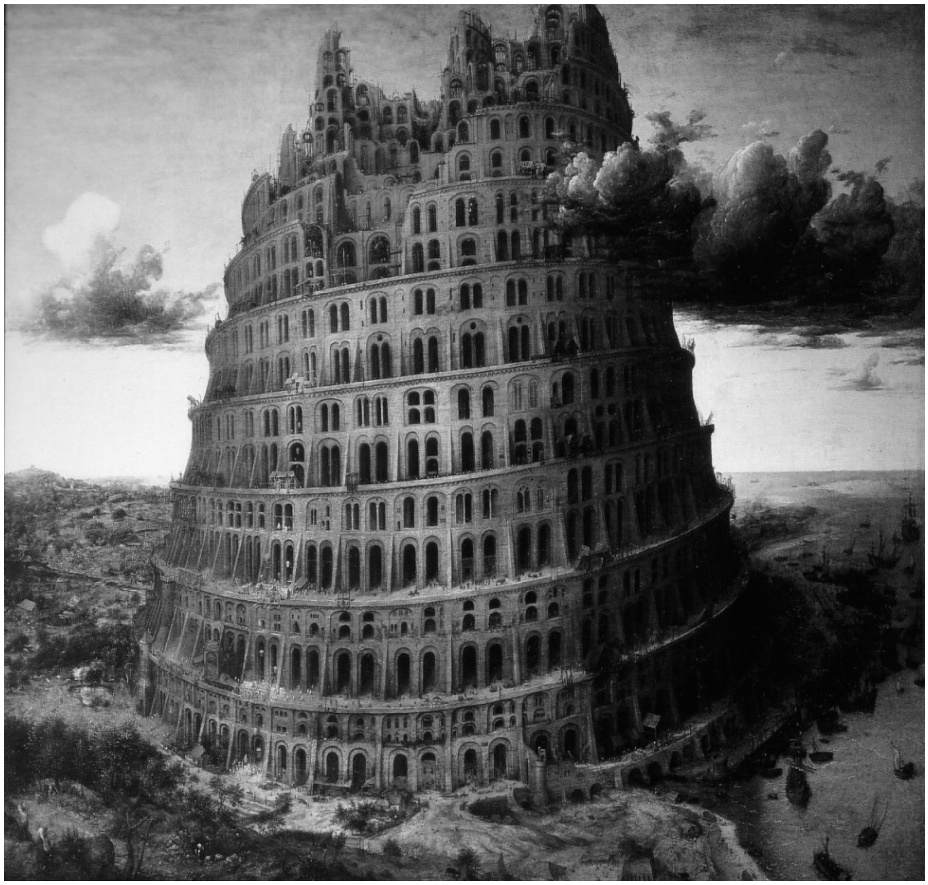
The two central research questions are answered separately in the two concluding chapters. In **Chapter 8** the question after the evolution of innovation attempts into system innovation is answered through generic translation dynamics. This synthesis brings together the insights from separate case analyses. Comparative analysis elicits commonalities and differences between translation sequences, and analysis of 'intersections' addresses the co-evolution of translation sequences; an essential phenomenon in the evolution of innovation attempts. This synthetical analysis also facilitates an overview of systemic changes.

Chapter 9 involves the step from insight to action, answering the second research question. The conclusions on translation dynamics are elaborated into practical guidelines. Developed through a two-way perspective, the translation dynamics do not allow for easy prescriptions, however: Formulation of the synchronization strategy takes the attendant ambiguities into account. After presenting its five elements, these are discussed as contributions to the system innovation debate as introduced. Assessing the fruitfulness of the advocated immanent approach, recommendations can be formulated for further system innovation research.

Chapter 2 Theorizing immanence: Self-reference and translation

"Das System ermöglicht und begünstigt loose talk. Nichts hindert den Politiker, man liest es in den Zeitungen, eine ökologische Anpassung der Wirtschaft zu fordern, in Aussicht zu stellen, zu versprechen; er ist ja nicht gehalten, wirtschaftlich zu denken und zu handeln, operiert also gar nicht innerhalb desjenigen Systems, das seine Forderung letzlich scheitern lassen wird."

Niklas Luhmann - Ökologische Kommunikationen (1990, 225)



Pieter Bruegel (I)
De toren van Babel (2443(OK))
Museum Boijmans Van Beuningen, Rotterdam

2.0 Developing the immanent approach

Having argued for an immanent approach to system innovation 'in the making', this theoretical chapter serves to elaborate this research philosophy into a conceptual framework. First, the discussed tensions in 'system innovation in the making' are revisited. These did not only motivate the choice for an immanent approach, but also yield conceptual clues and telling observations that can aid its further development. This theoretical circumspection elicits the tendency to understand innovation as 'one-way traffic', i.e. through the eyes of innovation 'senders' only **(2.1)**. Second, the immanent approach is grounded in a framework with an emphatically polycentric outlook. Luhmann's theory of self-referential systems is invoked as a way to shift perspective. It helps think through the observed difficulties of innovation reception and transmission. Luhmann explains immanence as the normal condition, following from the need to cope with complexity through self-reference. Three basic mechanisms of self-referential change are exposed, providing a basic conceptualization of the evolution of innovation attempts **(2.2)**. Third, these guideposts are elaborated through a framework similarly polycentric in outlook, yet more concrete and inductive in its approach of 'two-way' innovation traffic. The concept of 'translation' helps understand how innovation attempts are appropriated and selected upon by diverse actors, and how innovations undergo changes when circulating through a polycentric environment. The signaled 'hybridizations' in system innovation can thus be understood in their material dimension as well **(2.3)**. Fourth, the question asserts itself what to do with the two similar but different conceptualizations. The theory of self-referential systems tending towards transcendental 'helicopter vision' itself, the translations framework is to be preferred for its concreteness. On the other hand, the Luhmannian framework captures more of the evolutionary dimension to system innovation. Hence the research question raised earlier: ***How can the immanent approach be elaborated into a research set up that adequately deals with micro-macro linkage?*** This question is taken up by exploring ways to keep the best of both conceptual worlds. Such theoretical multiplicity has been argued to be particularly worthwhile for grasping multifaceted system innovations **(2.4)**. Fifth, the translations framework is 'tailored' to research aims. This leads to three adaptations. 'Stretching' the empirical focus towards aggregated clusters of actors and translations, some of Luhmann's attention to systems of meaning is retained. Furthermore, the construction of a translations typology serves systematic comparison, beyond insightful description. Yet the crucial choice is to follow a nested-case research design. The investigation of parallel but potentially intersecting translation sequences enhances the view on *system* evolution – and on translators' foreseeable difficulty to synchronize their translations. The chapter concludes with a conceptual scheme for translations tracing **(2.5)**.

2.1 Two-way traffic; a shift of perspective

Attempts to achieve system innovation tend to yield results other than envisioned by the initiators. Whether observed by staunch 'transition management' supporters or by critics, the various accounts of 'system innovation in the making' show the transmission from innovation 'sender' to receivers to be far from straightforward. Along the way, the attempted innovation is transformed: Some of the attempted innovation's elements are

'linked up' to the receiver's context, others 'bounce off'. This yields 'hybridization' of innovations (Heiskanen et al., 2009), and at the receiving end 'policy mixes' emerge that can be more or less coherent (Kern & Howlett, 2009, see also Rotmans & Kemp, 2009).

This phenomenon may be surprising in cases of dramatic innovation failure or unintended innovation uptake. On the other hand it has been frequently reported (Geels & Smit (2000), Ferlie et al. (2005), Tushman & Anderson (1986)). With respect to policy changes, Pressman & Wildavsky (1973) produced the classical description of implementation processes assuming a life of their own. Similarly, Teisman (2005) describes the recurring pattern in public management that change initiatives and partnerships evaporate over time: Even after initially successful transmission, when senders' expectations are *not* dashed, the change is often short-lived. In this regard Grin (2010) reminds that initiatives for system innovation and transitions by definition set high goals for change. As transmission can be expected to be accordingly problematic, a key challenge for system innovation then becomes to anticipate and face its problems. The selection environment for radical innovations will generally be less than receptive: This also captures the essence of strategic niche management (SNM). This framework helps to understand the barriers to market entry of 'niche' technologies, and theorizes possibilities to harness them. Nurturing 'niches' in protected environments then prepares for market penetration against the odds (Kemp et al. (1998), Raven (2007), Schot & Geels (2008), Raven et al. (2011)).

Investigating the contextual embedding of system innovative endeavors could thus profit from considerable earlier work. Its challenges have been charted in the fields of public administration, innovation studies, organization theory and technological change. Moreover, the proposed view on innovation as two-way traffic has by no means gone unnoticed: Be it through dispersed acts of implementation, through administrative systems struggling to incorporate change initiatives in their internal organization, through experienced turbulence arising from ongoing operations or through path-dependent selection pressures working against breakthrough of radical novelty – a variety of perspectives could be drawn upon. Feeling a deep sense of urgency, the system innovation champion may hold to his audience that there is a need for change in a particular direction, and they better follow. Their failure to do so may leave the initiator bewildered, but the above accounts present various mirror perspectives: *Why would they?*

In this respect the immanent research philosophy amounts to a resuscitation of old ideas, bringing these to bear on the newly emerging field of system innovation research. Yet it involves more than just 'paying attention' to the world of the receiver. As discussed briefly in sections 1.3 and 1.4, the theoretical issue addressed is not so much that receivers' contexts are forgotten about and transmission is held to be unproblematic – awareness of the latter is almost axiomatic. The issue is more intricate: In system innovation research, with its particular focus on resolution of urgent problems, these shifts-of-perspective still seem to be made from the perspective of the sender. This orientation leads to a derivative interest in the receiver: *Why* wouldn't *the receiver go along in the dearly needed innovation? What causes the receiver to resist? What can be done to remove the mental or institutional barriers impeding acceptance?* The removal of 'barriers' to acceptance often gains analytical primacy over the motivations of receivers, and over the intricacies of the transmission process itself. This goes at a price that is particularly high in the context of sustainability transitions, as critics have argued.

The basic scheme of innovation transmission between sender and receiver helps to flesh out how much theorizing about the receiver end, however insightful, is ill-suited to inform the advocated immanent approach.

System innovation undertakings are sent and received: The sender perceives a system in need of innovation, and likewise, the receiver appreciates this initiative through a particular system understanding. This symmetry is important. Furthermore, the difference between these system understandings is generally understood to result in transformation or hybridization of the transmitted change impulse. Expressed in these terms, symmetry is maintained. Yet once qualified as 'dilution', 'capture' or 'deformation', more is said. The latter terms express deviance compared to the intended reception. Such observation of deviant reception is innovation-dynamically relevant, of course, but it does invite analytical one-way traffic. First, it introduces a dichotomous categorization between compliance and deviance, the coarseness of which may not do justice to the complexity at hand. The vocabularies of 'policy mixes' and 'hybridizations' are richer, for example. Reducing hybridization to deviance also bears a second downside. It is one thing to force hybridization into binary categorization, it is yet another thing to normatively dismiss deviance as 'shallow' reception or 'resistance to change'. These judgements projecting particular system understandings onto system innovation in the making, the transcendental temptation resurges - even when engaging with the plural system understandings of actors involved. This temptation goes all the way down to the concepts developed to describe system innovation processes: Identification of transition phases, distinctions between 'regime' and 'niche' players, 'radical' and 'incremental' innovations, 'frontrunners' and 'laggards'. And whereas 'barriers' and 'resistance to change' are clearly asymmetrical notions, the sender perspective transpires even, albeit more subtly, in notions of 'broadening, deepening and upscaling' (Kemp & van den Bosch, 2006, van den Bosch, 2010): The sender's initiative is yardstick.

In many insightful ways the symmetry between sending and receiving is acknowledged, played out and used to instruct anticipation. Yet *as* anticipations, these insights remain extensions of 'one-way street' thinking[1]. The difficulty to maintain symmetry becomes especially clear through the notion of 'receptivity' (Jeffrey & Seaton, 2004). As discussed in Bressers (2011), the concept was developed as a determinant of innovation adoption – a unidirectional concept. Extending analytical attention to the diversity and changing contexts of potential adopters, the shift-of-perspective was made from adoption to the willingness and capacity at the receiving end. In Bressers' analysis this anticipatory move is followed by the awareness that the senders better be receptive i.e. understanding towards the receivers as well. The analytical camera having made full circle, the conclusion followed that 'the real receptivity lies in the interrelation between sender receptivity and receiver receptivity, in their interface' (32). The theoretical puzzle then remains whether, after these consecutive 'camera switches', still the initial 'sender' perspective of the adoption framework overrides, or whether a truly symmetrical understanding has been arrived at.

To conclude, a variety of theoretical resources are available to instruct the immanent perspective on 'contextual embedding'. Considering the drawbacks of analytical 'one-way traffic', richer models of sender-receiver transmission are needed. Yet as especially

[1] Considering the aim to inform situated action towards system innovation, this applies to this thesis as well. The immanent approach can be considered an attempt to suppress this 'anticipatory shadow'.

the concept of 'receptivity' helps understand, a completely symmetrical perspective proves hard to maintain. As lateral perspectives constantly resurface, conceptualization could at least allow for camera switching between sender and receiver, or zoom in onto their interface. For these reasons Luhmann's theory of self-referential systems is an attractive theoretical starting point: Sending and receiving are treated symmetrically, and the difficulty of transmission is centre stage. According to Luhmann, this difficulty is an inevitable consequence of the complex conditions under which senders and receivers operate.

2.2 Innovation as self-referential change

2.2.0 Introduction

Contextual embedding of system innovation attempts proves difficult. Better understanding of the transmission between sender and receiver is therefore dearly needed, but as argued, this understanding is difficult to gain. Theorization of the receiver side tends to be eclipsed by anticipation, by asymmetrical perspectives that side with the sender. The activist argument that 'there is a need for..' takes precendence over the 'why would they' question. This tendency, by all means understandable through the indications of serious systemic problems, is completely absent in Luhmann's theory of self-referential systems. This theoretical edifice was built at great distance from any problems or solutions, rather focusing on the question how transmission is at all possible. Conceiving of societal development as a co-evolution between connected but not entirely compatible systems of meaning, Luhmann offers a distantiated perspective that comes in useful. As innovation transmission is problematic, coherent system innovation is an improbable evolutionary outcome. Yet reasoning from its improbability, the observed difficulties of contextual embedding can be better understood: The quest for system innovation is turned on its head, as it were. After a general exposition of the theory of self-referential systems **(2.2.1)**, three mechanisms of self-referential change are posited: 'Internal differentiation' **(2.2.2)**, 'resonance' **(2.2.3)**, and 'reflection' **(2.2.4)**. These mechanisms help explain how system innovation can emerge from co-evolving innovation attempts – but they also raise further questions **(2.2.5)**.

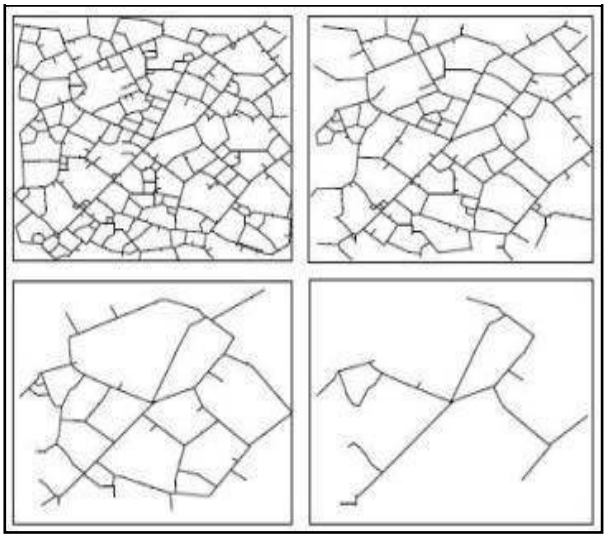
2.2.1 Coping with complexity through self-reference

As exposed in the previous chapter, system innovations and transitions can be imagined as the broader rivers of change that form out of the merging or 'cascading' of many little streams. Such merging does not always take place. In the case of rivers gravity and height gradients will do their work, but in the case of social processes, transition theoretical wisdom points out that considerable mutual reinforcement is required to arrive at such joining of forces. It is a particular course amidst many others in which forces rather mutually detract. Imagining ourselves in the shoes of actors with system innovation ambitions, the possible 'cascade' through which this could be achieved will be opaque: The dynamics of complex adaptive systems (CAS) are notoriously elusive to linear programming of system innovation, as Rotmans (2003) and Loorbach (2007a) explained.

This societal complexity is the point of departure of Luhmann's theory of self-referential systems. The many elements and interrelations that CAS consist of, the many facets of the cultures, structures and practices targeted for system innovation, all in constant flux, to make matters worse - at first sight these will appear as a gigantic blur. For any actor it will be hard to figure out what is going on. Luhmann focuses on the difficulty to 'connect the dots', and the related difficulty to make sense of a situation or 'system state': *"We will call an interconnected collection of elements 'complex' when, because of immanent constraints in the elements' connective capacity, it is no longer possible at any moment to connect every element with every other element."* (Luhmann, 1995, 24). This observed or experienced complexity can be illustrated through the introductory case of the A4 expansion: The addition of an extra lane, an attempted innovation, would have many ramifications: The change would not only affect traffic flow on the road segment itself, for example, but would also affect flow up- and downstream, and traffic flows on adjacent parts of the road network. Considering more and more interdependencies in the road network, the consequences of the extra lane thus become decreasingly determinable.

Strikingly, the Court of Appeal barred the expansion plans for the insufficient elaboration of these network effects. They considered the Ministry's representation of complexity to be oversimplified, and unsuitable for proper impact assessment. Referring to the picture on the right, at issue was which of the four diagrams would represent the set of roads affected adequately. Yet even if the upper left corner model may have sufficiently captured the complex traffic flow effects, still the attendant effects on air quality could remain underrepresented. Mapping all impacts, direct and indirect, and over longer time spans, would arguably be extremely hard. Cartographical wisdom would suggest the creation of separate thematic maps, for the sake of communicative value. The above diagrams could be equipped with various overlays for specific themes and accuracy levels, and the Court of Appeal could specify the lacking information.

Figure 2.1 Complexity reductions



Left aside the issue of what should count as adequate representation, the example shows how complexity forces selective observation[2]. Luhmann formulated complexity as a problem for an observer. Complexity is only the 'horizon within which selections are made' (Luhmann, 1995, 28). In order to make complexity manageable somehow and

[2] See te Brömmelstroet (2010) and Moody (2010) for the politico-administrative relevance of models and maps.

avoid being overwhelmed, it has to be reduced. The systems targeted for change being elusive to full decomposition, both innovation 'senders' and 'receivers' can be expected to be selective in their system understandings. This basic insight, the need for complexity reduction and selectivity, could be considered near-trivial[3]. The inaccessibility of transcendental and complete knowledge about the world implies that immanence is the unavoidable condition for observation. This insight received much elaboration: A notable example is Herbert Simon's behavioural decision theory and his well-known notion of 'bounded rationality' (Luhmann, 2002, 33). Yet beyond this decision-psychological elaboration, Luhmann took the idea of selective observation as a basis for systems theory.

The complexity of the world forces selectivity upon its observers. In order to make sense and accord meaning, the dots have to be connected in a particular fashion. This selectivity is the driving force behind the formation and evolution of social systems, Luhmann explains: Selectivity amounts to singling out the relevant chunks of reality, and being indifferent about the rest. Through this distinction between relevance and irrelevance, systems develop. These are constituted by organizing relevant elements into a coherent whole, and relegating the irrelevant to the system's environment. Any system being a particular simplification of its environment, a discrepancy between the two always remains. The system is always of lesser complexity, and this it can only compensate for by its coherent, ordered nature (Luhmann, 1995, 182). The selectivity can be more or less reliable in the face of environmental contingencies, yet there is never a point-to-point correspondence between system and environment (184). The system has to process the richness of the environment through recourse on its schemes, i.e. *self-referentially*. Self-reference indicates the system's closure towards it environment, which it can only deal with in constant reference to itself.

Self-referential coping with complexity serves system stability. Through self-reference, the system can develop without losing itself in the impulses it receives from its turbulent environment. Self-reference 'accompanies' reference to the environment (Luhmann, 1995, 446). This closure does not amount to complete conservatism, however. The limited complexity of the system is constantly 'irritated' by the new situations its changing environment presents it with. Applying limited decision premises to ever new situations, new decisions are made, and new communications with its environment arise (Luhmann, 2002). Change is therefore inevitable. The system's boundaries do not block environmental signals, but *channel* them. Self-referential closure stabilizes communication channels, but environmental signals are not 'made up' by these channels – the incoming signals are co-productions of the system's self-reference on the one hand, and reference to events in its environment on the other. Self-referential operation cannot guarantee any lasting stability; if the simplifying schemes would remain the same forever, their function to cope with changing circumstances would be increasingly difficult to fulfill. This is why the moments of overwhelming complexity incite the system to sophisticate and fine-tune its complexity-processing channels: The stability afforded by a self-referential relation with the world needs to be understood as one of dynamic instability.

[3] How else, but through the operations of a priori categorization, could we make anything coherent out of the multitude of sense data we receive, Immanuel Kant argued two centuries ago.

Through this notion of self-referential 'closure'[4] several aspects of system innovation can be better understood. First of all, immanence is shown as a direct consequence of complexity needing to be coped with. Situated quests cannot rely on transcendental oversight, but will always be mediated by particular reductions of complexity – or what is often identified by researchers as systemic myopia[5]. In the light of this lack of oversight, it becomes all the more clear why system innovation involves waging innovation *attempts*. Second, the complexity-reducing operation of self-referential systems accounts for system stability. This sheds light on the often lamented phenomenon of 'resistance to change'. As Rotmans (2006, 41) explains: *"…in transition terminology this is how a regime attempts to maintain itself".* This maintenance of stability simultaneously generates change, however: Third, the dynamic instability of self-referential systems indicates not only that innovation attempts may run into the selectivity of social systems, but also that these systems change in the course of their self-referential reproduction. This 'closure that makes openness possible', specified through the mechanisms of 'differentiation' **(2.2.2)**, 'resonance' **(2.2.3)** and 'reflection' **(2.2.4),** helps to explain how system innovation can emerge from co-evolving changes **(2.2.5)**.

2.2.2 Innovation as differentiation

The risk of being overwhelmed by complexity incites systems to constantly sophisticate and fine-tune their communication channels. The system is always lagging behind for its lesser complexity, and encounters contingencies for which its repertoire of reactions has remained underequipped. Momentary non-correspondence with the environment is inevitable; without time limits, the system could do without self-reference (Luhmann, 1995, 42). This is why self-referential systems are inherently restless, seeking to gain time. They can store up experiences, they can speed up, and they can integrate certain relations with their environment (45/46). By means of anticipation and delay the system can gain 'temporal autonomy' (186), a repertoire of standard reactions compensating for its lesser complexity.

Self-referential 'closure' does not free systems from the need to improvise. It does offer the basis for controlled renewal, though. The self-referential stability allows for *differentiation*s that can be safely developed within system walls, in 'internal environments' (Luhmann, 1995, 189). Differentiating the initial distinctions through new distinctions, the system's processing of complexity is 'intensified' (193). Some differentiations are more likely to be consolidated into the system than others, however. They have to prove their added value to be consolidated in the system's organization. In the successful case, the differentiation affords the system with more sensitivity towards its environment. More often than not it will fail to do so however, and become leveled out over time. *"Although processes of internal differentiation can begin almost at random and are not directed by any 'developing' form, still there seems to be a kind of selection that chooses what is capable of becoming permanent. This explains why so few forms of differentiation have been able to survive in long-term systems: (…) Apparently, the only forms of differentiation able to survive are those that can mobilize processes of deviation-amplification (positive feedback) to their own advantage and keep themselves*

[4] Schaap & van Twist(1997) elaborate this concept for management and analysis of negotiation in polycentric settings.

[5] See for instance the crucial role accorded to 'thin simplifications' in Scott (1998), or Paehlke & Torgerson (2005) on administrative rationality.

from being leveled out again." (Luhmann, 1995, 190). As examples of differentiation types likely to be consolidated, Luhmann gives segmentation, center/periphery differentiation, hierarchy establishment, and functional differentiation. Apparently, these kinds of renewal compromise the overall organization to only a little extent, and are easy to fit in.

To conclude, system differentiation specifies how the dynamic instability of self-referential systems yields constant system maintenance and reproduction. This endogenous renewal generates innovation attempts 'from within'. Many differentiations will not become consolidated however. This corresponds with the earlier raised observation in Teisman (2005), namely that application of innovation often does not last, and evaporates. The mechanism of differentiation thus leads to further questions: Under what circumstances are differentiations consolidated? And what is the system innovation potential of internal differentiations compared to other types of innovation attempts? The dynamic instability also raises questions about system resilience: What preexisting differentiation can the system rely on, and what further differentiation does it need? And how can the system avoid that self-destabilization ends up in collapse? The possibility of system collapse will resurface in section 2.2.4. The following subsection addresses change from the outside.

2.2.3 Innovation as resonance

As radical societal innovations on a higher order systems level, 'system innovations' can be expected to require more than reproductive changes and system improvements (Geels & Schot, 2007). Considering that reproduction primarily serves to maintain system operation rather than contribute to higher order system innovation, there are reasons to bet on the innovation attempts undertaken from *outside* the system. Endogenous renewal did rely on outside 'triggers', but how to account for *externally-induced* change?

Innovation attempts from the outside reach self-referential systems just like any other signal from their environment. They are similarly appropriated through the particular differentiations a system has developed, its complexity-processing structure[6]. When confronted by an innovation attempt, the system 'informs itself' about the attempt, with reference to its decision history (Luhmann, 2000, 53); innovation attempts ventured from surrounding systems are self-referentially classified and 'filtered'. And just like tentative differentiations, these innovation attempts easily become filtered out. *"In the context of autopoietic reproduction the environment functions as irritation, disturbance, noise, and can only become meaningful when having an impact on the decision-making context of the system. This is only the case when the system can recognize the difference this will make for its decision-making activity, when the environment in some way or other is changed or not."* (Luhmann, 2003, 40/41). According meaning self-referentially, outside attempts are easily received as irritation, disturbance or meaningless noise. Only incidentally they are interpreted to be relevant.

The difficulty of reception thus becomes clear. This applies especially to innovations related to the natural environment (and therefore often parts of system innovation ambitions): Luhmann (1986) described how self-referential organizations deal with the natural environment. The natural environment in itself is 'mere facticity', he stressed (45). It remains devoid of meaning only until an environmental *issue* can be articulated

[6] The German word 'Komplexitätsaufbau' expresses more clearly how differentiation should be understood as a historical process.

that irritates a self-referential system sufficiently to have it 'resonate'. Resonance is an apt term for the limited response capacity of self-referential systems. With a physics metaphor, self-reference can be said to endow systems with a certain eigenfrequency; systems respond only when innovation attempts touch the right string. This is how resonance with environmental irritations is the exceptional case, Luhmann noted[7]. Against the moral appeals for more 'care for the environment', he signaled a problem of too little resonance capacity; the natural environment hardly connects with the societal system. Moreover, he also noted the related problem of *too much* resonance (220): As societal systems are more likely to resonate with each other than with the natural environment, resonance with the natural environment is likely to trigger a whole chain of resonances and unintended consequences. This problem of too little and too much resonance helps understand the introductory case of the A4 lane addition: It unleashed a turbulent chain of legal, political and scientific resonances.

The scope for innovation attempts from the outside thus depends crucially on the limited resonance capacity of receiving self-referential systems. A sobering conclusion for innovation senders is therefore that the intentions behind an innovation attempt don't count for the receiving systems of meaning. And as far as their initiatives are not dismissed as meaningless noise, they are likely to trigger 'resonating' repercussions that are difficult to foresee. The theory of self-referential systems warns how differentiated societies leave little room for innovation idealism; hence the image of the Babel's tower that accompanies this chapter. As Luhmann put it somewhat polemically: *"Das System ermöglicht und begünstigt loose talk. Nichts hindert den Politiker, man liest es in den Zeitungen, eine ökologische Anpassung der Wirtschaft zu fordern, in Aussicht zu stellen, zu versprechen; er ist ja nicht gehalten, wirtschaftlich zu denken und zu handeln, operiert also gar nicht innerhalb desjenigen Systems, das seine Forderung letzlich scheitern lassen wird."* (225). Taking this advice to heart, innovation attempts need to find the right 'frequency' of self-referential systems to provoke resonance and have an impact. This yields empirical questions after these self-referential 'frequencies' or 'filters': What do they look like? How to investigate the (possibly compatible) filters of senders and receivers?

2.2.4 Innovation as reflection

Self-referential systems continually renew themselves; they differentiate in order to stay in tune with their environments. Still, differentiation does by no means guarantee their resonance with innovation attempts stemming from their environment. Self-referential systems will discard many innovation attempts as 'noise'. But how come the self-referential systems do not seem to know about their limited resonance capacity? How can they be so myopic or unconscious about their limitations?

Luhmann's famous explanation is that self-referential systems 'cannot see, what they cannot see'. Self-reference prevents observation without recourse to the codes, programs and schemes a system needs to cope with complexity. These codes becoming a self-referential system's blind spot, self-scrutiny of its resonance limitations is accordingly problematic. The self-reproduction process does presuppose a certain monitoring or self-observation, however. Self-referential systems can reflect on their processes, and communicate about their communications (Luhmann, 1995, 450-454). Through these

[7] Adding cynically that non-response is exactly what has brought us to the present stage of development (42). Luhmann espoused a radically anthropocentric, or rather systems-centric, view on ecological issues.

self-descriptions, the very system/environment distinctions that constitute them can be fed back into the system. This 're-entry of the system/environment distinction' (455, 473) is a *re*-entry as in the process of becoming a system, it needed to be forgotten. *"The reintroduction leads to the very blind spot that requires the whole apparatus of observations in order to make seeing possible."* (Luhmann, 2003, 52). Re-entry, allowing to 'see, what cannot be seen', is thus paradoxical: The system/environment distinction is, and isn't there. Phrased differently, it amounts to a situation where a system observes itself as it uses to observe others, and is able to see through its own particular complexity reductions. Regarding the practical possibilities for such reflexive 'step aside', further empirical questions arise. The paradox of 're-entry' does indicate it will take considerable efforts for institutions to be critical about their preconceptions, and to imagine a paradigm-shift in their operations.

The reflexive act of 're-entry' brings a system in a situation where two orders coexist: The old way of channeling complexity, and the new, enlightened one. This tense, paradoxical situation helps understand what is often observed in 'system innovation in the making', namely the difficulty of receivers to fit in radical innovations with their ongoing operations. System innovation champions seek to stimulate reflection and 'second order learning' on system understandings, but this easily leaves receivers in a 'twilight zone' between orders (Teisman & Edelenbos, 2004, see also Avelino, 2009). Innovation attempts may be launched to induce reflection[8], but self-referential systems can be expected to eavade the ensuing confusion. By contrast, endogenous renewal through differentiation and resonance allow receivers to remain in their self-referential 'comfort zone'. This gives rise to further questions about the 'reflection' pattern: How does the twilight zone manifest concretely? How can self-referential systems settle the problem of coexisting orders?

2.2.5 Emergent system innovation

The patterns of 'differentiation', 'resonance', and 'reflection' specify the dynamic instability of self-referential systems. Highlighting different aspects of innovation sending and receiving, they account especially for the difficulty and *failure* of transmission: In the differentiating process of endogenous renewal novelty easily evaporates, exogenous change attempts are often dismissed as 'noise' rather than being 'resonated', and reflection upon systemic blind spots appears as overdemanding. The paradox of 're-entry' points out serious limits to self-referential change: It requires a system to draw away the carpet on which it is standing, and forego the advantages of its historically achieved ways to handle complexity.

The theory of self-referential systems gives ground for pessimism about the scope for radical 'out of the box' thinking. Given this limited scope for reflection, innovation attempts' evolution into system innovations depends primarily on differentiation and resonance. These two mechanisms can amplify each other: As differentiation is triggered by 'irritations' from a system's environment, senders can increase and shape these external impulses through innovation attempts. And if these innovation attempts manage to touch a system's eigenfrequency, the receiving system will not only integrate the novelty into its operations, it will resonate it to other systems as well. This amplification between differentiation and resonance is a co-evolutionary process. Systems are surrounded by systems; they part of each other's environments.

[8] Re-entry amounts to 'double loop learning'; differentiation roughly corresponds to 'single loop' learning.

Consequently, the innovation of one system changes the environment of other systems. This change may spur internal differentiation in other systems, as far as they resonate, and eventually higher order innovations such as system innovations and transitions may emerge through a sequence of changes – the innovation 'cascade' towards broader rivers of change the quest for system innovation is aiming for.

Ultimately, the system-innovation achievements of innovation attempts depend on the co-evolution of self-referential systems. Any system change can become a relevant environmental change for another system: Even the marginal innovation attempt could become the proverbial butterfly that triggers the emergence of a tornado through a string of events. In transition theoretical terms, Luhmann's conceptualization indicates that radical system shifts rely not so much on processes of reflection and radical reframing, but will have to follow from a manifold of interacting and resonating 'incremental' changes[9].

The course of this emergent chain of events will be hard to predict, however, nor can it be unilaterally steered. On Luhmann's account of system innovation, the transmission of particular premeditated changes is deeply problematic. As innovation transmission will often involve different systems of meaning, both sender and receiver will make particular decompositions of the complex condition they find themselves in. These interpretations can easily be incommensurable (Cilliers, 2005), leading to the often observed phenomenon that the sender's appeal for change is received as irrelevant 'noise', or 'loose talk'. The sender may perceive the lack of resonance as 'resistance to change', or may be disappointed about the warped or 'diluted' signal that is resonated, but the theory of self-referential systems sheds another light on this. The receiving system is likely to have had *another* change in mind, rather than no change at all: The scheme of action/resistance is deceiving (Luhmann, 1997, 45). Another way to understand this is to consider that different systems necessarily have different environments, and they resonate with only some the parts of their environment - those that become relevant to them. This is how reception of innovation attempts always occurs while receiving other relevant inputs as well; as also discussed under the tensions of system innovation in the making, innovation attempts tend to land in a context in which other changes matter as well. Resistance to change may therefore very well reflect the presence of other developments deemed relevant by the receiver.

This is how the mediations of self-referential schemes or 'codes' help understand and interrelate the observed 'transmission problems'. Through this 'filtering' it is entirely understandable how radical innovations appear to be resisted and the more shallow ones meet with greater receptivity. It also becomes understandable how innovations often evaporate over time; their relevance and added value in coping with complexity has to be proved under changing circumstances. Moreover, if transmission succeeds at all, this will generally take the shape of hybridization, bearing the stamps of both sending and receiving system. On the receiver side the 'emergent incoherence' of policy mixes (Kern & Howlett, 2009) can be considered the normal state of affairs, and on the level of organization-transcending system innovation, emergent incoherence is even more probable. As theorized by amongst others Leydesdorff (1997, 2000) and Rip (2006), the interplay between multiple and divergent self-referential 'codes' yields emergent

[9] Luhmann's three change mechanisms bear striking similarity to the three responses to novelty displayed by CAS, see section 1.2.

outcomes. From the perspective of each of the involved systems, unintended consequences can be expected to prevail.

In this Babylonic view on society, it is thus entirely conceivable how higher-order systemic changes can emerge from innovation attempts. This helps answer the first research question. Yet as regards situated actors' scope for purposeful intervention, Luhmann tells disappointingly little. His mechanisms of change offer useful insights into innovation evolution, but the posited 'filtering processes' raise many empirical questions about the interactions that allow them to happen. The latter concrete processes are particularly relevant to the research aims. They can be addressed through the 'sociology of translations'.

2.3 Innovation as translation process

The theory of self-referential systems offers a rough conceptualization of innovation attempts' possible evolution into system innovations. Indicating complexity reduction as the driving force in societal evolution, the tentative nature of sending and transmitting innovation becomes clear. The mechanisms of resonance, differentiation and reflection help organize the observations of problematic 'contextual embedding' through analytical two-way traffic. The interplay of systems of meaning yields emergent dynamics that will pose surprises to both senders and receivers. This account of system innovation tensions bearing a prima facie plausibility, on second sight it is also worrisome, however: Luhmann tells little about possible intervention in this co-evolution, nor does he shed light on the transmission processes between enthusiastic innovation senders and sometimes reluctant receivers – the concrete movements of 'innovation traffic', and the hybridizations that are frequently observed to come out of this. Leaving the relation between systemic communications and situated action under-theorized, its 'building blocks' are more useful in generating empirical questions than in answering those (Mingers, 2002, 291/292, see also van Twist, 1995). On a more positive note, the theory of self-referential systems offers preliminary answers that can be used as theoretical signposts. Conceptualizing the evolution of innovation attempts through the patterns of self-referential change, further theorization should specify the concrete processes and behaviors that allow it to happen: After an innovation attempt is launched into a differentiated, polycentric society, what are the phenomena to look for? And assuming that these are bound to be received as irrelevant 'noise', and that resonance will be warped by self-reference: *What empirical phenomena could account for this mysterious resonance capacity?*

Understanding of these phenomena can benefit from work in science and technology studies, and within this field, from actor-network theory (ANT) and the related Social Construction of Technology (SCOT). These approaches developed from research interests very different from Luhmann's all-encompassing questions after transmission. At the focus of attention is not so much the resonance capacity of systems, but first of all the knowledge and technologies that somehow emerge out of transmissions – the material outcomes often observed to take the shape of hybrids. These approaches start with curiosity or suspicion about apparently monolithic 'things', such as self-evident knowledge or taken for granted technologies. Through meticulous investigations the unexpectedly complex ontogenesis of those can be highlighted (Law & Hassard, 1999). Detailed empirical accounts show the solid-appearing world to be constructed, and this

subtly undermines common categorizations and juxtapositions: Between 'hard' natural science and 'soft' social science, for example, or between 'the social' and 'the technical'. As Callon and Latour argue, these categories hide more than they reveal; as 'black boxes' they hide how these constructs have come into being. This also applies to the social-theoretical ordering device of 'systems'. These demarcations impose coherence that itself is in need of explanation (Callon & Latour (1981, 297), Law (1992), Latour (2005)). *How did those systems come into being in the first place? And what connections between their elements keep them from falling apart?*

These deconstructing questions remind of the critical questions raised regarding transition management and its systemic governance. They resonate with the calls to maintain an 'open-textured' understanding of transitions, to be open to 'diverse transformations', and to be sensitive to two-way innovation traffic. This curiosity for the contents of black boxes is a promising bases for more concrete understanding of contextual embedding. The basic idea of these approaches is that transmission is a change process in which the relations between sender, receiver and that what is sent are reconfigured. What semiotics does to texts, showing the meanings of words to be mutually dependent, is extended to the world of actions and objects (Law (1992), Law & Hassard (1999, 4)). These too cannot be understood properly in isolation: Innovation is conceived of as three-way traffic, as intertwinement between sender, receiver and that what is sent. A concept like Luhmann's 'resonance capacity' tears this intertwinement apart. His camera may switch between sender and receiver and give both equal attention, but still the intertwinement *process* escapes attention. By contrast, this relationist perspective focuses on the many convergences and associations between heterogeneous elements, and on the formation of more or less stable objects and structures.

Callon, Latour, Law and colleagues produced detailed ontogenetical accounts (of authoritative knowledge on scallop fishing (Callon, 1986), the development of an electrical car (Callon, 1980), the Concorde project (Law & Callon, 1992) or of 'mundane artefacts' such as doors and seat belts (Latour, 1992)), following actors' attempts to strengthen their positions by associating with allies. These associational processes were never trivial. They displayed associations interspersed with disintegration, shifting associations, and the emergence of hybrids – the results also frequently observed in system innovation. The associations had to surmount considerable heterogeneity. In order to have them join the associational network, the potential allies had to be actively 'enrolled' to become actual allies. This trick of enrollment required initially divergent interests to be gradually 'funneled' into a perceived joint interest (Callon & Law, 1982, 619). It is this funneling process and its transformations of interests that gave rise to the sociology of translation, following actors in their attempts to enroll others. *"In order to grow we must enroll other wills by translating what they want and by reifying this translation in such a way that none of them can desire anything else any longer."* (Callon & Latour, 1981, 296).

The sociology of translation focuses on the processes in which heterogeneous actors converge and diverge, trying to enroll others. Translation indicates how association-forming is a process of struggle and persuasion, in which the relations and the identities of the constituent parts of an actor-network are constantly renegotiated. This emphasis on overcoming heterogeneity corresponds with Luhmann's Babylonic worldview. Translations could be considered lower-order phenomena of meaning-processing, accounting for resonance between self-referential systems (Leydesdorff (2000, 244),

(2010, 15)). Yet more is processed than meaning. As mentioned, translation in the ANT understanding is a network-formation process in which both human and non-human elements cluster: The latter tend to play roles more important than just mirroring meaning accorded to them, and human elements can sometimes even be replaced by non-humans: Latour (1992) provided the famous example of the 'sleeping policemen', the road bumps taking over the 'enforcement' of speed controls from human policemen. This replacement or 'delegation' signals how the relationism of ANT yields radically different descriptions of innovation transmission: That what is being transmitted is no longer a passive object; not only senders and recipients matter.

The sociology of translation aims to maintain symmetrical understanding regarding all elements of association processes. Unsurprisingly, the rather bizarre concept of non-human agency has met with criticism and ridicule. Yet the point behind this symmetry is not so much the sweeping claim that non-humans act like innovators or receivers do, but rather to avoid the human-centered presupposition that only the latter are worth attention[10]. Full three-way symmetry between sender, receiver and the transmitted could thus be a most parsimonious and 'open-textured' approach, but then the assumptions about enthusiastic innovators and more or less reluctant receivers would have to be dropped as well. Such full symmetry does not fit the research question after purposeful intervention in innovation evolution. ANT's rigorous avoidance of reification thus comes in helpful in creating open-textured approaches, but it is rarely applied in its radical form (see Latour, 2005, 10/11). The focus on dynamic processes of coming-into-being and their hybridizing transformations have attracted many innovation scholars, including the ANT developers mentioned. As Miettinen (2000, 181) indicates, in these cases the symmetry is played down, in favor of descriptions that do show purposive innovators seeking to achieve their goals. These innovation-related applications are most instructive for present purposes:

The developers of the 'sociology of translation' have also used the concept to unpack innovation processes, approaching these as sequences of enrollment and disenrollment. Akrich et al. (2002 a,b) highlight the difficulty to move successfully from an idea or prototype to an innovation endorsed by users: Innovation involves a myriad of bigger and smaller decisions, and takes place in a permanently changing environment where prediction of demand is almost impossible – if only for the elusiveness of user preferences. An exemplar case is the intended diffusion of photovoltaic kits in Africa. French industrialists had designed them as simple solutions to difficulties with lighting provision. The kits were attractive for their relative low installation costs, reliance on renewable energy, robustness and portability. After technical testing they were sent to Africa. After a short-lived infatuation the kits 'rusted under the attentive gaze of the engineers especially sent out', however, abandoned by their intended users (Akrich et al., 2002a, 17). The crucial problem with the kits resided in the rigidity of design: The fixed length of the wire literally narrowed its range of application, and moreover, the non-standard elements and the hermetically sealed battery-regulator prevented any repair or alteration. The devices thus failed to be taken up, despite the carefully designed properties that had made them seem attractive solutions. Not allowing for the translations to weld a stable network around them, the innovators failed to enroll users and repairmen.

[10] See for more extensive discussion of this topic the Latour & Callon vs Collins & Yearley debate.

Successful innovation relies not on the intrinsic properties of an innovation, Akrich and colleagues stress; it relies primarily on the enrollment of allies. They denounce the 'diffusion' model of innovations that separates the properties of the innovation from its potential allies, and instead formulate a 'model of interessement'. *"The model of interessement allows us to understand how an innovation is adopted, how it moves, how it progressively spreads to be transformed into a success. The socio-technical analysis underlines that the movement of adoption is a movement of adaptation. The continuous flow method* [an empirical example used in the text- B.P.] *does not exist in general. It must be transformed, modified according to the site where it is implemented. To adopt an innovation is to adapt it: such is the formula which provides the best account of diffusion"* (Akrich et al., 2002b, 3). To adopt is to adapt, the interessement model states. An innovation goes through the hands of many inventors, users and intermediaries who become enrolled through their adapting translations of an innovation. In this model the fate of an innovation typically depends on the collectivity of actors, on their ways to circumvent resistance, and on the distributed ability to arrive at a stabilized network of associations around an innovation. In this process of translation the innovation inevitably changes; 'the future is to the hybrids' (6).

This exposition shows more clearly how the 'translations' concept helps understand innovation evolution – and how human interventions could exert influence on these network dynamics. The example of exporting photovoltaic kits can easily be related to the observations on system innovation in the making; it describes these transmission challenges through concrete reconfigurations, and through translations by actors who adapt innovations. This relatively human-centered concept of translation – emphasizing the social construction of technology (SCOT) over the technological construction of the social - gives several useful empirical leads. It helps understand innovation traffic as an ongoing two-way process with several moments. Tellingly, Akrich characterized the aforementioned export of photovoltaic kits as a case of 'technology transfer' (Akrich, 1992, 207): 'Transfer' suggesting a rather smooth and singular displacement from A to B, it resembles the all too easy ideas about 'transitionizing', turning business-as-usual into transformative change as by magic wand. Viewed in slow-motion, transfer and transmission look more like the following: An innovator has a certain ambition (helping people in low-developed countries, seducing inert 'regime players' into transformative change), and decides to devise an innovation attempt (constructing a photovoltaic kit, setting out a management strategy for 'sustainable' operations). The innovator then inscribes his ambitions in the attempted innovation: The content or shape of what is transmitted then embodies a certain scenario, circumscribing its use in the targeted context of application. The innovator may hope that receivers do so in line with his ambitions, but this depends on the inverse process: Receivers may have different ambitions, and accordingly, they refuse the script, adapt it, or devise their own. These receptions in other contexts may lead to tinkering with objects, to edited texts, or to requests for amendations. This is how two-way innovation traffic between innovators can be read off from the changes in the innovation object (Akrich, 1992, 209). The signaled 'dilutions', 'deformations' and 'hybridizations' in system innovation can be understood through their material expressions as well.

Innovation initiators and receivers translate innovations, yielding different shapes and adaptations. In the case of linguistic translation and modification of texts, translations can be traced easily through the 'track changes' function. Displaying several authors' changes simultaneously, this is revealing about their mutual interactions as well - do

they respond to each other's suggestions? Translations can also take on a material character, however. Czarniawska & Joerges (1996) highlight how translation processes can account for the spread of innovation precisely because ideas materialize in objects. As objects are used, acted upon and give food for new ideas, translation needs to be understood as comprising both semantic and material dimensions. They distinguish three moments in the ongoing translation processes: *Ideas, objects and actions*. An innovation attempt in either of these guises therefore needs to be understood as a snapshot of *ongoing transformation* (9/10). These ongoing transformations are particularly salient to the changes in cultures, structures and practices at issue in system innovation research: Translations analysis captures the spread of innovation attempts in all of these dimensions. This also indicates how translations analysis is more open-textured than the similar frameworks of 'technology transfer', 'policy transfer' or 'innovation diffusion': The latter are less responsive to ongoing transformations and tend to presume transmission of stable entities (Bergström & Dobers, 2000, see Heiskanen et al., 2009 for combined application of 'transfer' and 'translations' analysis). As nicely expressed in Doorewaard & van Bijsterveld (2001, 60/61), this attention to ongoing transformation captures not only an organization's adoption, copying or assimilation, but also the intricate 'osmosis' of novelty 'fighting its way through an organization's semi-permeable membrane'.

Through its attention to ongoing transformations, the sociology of translations calls attention to phenomena often treated rather casually. In the world of system innovations and transitions, with its particularly high ambitions for societal change, it is a common expression to say that 'eventually, the visions have to be translated into practice'[11]. Translations analysis sets this 'elaboration into practice' in the plural. It sensitizes to processes of circulation. In Latour's words, translation is *"…the spread in time or space of anything – claims, artifacts, goods – in the hands of people; each of these people may act in many different ways, letting the token drop, or modifying it, or deflecting it, or betraying it, or adding to it, or appropriating it"* (Latour, 1986, 267). Beyond the basic sender-receiver scheme, the sociology of translations emphasizes that innovation is a collective process. Many visions can be expected to be translated in many practices (and vice versa). And as Akrich (1992, 208/209) points out, adjustment between designer and user will be needed if the innovation is to be more than a chimera. If the innovation is to achieve a stable form, such as a photovoltaic kit that benevolent sponsors, intended users as well as repairmen can endorse, coordination is needed. Yet as these protagonists operate in a constantly changing environment, they are bound to face a challenge typically occurring in a game of Scrabble: *"Like the game of Scrabble, one must be prepared to take into account the state of the board that the turns played by adversaries permanently modify. Sometimes it is better to change combinations i.e. redefine the product so as to take advantage of an opportunity rather than to stubbornly persist in passing one's go while waiting for the hypothetical opportunity to put down the complete word which has been prepared on the letter-rack"* (Akrich et al., 2002b, 214). In system innovation in the making, a multi-player game by definition, this coordination challenge can be expected to be especially severe. The protagonists cannot afford to remain immersed in the construction of their 'words'. Instead they need to update their views on the board situation regularly, and revise their planned actions accordingly.

[11] See for instance the set up of the transition management cycle, discussed in section 1.2. The intention to create iterative cycles reflects responsiveness to ongoing transformations, it needs to be said.

Star & Griesemer (1989) call attention to these coordination problems from an ecological angle on translation processes. They explain that the multitude of players will yield a diversity of overlapping games. The coordination of translation processes will therefore require more than local 'negotiations', as indicated with the limited-player example of Scrabble. In the case of a multitude of translations, when multiple social worlds intersect, there is the risk this yields only a cacophony of translations. With respect to system innovation, this reminds of the 'emergent incoherence' in receivers' policy mixes as observed by Kern & Howlett (2009). Observed at the level of the networks the translators are operating in, Star & Griesemer (1989) signal that actual consensus is unlikely to restore coherence. In their extended translation analysis they raise attention to stabilization in spite of this. They come up with the phenomena of standardization and the formation of 'boundary objects'. The first reduces heterogeneity, ensuring that, to some extent, translators translate alike. The second, the formation of 'boundary objects', can be considered the more intriguing addition to translation analysis. These objects somehow manage to meet the requirements of a multitude of divergent ambitions and interests, without being torn apart by the translators pulling at them. *"Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of several parties using them, yet robust enough to maintain a common identity across sites."* (393). An example of a boundary object would thus be a flexible photovoltaic kit embodying sponsors' intentions while allowing for various practical uses. In section 1.3.2 Kemp & Rotmans (2009) provided another example: In the analyzed 'contextual embedding' of transition management principles, the translation traffic between its promoters and the ministerial receipients materialized not in an entirely shared understanding of this governance model, but rather in a 'boundary concept' negotiated to be meaningful to all parties.

The theme of emergent incoherence unmistakeably echoes Luhmann's account of resonating self-referential systems. Yet as Luhmann did little to elicit the scope for negotiation and the plasticity of innovations themselves, the translations framework can be considered more promising to investigate intervention in innovation evolution. On the other hand, Luhmann's conceptualization offers a broader perspective on systemic change. Similar to Star & Griesemer's ecological extension to the translations framework, this broader perspective may still prove useful. In the next subsection it is assessed how to keep the best of both conceptual worlds.

2.4 Self-reference and translations: Exploring theoretical multiplicity

The immanent approach to 'contextual embedding' of system innovation attempts requires a two-way understanding of innovation transmission **(2.1)**. Luhmann's theory of self-referential systems meets this requirement, yet tells little about situated actors' scope to change the course of events **(2.2)**. The 'sociology of translation' is more informative on that matter, focusing on concrete network interactions and eliciting the ongoing transformations of the innovation 'transmitted'. The latter focus on situated reconfigurations and actions, as well as the attendant aversion to presuppositions about 'systemness', meets research aims best **(2.3)**. Yet before settling the theoretical issue by simply discarding the theory of self-referential systems, it is considered whether some of its systemic perspective could be retained. This would capture more of the evolutionary dimension to translation processes, which is particularly important in system innovation

research. Hence the research question posed earlier: *How can the immanent approach be elaborated into a research set up that adequately deals with micro-macro linkage?* This question is taken up by exploring ways to keep the best of both conceptual worlds. Such theoretical multiplicity has been argued to be particularly worthwhile for grasping the multifaceted processes of system innovation.

The two conceptual worlds display clear similarities. Both frameworks raise attention to the circumstance that innovation attempts are launched into a polycentric, heterogeneous society. In the same vein, both deem it improbable that an innovation attempt will 'diffuse' or be followed just for its alleged intrinsic value - its designed potential to solve a systemic problem for example. The sociology of translations highlights how adoption tends to entail adaptations; the theory of self-referential systems exposes the mediation by self-referential resonances. In these senses translations could be considered micro-manifestations of 'resonance'. Inversely, Luhmann's account of emergent system evolution could be considered a higher-order manifestation of the chaotic 'Scrabble' game of translations.

Appreciated as such, it would be ideal to merge the two frameworks into a layered but singular conceptual world. Such integrated framework would help trace the entire innovation cascading from small sources to entire rivers of change. The division of labor between system resonances and actor translations would neatly achieve micro-macro linkage: Combining helicopter vision with situated perspectives on the ground, conceptualization would reach the 'double vision' so desirable for the understanding of system innovation and its governance (Grin, 2010). Also Termeer & Dewulf (2009) and Geels (2009, 2010) argue such theoretical multiplicity to be valuable for system innovation and transitions research: Especially when studying multidimensional and multilevel processes, singular theoretical frameworks are bound to run up against their limitations. Whereas Termeer & Dewulf concentrate on transition management, Geels focuses on the conceptualization of transition dynamics. In Geels (2009) he indicates that the Multi-Level Perspective (see section 1.2) is a 'global model', a macro-perspective on societal transitions. Through the notions of 'regimes', 'landscape' and 'niches' the model aids systematic investigation of transition trajectories, pathways, stages and change patterns. By contrast, local models give micro-perspective 'explanations from the viewpoints of the actors involved' (Geels, 2009, 808). He continues to point out that with regard to these 'local' models, different ontological positions exist. Each postulating certain causal mechanisms, these models elicit particular aspects of agency. In his empirical case on pig husbandry, rational choice theories highlight actors' rational responses to changing prices of wages, fuel, animal feed and fertilizer, for example; part of the development towards intensification into pig industry can be explained through cost-benefit calculation. By contrast, interpretive analysis highlights that these very calculations only became common practice over time. This could be explained through the learning processes induced by farmer associations and agricultural schools (824).

Theoretical frameworks yield specific insights and oversights. By comparing concrete complementarities and tensions, the scope for theoretical 'crossovers' can be appreciated beyond general ontological considerations. The productiveness of theoretical multiplicity depends on careful consideration and testing. It involves tradeoffs between theoretical insights and oversights, and these can be handled more or less successfully: Geels concludes that oversights better not be patched through a fully integrated theory.

Such synthesis is likely to be ontologically inconsistent, or to remain insufficiently specific (827). The risk of inconsistency also applies to eclectic ad-hoc combinations, dynamic relationships between conflicting concepts often *remaining* unclear. On the other hand, too much respect for incommensurability between paradigms would privilege 'normal science'. Such singular-framework research would forego the signaled opportunities for enriched observation and theoretical complementarities through which to grasp the dynamic interactions so typical for system innovation. Geels therefore argues for crossovers and meta-paradigm analysis that focuses on interactions and relations between ontologies. This approach respects theoretical incommensurabilities (systemic problems cannot be considered as both constructed and objective), yet deliberately targets particular theoretical tensions for paradigm interplay. As an example of such interplay he gives actor-centered institutionalism (Scharpf, 1997), yielding a better appreciation of the 'games real actors play'. While 'sacrificing some parsimony', such hybrid approaches 'gain in accuracy and realism' (Geels, 2009, 828)[12].

Combining the conceptual worlds of 'self-referential systems' and 'translations' could thus reap gains in accuracy and realism – provided this does not wind up in untenable eclecticism or overly general integration. Beyond their convergences, it therefore needs to be considered in which respects they constitute incompatible conceptual worlds. The classifications in Geels (2009, 2010) help specify the differences. Both frameworks are constructivist conceptualizations, to begin with, taking changing interpretations of problems and solutions as the main driver behind the emergence of system innovation. They differ in the emphasis placed on agency and structure however: The self-referential resonances could explain system evolution, but not the immanent actions and experiences of individuals waging or receiving innovation attempts. Similar to other structuralist accounts, the systems of meaning operate 'behind actors' backs'. The mysterious character of the resonances invites further empirical questions. As discussed, the more actor-centered translations analysis is to be preferred for its attention to concrete transmission processes. It could lose sight of *systems* of meaning as well as *system* innovation, however: According to Luhmann, the very attention to agency tragically risks to miss the action. Because of this relative independence of systems of meaning, self-referential change cannot simply be treated as a 'macro-translation'. Inversely, the sociology of translation cannot understand self-referential systems but as temporarily solidified clusters resulting from translations.

This incompatibility between translating agents and resonating systems of meaning is compounded by a second theoretical difference. The translation framework conceptualizes an element not articulated in the theory of self-referential systems, namely the innovation itself. Approached from the theory of self-referential systems, innovation attempts are reduced to 'incoming signals'. Whether ventured as claims, artifacts, or as actions, theoretically they can only be grasped as signals. Instead, the 'translation' conceptualization is attentive to the relatively autonomous and often material existence of the innovation 'transmitted'. The aforementioned photovoltaic kit was not just received as 'noise', it proved unfit for the appropriation and tinkering to make it useful to others.

For these reasons the translations cannot simply be reduced to micro-level processes of self-referential change - nor can resonance be treated as magnified translation: This

[12] Theoretical multiplicity is an important way of meeting the call for attentiveness to diversity in system innovations research, see Stirling (2009, 2011) in Ch.1.

would be an all too liberal application of theoretical multiplicity. For the more cautious strategy of paradigmatic *interplay* there is considerable foothold, however. The two frameworks share a constructivist paradigm, and the respective emphases on systems of meaning and translating actors do not indicate entirely incommensurable conceptual worlds. The relationist translations framework does resist reifying analysis that projects systemness onto ongoing transformations, it is true. Considering that Luhmann's system/environment distinctions are constantly renegotiated, the researcher would be advised to watch closely this improbably stable association into 'translation machines'. Yet to mistrust these resonating systems as obfuscating 'black boxes' is not to deny systemic processing of meaning as part of ongoing transformations. As also indicated by Noe & Alrøe (2005) and Grundmann (1999), the associational translation processes do presuppose a certain stabilization to prevent the networks from disintegration. Translators seeking to safeguard their achievements will erect boundaries to maintain themselves amidst ongoing transformation, and thus initiate systemness: In the process of ongoing transformations, translations cluster, and systemic structures emerge that set conditions for further translations.

The signaled 'micro-macro division' between the two frameworks risks to exaggerate their differences. Sharing theoretical attention to both stability and change (Bakken & Hernes, 2003b), both circumvent the traditional micro-macro juxtaposition. Both are sensitive to systems *formation* and to clustering agency that *stabilizes* into quasi-systemic configurations. These dynamic representations steer clear of both voluntarism and determinism. Especially the translations framework helps understand 'micro-macro' linkage as a continuous process of actors gelling together into more or less stable and obdurate 'macro-actors' (Callon & Latour, 1981). Structure is not a noun but a verb, Law (1992, 5) expresses it elegantly, and this means that empirical analysis better keep an open eye to the concrete ways in which systems, routines and ideologies are reproduced, drawn upon or broken down[13].

To conclude, the exploration of theoretical multiplicity has specified how the theory of self-referential systems and the 'translations' framework constitute different conceptual worlds, but still allow for what Geels (2009) indicated as 'paradigmatic interplay'. Tailored combinations could afford a better view on the phenomenon studied: The processes through which innovation attempts are received and embedded, and 'cascade' into more or less coherent systemic changes. This theoretical circumspection leads to the following considerations and choices:

First of all, it has become more clear why the translations framework should be taken as the basis to be extended, rather than the add-on to fill in Luhmann's abstractions: It is the more parsimonious approach to systems formation, avoiding the premature reification that gives rise to 'transcendentalism' in system innovations research. Second, the translations framework is a better basis for investigating 'contextual embedding'. It's two-way perspective is also attentive to the ongoing transformations in the innovations 'transmitted' – this material dimension to innovation is not articulated in the theory of self-referential systems. Third, it has become clear how the translations framework is indeed rather limited in scope for its aversion to reification: Rather than following Luhmann in theorizing systemic resonances and societal evolution, this framework zooms in onto the processes that allow systems to be systems in the first place. This is a

[13] To conceive of 'structure' as a verb is similar to Giddens' (1984) account of structuration, Law indicates.

downside to be taken seriously. Geels (2010) signals that the focus on local stabilization processes neglects their broader sedimentation into society, that the attention to contingency makes it difficult to establish more generic patterns, and that the 'flat' relationist ontology defuses the very aggregating notions of 'systems' and 'levels' that are central to transitions research (502/503, 507). The relationist parsimony goes at the price of underexposing how the rules and resources in institutional fields filter, enforce and select upon innovative variation (Rammert, 1997, 185-187). Fourth, consideration of theoretical multiplicity has shown that this downside, the relationist insight that also entails oversight, could be 'patched' through Luhmannian insights. The gelling together of actors, the hardening of networks into configurations with systemic properties - this continuum of structure-formation could be built on to afford translations analysis with some of Luhmann's attention to systemic 'filtering'. This would amount to stretching the framework a little, more than corrupting it through completely alien elements. Geels (2010) indicates this particular form of paradigmatic interplay to be promising for system innovation and transitions research. The continuous representation of structuration may not cover the entire structuration range theorized through the Multi-Level Perspective[14], but could be an alternative way of investigating transition (507). The proposed immanent approach is such an alternative way: This two-way focus on system innovation in the making deliberately involves less aggregation than required for explanation of transitions.

In the final subsection this theoretical exploration is completed. Having clarified how 'micro-macro' linkage can be dealt with, the translations framework is tailored to research aims. 'Stretching' the framework will be done in three ways: Through focus on aggregated actors and innovation attempts with system innovative relevance, through a translation typology that enhances systematic exploration of 'filtering', and through the choice for a nested-case set up.

2.5 Conceptual scheme: Intertwined translation sequences

2.5.0 Tailoring the translations framework

The sociology of translation is particularly useful to study the interplay between innovation initiators and receivers as two-way traffic. Its attentiveness to the transformations in the innovation itself meets the aim of immanent research. The parsimonious approach underexposes how innovations are structurally 'filtered', however. In this respect the framework could be 'stretched' and tailored to investigation of *system* innovation processes. Even moderate paradigmatic interplay with the theory of self-referential systems can extend its scope of significantly: A first way to do so is to focus on aggregated actors, and on innovation attempts with system innovative relevance **(2.5.1)**. Second, a translation typology enhances systematic exploration of 'filtering' **(2.5.2)**. Third, a nested-case set up helps trace the co-evolutionary dimension to system innovation **(2.5.3)**. These choices lead to a conceptual scheme in which innovation attempts are translated by various actors, the resulting 'translation sequences' of which may intersect. The research questions can be answered through the resulting insights into translation dynamics **(2.5.4)**.

[14] See Figure 1.4. The vertical axis with the 'niche', 'regime' and 'landscape' levels indicates a continuum – a representation actually inspired by actor-network theory (Grin et al., 2010, 18/19).

2.5.1 Aggregation

The choice for translations analysis implies in-depth process tracing. It is a way to study the coming-into-being of systemic change: The analytical camera focuses on innovation initiators seeking to draft allies, on receiving actors with different system understandings and ambitions who translate accordingly, on the changing shapes of the innovation itself, and on translators' foreseeable struggles to cope with the attendant coordination challenges. Similar research has been done before. Yet as discussed earlier, the choice for in-depth investigation does entail a tradeoff with global explanation. The ethnographic commitments of the sociology of translation could narrow empirical focus to local practices that tell too little about *system* innovation. There is a considerable analytical gap to be bridged between the local innovation attempt and its translations on the one hand, and system innovations on the other. The challenge is to reduce the explanatory shortcomings of translation tracing, whilst retaining its advantage of fine-grained research.

Translations analysis tends to zoom in onto the emergence of the tiny innovation streams - interesting enough in their own right, but of limited systemic significance. Theorizing boundless circulations and transformations of a multitude of heterogenous actors, there is no reason why the translations framework couldn't be attentive to wider circulations and broader innovation streams as well. This possibility speaks from the bigger and smaller 'objects' that have been targeted for translations analysis, and from Star & Griesemer's 'ecological' translations analysis. Moreover, remembering Law's dictum that 'structure is a verb', an integral part of the framework is the acknowledgement that translation tends to bring forth amalgamations, clusters and 'macro-actors' that can harden into constellations with systemic properties. On this continuum especially these aggregated clusters are suitable foci for system innovations research.

A first way to aggregate is to remember that the two-way traffic between initiator and receiver generally involves a multitude of interactions. The studies on 'system innovation in the making' and 'transitioning' display translation dynamics in condensed fashion. The 'hybridizations' and the like were reported in the form of summarized results and patterns of negotiation: Not the many separate actions through which the transitions approach was slowly inserted in the minds of individual policymakers, but rather the ways in which groups of actors and entire departments took up the concept (Rotmans & Kemp, 2009); not singular appreciations but emerging discourses on the 'transition to sustainable mobility' (Avelino, 2009). Such focus on aggregate actors (institutions) and translations (discourses) retains some of Luhmann's view that translations are shaped by systems of meaning. These aggregates operate as larger-scale 'translation machines'. Accounting for *lasting* association, *sustained* translations and *widely spreading* innovation processes, they widen the scope of translation tracing. Czarniawska & Sevon (1996) expose a similar 'stretching' of translations analysis to account for the 'travels of ideas'.

2.5.2 Translations typology

A particular kind of translations analysis is needed. The interests in *system* innovation and the scope for intervention therein both imply a desire to detect translation-dynamic patterns. The 'ongoing transformations' of innovation are not investigated out of sheer curiosity, but with an anticipatory motive. In this regard Luhmann's distinction of

change 'mechanisms' is attractive, similar to the footholds identified under the transition management framework. Identification of differentiations, resonances, reflections and their mutual amplifications could afford a more generic understanding of translation dynamics, and provide beacons for action. Such classification would yield insights into the 'cascading' processes between small streams and rivers of change, beyond the description of interesting examples. As Smith (2007) indicates, some of these insights have been developed under 'strategic niche management' research. Still a 'theory of linking' between innovative 'niches' and regimes under stress he finds lacking: It would help to investigate the 'connecting processes' through which the innovations in 'niches' are selectively appropriated by dominant institutions (431). This led him to distinguish three kinds of 'higher order' translations,[15] constituting different forms of niche-regime interplay.

As discussed under 'aggregation', it is indeed recommendable to 'stretch' the translations framework a little to follow higher-order circulations. *"These higher order translations might usefully be conceptualised and deconstructed into multiple actor translations within intersecting and reconfiguring networks, but I do not develop such a method in the space available here",* Smith comments instructively on his aggregation (448, note 6). Involving the identification of 'niches' and 'regimes', this particular tailoring overstretches the translations framework, however. Projecting particular system understandings onto translation processes and introducing unnecessary presuppositions on the dominant or dominated position of protagonists, these notions invite analytical one-way traffic. Instead, it is more parsimonious to break down these higher-order translations, as Smith suggests, and distinguish basic translations. Possible 'higher-order translations' are then left to emerge out of empirical investigation, in keeping with the 'open-textured' approach that remains sensitive to diverse transformations[16]. For the same reason translation types' *functionality* for system innovation better be left open – even when it is well conceivable that particular ways of translation are generally fruitful or not: When, as Luhmann considered likely, an innovation is widely received as irrelevant 'noise', not much systemic change will result from the collective process. By contrast, massive 'resonance' can be expected to unleash complex 'cascading' processes. However plausible, the typology should be freed from such presuppositions. Remembering the examples from system innovation in the making, the typology could distinguish between more and less enthusiastic reception, or between adaptations more or less in line with initiators' intentions. It then remains to be seen what combinations and sequences of translations occur, what translation-dynamic patterns arise, and how these patterns relate to the system innovation achievements made in a particular case.

Luhmann's change mechanisms circumscribing the dynamic instability of self-referential *systems*, the typology of translations should cover the range of possible translations by *actors*. The following categories come to the fore: In the first place, there is the distinction between affirmative and negating responses: Endorsement and rejection, adoption and resistance, or in terms of self-referential change, between 'noise'

[15] 1.Translating sustainability problems, i.e. how problems in the regime inform the guiding principles in creating the niche; 2.translations that adapt lessons, i.e. reinterpreting elements of socio-technical practice in the niche and inserting them into regime settings, or modifying the niche in the light of lessons learnt about the regime; 3.translations that alter contexts, i.e. changes that bring the regime closer to the situation that pertains in the niche, or vice versa.

[16] See section 1.4.

and 'resonance'. The second step is then to specify this general dichotomy. After all, the very immanent research philosophy is meant to move beyond such coarse categorizations. With regard to the negating translations, the theory of self-referential systems brings forward the notion of innovation-as-noise. Often innovation attempts are simply not relevant to receiving translators: This yields the category of a) *non-translation*. By contrast, the translations framework highlights how innovation attempts are often not just ignored, but even actively resisted. This entirely different kind of negating translation, involving struggle and conflict, gives rise to what can be called b) *interference*. These interferences indicating what an innovation attempt 'bumps into', they are particularly revealing about the structural impediments to innovation (Grin, 2010).

The theory of self-referential systems suggests that an innovation is received either as irrelevant noise, or as a signal conducive to lasting internal differentiation. This television metaphor, taking an innovation attempt as a signal, leaves the transformations of innovations underexposed, however. By contrast, the translations framework highlights that there are many possible kinds of 'resonance': The fate of innovation attempts will depend on the more or less enthusiastic ways in which they are received and used, and on the diverse ways in which they are passed on 'with a twist'. This yields a distinction between straightforward adoption and adaptation: The categories of c) *embracement* and d) *modification*.

Still, modification is a coarse category. If 'to adopt is to adapt', as emphasized in the translations framework, all affirmative translations can be expected to fall in this category. It is not difficult to further distinguish two types of modification, however: Regular modification, and modification that critically diverges from the initiator's intentions. This occurs often in system innovation, it appears through the reports of 'dilution' and 'capture'. These disapproving terms suggesting that initiator and receiver will experience mutual interferences, it seems worthwhile to distinguish d) modification from e) *alien modification*.

The possibility of 'alien' modifications turning into interference is a tragic form of translation, echoing Luhmann's warning against 'too much resonance'. This rather structuralist view typically overemphasizes such tragic mechanisms, however. By contrast, the sociology of translation is more appreciative of the scope for actors to intervene. Akrich et al. (2002 a,b) explain that the innovation initiator can seek to avoid interference by 'playing both registers', i.e. by exerting influence on both the translating social environment and the innovation itself. When the initiators are disappointed about the translation process as it unfolds, they can modify their innovation attempt. The photovoltaic kits that 'refused to disseminate' could be provided with a more flexible design, breaking through non-translation and reducing interference. In terms of the theory of self-referential systems, this indicates reflection, initiators seeing themselves in relation to users and innovation object. As attempts to achieve system innovation will generally evoke considerable interferences, occurrences of purposive f) *self-translations* will therefore be especially informative moments in translation.

2.5.3 Multiple translation sequences and their intersections

The translations framework cannot be 'stretched' at will. The idea of aggregating into 'higher-order' translations shows how aggregation can compromise the attentiveness to the complexity, contingency and directionality of system innovation. The translations typology therefore constitutes a more fine-grained framework. Possible translation-

dynamic patterns will surface through particular combinations of non-translation, interference, embracement, modification, alien modification and self-translation. These 'chains' of translations can be considered aggregate research units; *translation sequences*, with a beginning and an end.

Such demarcation of distinct sequences within otherwise unbounded processes is quite usual in translation analyses. Typically these are ontogenetic case studies, following the process between attempted innovation and its stabilization into a particular end shape. Similarly, translation sequences could be considered distinct innovation trajectories – a long as this is not misunderstood for natural, linear progress along a certain track. Instead of this determinist idea, Akrich et al. (2002b) propose the metaphor of an innovation 'whirlwind'. Bijker & Law (1992) warn similarly that the 'trajectory' notion easily projects linearity onto heterogeneous processes, the pretense of inevitability itself influencing the course of events (17-19)[17]. The translation sequences are better conceived of as less orderly developing innovation *journeys*, a term coined by Van de Ven et al. (1999). Having conducted an extensive research program on various product and organizational innovations, they saw various common assumptions about innovation challenged. Instead of a sequence of stages, they saw cases of divergent and parallel paths; instead of innovation leading to a new order, they saw indeterminate and fragmented final results and co-existing orders; instead of given innovation environments, they saw multiple enacted environments – partly changed by the innovation launched into that context (8); instead of a singular step from idea to innovation object they saw reinvention, proliferation, reimplementation, discarding, and termination. On its way towards actualization an innovation follows not a trajectory but an 'innovation *journey*'. This notion indicates both the capriciousness of a translation sequence and its unity.

Empirical investigation thus concerning translation sequences that unfold around a particular innovation attempt, with particular interest in aggregated translations, the translations framework is stretched considerably. In this respect Schot & Geels (2008) stress that the investigation of innovation journeys should not be limited to their 'internal dynamics', but take on board the linkages with ongoing processes at broader 'regime' and 'landscape' levels. Even when mildly aggregating and following their branches and diversifications, translation sequences will bear the general direction of the initial innovation attempt. They may meander broadly, but keep within watersheds. In order to get system evolution in sight range, they therefore suggest investigating *multiple* 'journeys', and keep a close eye on their interactions (550). Such research design seems worthwhile: The translations framework would be stretched considerably, while retaining the fine-grained way of investigation. Studying multiple translation sequences arguably increases the understanding of translation dynamics. The search for patterns is enhanced by allowing for comparison between sequences. Moreover, the attention to potentially intertwined cases extends the framework drastically - it allows to chart a phenomenon stressed by Luhmann - the Babylonic theme of 'emergent incoherence'.

As Luhmann sketched, the description of a singular translation sequence would bring out the considerable difficulty to have self-referential systems communicate and

[17] This coincides with Stirling (2009, 2011), who argued against unidirectional conceptualizations of what tend to be diverse transformations.

converge onto a shared understanding. Still it would not fully capture the complexity resulting from co-evolving changes: The emergence of system innovation will crucially depend on the *interplay* between resonances, differentiations and reflections. As these changes can display mutual amplifications or cancel each other out, the intersections between translation sequences are particularly interesting. At these intersections it can be observed how one translation sequence poses a relevant change to actors involved in another, and thus trigger further innovation. The intersections will afford a better view on what is particularly challenging in innovation in the making, namely the challenge to handle them immanently, immersed in the complexity of this evolution. The protagonists may be looking for the positive feedbacks and leverage that complex systems have to offer, but they will not fully oversee the innovation journey ahead – let alone its higher-order ramifications. Through self-translations initiators can intervene in the course of innovation evolution, it is true. Generally this course will be capricious, however, and the emergent outcomes are likely to be incoherent. As indicated earlier with the metaphor of the 'scrabble' game, the protagonists operate in a constantly changing environment. They cannot afford to remain immersed in the construction of their 'words', but need to update their views on the board situation, revise their planned actions accordingly, and seek to coordinate their actions with those of others. This coordination challenge increases with the number of translators involved, Star & Griesemer (1989) indicated.

The Scrabble metaphor may even downplay the coordination challenges involved. As the theory of self-referential systems stresses, players will espouse divergent readings of the turbulent board situation. They are playing their own games. Taking an ecological angle on translation processes, Star & Griesemer (1989) called attention to the coordination problems arising from overlapping games. Standardization and the formation of 'boundary objects' could help converge, but full consensus they considered unlikely to come about in multi-player games. The theory of self-referential systems warns similarly that negotiation will not easily lead to stable coordination: The system innovation game is played by players with self-referential readings of the board situation. If a particular translation process is deemed relevant by an actor, it still has to compete with other relevant developments. Leydesdorff (1997) explains that self-referential systems 'tick with their own frequencies' (election cycles, time horizons of businesses). It is then the attunement, the *synchronization*, of these clocks that makes resonance possible. As synchronization may go at the expense of their self-referential cycles, it can be expected to be unstable and hard to maintain, however. Thus considering how full 'supersystem' synchronization would result in severe instability, it becomes more clear why system innovation involves fundamental coordination challenges. Synchronization indicates the challenge not only to attune translations between singular senders and receivers, but also amongst multiple players in translation sequences, and eventually between populations of translators involved with different translation sequences that turn out to intersect. With respect to the synchronization challenge on the level of higher-order innovations, Rammert (2000) observes that indeed, the various clocks of innovating actors are increasingly out of tune. When synchronization is lacking, an incoherent cacophony of translations emerges: The problem of simultaneous, yet uncoordinated change. Reflecting on the increasing speed of many individual innovation trajectories, Rammert describes how the many 'accelerandos' may actually result into the 'ritardando' of the concerted innovation.

Next to self-translations, synchronizations can thus be considered crucial events in translation sequences. As attunement of diverse translations they promise to be important keys to intervention in otherwise capricious innovation evolution. They can be expected to occur within, but also between translation sequences. Such nested analysis is a particularly useful way to study translation dynamics, as it gets these synchronizations into sight range.

2.5.4 Conceptual scheme of translation dynamics

Having tailored the translations framework to research aims, a conceptual scheme can be established. Figure 2.2 below displays how *innovation attempts* are theorized to be launched into a polycentric environment. Empirical investigation will follow *initiators* with certain *ambitions* for systemic change, *translators* with possibly different ambitions and system understandings, different *types* of translations that can be expected to occur, undergoing the typical transformations between *ideas*, *objects* and *actions*. The combinations of translations will yield several *translation sequences*, and following a nested-case set up comprising multiple sequences, it can be studied how sequences co-evolve through *intersections* - or develop only in parallel. A constant point of attention is the *synchronization* through which heterogeneous actors can attune their translations.

Through this fine-tuned translations framework it is possible to study 'diverse transformations' as they take place in the traffic management field, following the innovation processes through the eyes of different actors – as two-way traffic. The resulting translation-dynamic insights form the key to answering the central research questions. The next chapter specifies the methodological considerations and choices needed for actual application of theory to empirical contexts. This also involves reflection on the status of translation-dynamic insights, on the interpretive work implied with their production, and on the strategy for generalization. Some of the choices involved in theoretical multiplicity will thus resurface, and require further tailoring.

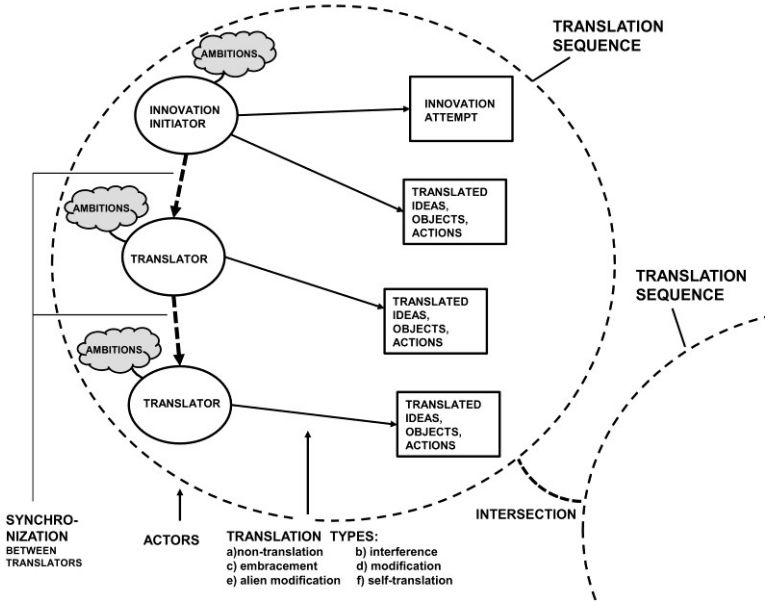
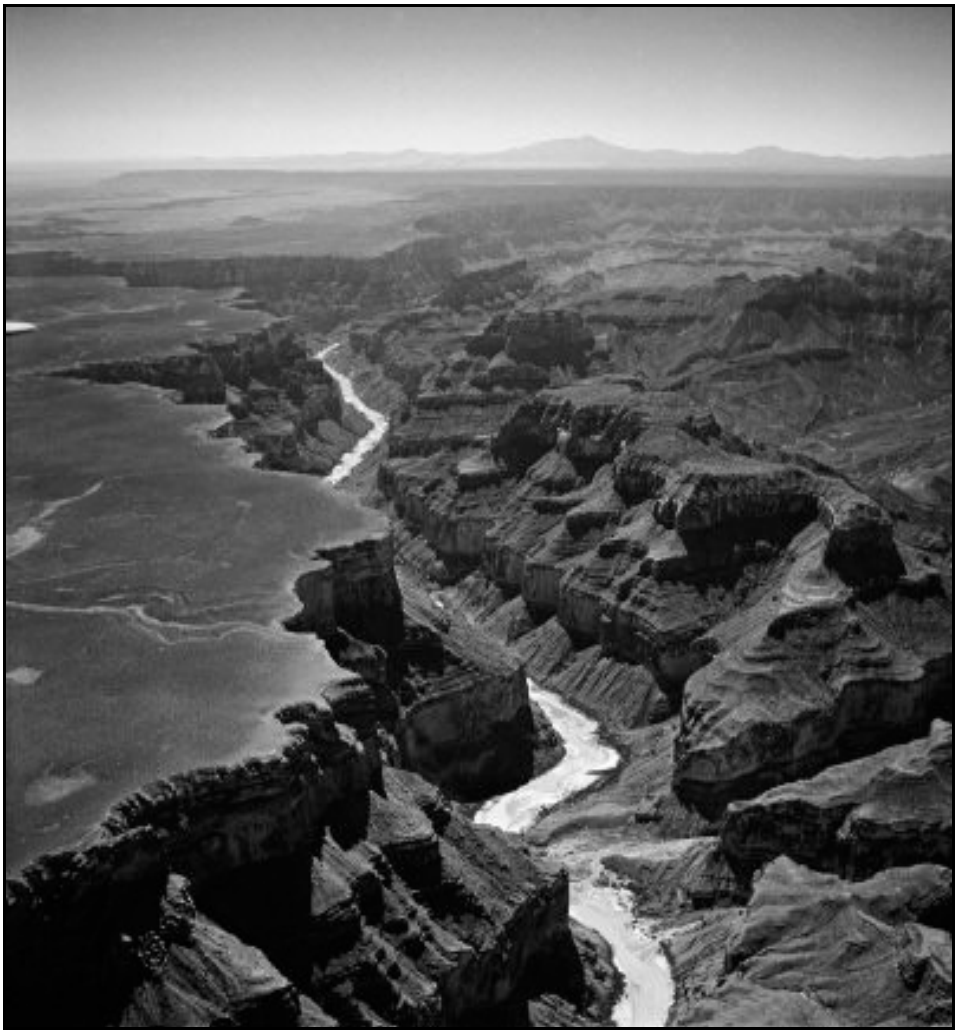


Figure 2.2 Conceptual scheme of translation dynamics

Chapter 3 Methodology: Tracing translation sequences

"Much of 'scientistic complexity' is concerned with the dynamic trajectories of individual systems. We as social scientists can deal with – to use the terminology – ensembles of systems. We can deal with lots of cases and see how the configurations they represent can help us to understand the various *ways in which things have come to be as they are, the* various *ways in which they might be different, and – with luck and the wind in the right quarter – how social action might produce one possible future rather than another."*

David Byrne - Complexity, Configurations and Cases (2005, 101)



3.0 Introduction: Understanding system innovation through translation dynamics

In this chapter the theoretical positioning is elaborated methodologically. In a way this is a straightforward task; translations tracing in innovation processes has been done before, and manuals must be available. On the other hand, the basic framework has been tailored in view of a nagging question: *How can it help relate the situated actor's innovation attempt to possible system innovation?* The framework was therefore 'stretched' through mild aggregation, through a typology, and through a nested-case research design. It was important not to overstretch the framework into a reifying apparatus of translation 'mechanisms' however; such would undo the advocated open-textured approach. Considering this theoretical balancing, translation tracing cannot simply be done by the manual. The adapted framework is open-textured, yet geared to generate insights on systemic change, and this double commitment poses challenges for investigation and analysis. It requires thinking through what kind of knowledge is produced, and what research strategy this entails. A leading orientation is the seemingly paradoxical concept of 'grounded systems research'. This general modus observandi helps arrive at consistent further choices **(3.1)**. Traditionally, translation tracing is a 'grounded' kind of investigation that avoids unnecessary theoretical presuppositions. Aiming to understand how initiators and translators make sense of the innovation processes they are engaged in, it is a detective-like work of following the circulations and twists of innovations, tapping from a variety of empirical sources. The translations framework provides 'sensitizing' concepts, the translations typology guiding investigations and progressive insight through 'foreshadowed problems' **(3.2)**. Translations tracing involving typically intertwined processes of data gathering and interpretation, an important issue to clarify is the progressive build-up of generic translation-dynamic insights. In this respect the translations typology provides stepping stones within a more encompassing analytical process, involving analysis of separate cases, comparative analysis, and analysis of intersections between translation sequences **(3.3)**. Next, the nested-case research design is worked out, also eliciting the process of progressive demarcation. After rough delineation of the traffic management 'action field', four innovation attempts are selected as starting points for 'diverse transformations'. They are based on different visions to change the traffic management action field, address different dimensions of system innovation, and are undertaken by actors in different positions. Furthermore, they are selected such that their translation sequences have a certain potential to intersect **(3.4)**. The chapter concludes with a concise format for case analysis. Aiming for in-depth understanding, case reports include detailed description and specific attention to actors' appreciations of innovation attempts. Considering the instrumental use of cases, the reports also feature the researcher's assessment of system innovation achievements and establishment of translation-dynamic patterns **(3.5)**.

3.1 Research strategy: Grounded systems research

Theoretical review led to the argument for a special kind of system innovation research. This 'immanent' approach responds to the charges of 'transcendentalist' tendencies in transition management, to the signaled challenges of system innovation in the making

and to the pleas for 'open-textured' and 'bidirectional' approaches to systemic change. Subsequently, the basic idea to study system innovation processes as two-way traffic has been rephrased as a task of translation tracing. The resulting conceptual framework features initiators and translators with particular ambitions doing particular translations, collectively producing translation sequences that may intersect. Innovation attempts' possible evolution into system innovation can be better understood through translation dynamics, i.e. by observing how patterns emerge within and between translation sequences.

The adapted translations framework constitutes a kind of translations analysis that is open-textured yet focused, immanent yet attentive to higher-order development, and oriented towards both understanding and explaining. Before simply selecting sites for investigation and 'running' the theoretical program, these double commitments better be thought through. What was earlier described as 'switching the camera' between innovation senders and receivers (section 2.1) is only a very general idea of making movies – or documentaries. A first question is what kind of insights and analyses the documentary is to convey. There have been many disputes over what constitutes good documentary-making, what is 'out there' to record (ontology), what can be said and shown on what basis (epistemology), and what techniques are appropriate to record and assemble the footage accordingly (methodology). In this regard the immanent approach reflects the idea that in system innovations research the system-analytical voice-over tends to be too loud, too judgemental and too confident about translators' relevant destinations. Instead, translations researchers urge to mind careful registration, and to tone down voice-over: *"The rule is to reconstruct the perspectives and projects of one and all without taking sides, to avoid using nothing more than a bit of common sense in letting oneself believe that a given protagonist, who makes a mistake 'because he is blinded by his interests or that he is ill-advised', would have been able to make a rational decision and identify the right path by himself. In other words, show sufficient tolerance and agnosticism so that the meanings of decisions, taken seriously even by their adversaries at the time they are made, are not described many years later as careless or rash. Or inversely, that a minority opinion fought by the majority is not shown afterwards to have been premonitory."* (Akrich et al., 2002a, 191).

Toning down the voice-over avoids producing retrospective accounts that eclipse the very ambitions, system understandings and translations of actors that are so worthwhile knowing about. The point behind translations analysis is that careful registration and camera-switching along a translation sequence could well be so informative that voice-over becomes superfluous – or appear as less than the convincing explanation intended (Latour, 2005, 136-139). Zooming in onto actors' engagements with innovation attempts and seeking to reconstruct their experiences, translation tracing comes down to constructivist rather than objectivist research. In Wilhelm Dilthey's famous terms, it aims for 'verstehen', rather than 'erklären'. Instead of explaining translators' readiness or failure to adopt an innovation through particular critical factors, the principal attention goes out to the ways in which they accord meaning to an innovation in the first place. Paraphrasing Yanow (2006), to trace translations is to investigate *how an innovation attempt means* to diverse translators.

As discussed in section 2.4, Geels (2010) considered translations tracing an interesting approach for producing 'alternative' accounts of system innovation. Still, he suspected it would offer abundant close ups and impressions, but too little overview on the bigger

story of systemic changes. Moreover, the associated tendency to mute the voice-over would insufficiently elicit *why* translators translated the way they did, and leave the viewer with little more than snapshots of unexplained events (see also Geels & Schot in Grin et al., 2010, 93-101). Taking to heart these reminders, voice-over better not be muted altogether. The 'stretched' translations framework therefore contains translation types as pointers, helping to identify common themes and regularities in and between cases. This diverges from the convention to let translators speak for themselves: It implies a wish to use the cases not only as enlightening and detailed recordings, but also as sources for more generic insights and theory-building (Eisenhardt & Graebner, 2007).

A key methodological challenge is thus to arrive at analytical voice-over without betraying translators' own meaning constructions. Some would argue for a recording plan that has the explaining narrator disappear, others would require that comments be accounted for extensively - to undo the betrayal. A prominent example of the first position is to aim for 'grounded' theory. This research philosophy, at least how it was devised by Glaser & Strauss (1967), is particularly radical in its aversion to voice-over. The core of the approach is to record actors' behaviors as accurately as possible, without contaminating the recordings by the researcher's theoretical presuppositions. Storylines are to emerge from careful recording. The eventual theory is to produce itself, as it were, through meticulous 'coding' of raw data. Only through constant comparison between emerging categories and data the researcher can converge onto integrative insight: A voice-over story that can be retraced to what is recorded. In this research philosophy, the translation types should only emerge out of this sifting procedure. The second position, by contrast, places the narrator upfront. This reflexive position takes full responsibility for what Luhmann would call the narrator's self-reference: Comments are admitted to reflect the narrator's particular ways of according meaning and ordering footage, and recording is explicitly related to the use of particular lenses and angles. As the documentary should not be misunderstood for showing reality 'as it is', the narrator should remind viewers of his choices, his *presence* in the story. Ideally, the documentary should be equipped with an extensive feature on 'the making of…', or have a first person narrative explaining its status as an 'authored tale' (Yanow, 2006, 28).

The above positions help specify a strategy for recording, assembly of footage and addition of voice-over. Both offer interesting suggestions, but neither is wholly suitable for the documentary intended. The methods for developing 'grounded' theory are appealing, to begin with. Such procedures of constant comparison and careful recording promise to enhance the attentiveness to translators' diverse experiences, ambitions and translations – instead of forcing these into preconceived translation types. Yet as has been pointed out often, a purely procedural and theoretically unfocused approach risks to yield not so much authentic documentaries, but rather meaningless compilations of footage. Worse, it invites ventriloquism, i.e. theoretical focus hidden in allegedly 'pure' yet unavoidably selective pieces of evidence (Bryant, 2003, Charmaz, 2003). In that respect the 'reflexive' position instructively indicates that theoretical guidance is inevitable anyway. This need not betray the translators recorded and commented upon, as long as selective observations, demarcations and interpretations are sufficiently highlighted. This openness about interpretation being a useful methodological guideline, the associated idea to place the narrator upfront is less appealing, however. Considering how voice-over would ultimately require voice-over itself, the metaphor of the documentary helps understand how this would distract from the issue of interest - translation processes. Excessive attention to the narrator could leave viewers wondering

whether they are presented with the (increasingly popular) genre of fictitious documentary.

In this regard Latour (1988) indicates that the sensitive issue of voice-over needn't invite embarrassment. If translation-tracing is presented with all too loud and extensive voice-over, the documentary is simply not very well crafted: Comments may subsume the richness of the translations under compelling generic terms, but these storylines never *contain* what they are made of. In that respect he doesn't see the point of extending insights from translation sequences to wider classes of translation sequences, as intended here. Yet to refrain from voice-over or to be nervous about active ordering of footage will not help either. In order to arrive at a worthwhile documentary, assembly and interpretation are inevitable. This storyline-production need not be shown through 'metareflexive' (166-169) focus on the assembler, but can be done 'infrareflexively' (169) as well: To show the documentary as an assembled story is to build in reflexivity, and avowal of assembly simply acknowledges that the researcher translates as well[1].

The above considerations on 'documentary-making' substantiate why translations tracing cannot be done 'by the manual'. It involves an incessant series of choices, and these better be informed through a clear idea about the kind of knowledge to be produced: To recapitulate, the documentary is to convey general insights into innovation 'cascading', the evolutionary processes of merging and broadening innovation streams. As this is easier to imagine, project and theorize from a bird's eye view than to oversee and control from the ground, zooming in is scientifically worthwhile. The documentary intended is explorative; apart from general expectations about emergent incoherence, the eventual storyline and indication of patterns is to form only in the course of recording. This recording should interpretively follow system innovation as 'two-way traffic', and the documentary should convey multiple perspectives. The eventual voice-over should thus elucidate the processes recorded, and help to make sense of other system innovation processes as well. Moreover, voice-over is to provide practical recommendations about what translators could or should do.

This roughly circumscribed storyline arguably requires translations tracing that involves focusing, zooming in and out, and considerable interpretive work to develop translation-dynamic voice-over. The general approach is thus to proceed in 'grounded' fashion, led by modest, 'open-textured' ideas about translation dynamics and system innovative 'cascades'. This combination of focus and openness clearly diverges from the objectivist strands of grounded theory that seek to suppress theory-laden observation. The director's cut, i.e. his attempts to make and add sense, places it more in the tradition of 'constructivist' grounded theory (Charmaz, 2003). Given the specific attention to diverse systemic transformations and actors' system understandings, it can be considered an example of what Gibson et al. (1999) call 'grounded systems research': Translation dynamics are developed through progressive discovery, guided by general expectations about translation sequences' meanderings.

3.2 Tracing translations

Having determined the general approach to translation tracing as 'grounded systems research', it is easier to work out its specifics. This involves answering several questions

[1] Indeed, this Ph.D. thesis is an innovation attempt and its initiator seeks to have it translated by others.

about the observation of translations, and about the interpretive work involved: *What empirical phenomena to observe? How to observe them, and through what sources? How to follow an innovation attempt and unravel a translation sequence?* As mentioned, translation-tracing can benefit from 'grounded' methods for careful recording, but also involves theoretical focus. Transparency about the latter being crucial for the credibility of eventual translation-dynamic explanation, the following choices allow the investigation process to be retraced itself:

What empirical phenomena to observe?

The earlier exposition of translations gives a fairly clear idea of how to do translations analysis. This is why it is described as translation *tracing*; it is a way of following movement and circulation. Latour (1986, 267) refers to translation as *"…the spread in time or space of anything – claims, artifacts, goods – in the hands of people; each of these people may act in many different ways, letting the token drop, or modifying it, or deflecting it, or betraying it, or adding to it, or appropriating it"*. Sifting observables from 'translations' studies and thinking through their pertinence to system innovation processes, the adapted translations framework has been built from general, but not overly abstract concepts: Innovation initiators and their ambitions, the innovation attempts they venture, translators, translations taking shapes in ideas, objects and actions, translation types, translation sequences and their intersections, and 'synchronizations'. These concepts do not immediately tell the researcher what objects to record and to count, but they do provide general directions. 'Grounded theory' researchers generally avoid the first 'definitive' concepts as sources of theoretical contamination. Following Blumer (1954), however, interpretive strands endorse the guidance through the latter 'sensitizing' concepts. Charmaz (2003) stresses that these theoretical cues can very well be used as starting points for analysis, provided they are not its ending points as well (259). This is in line with the desired 'open-textured' approach, and with the ontological parsimony of the 'sociology of translations'. Observation was led by the following sensitizing concepts:

First of all, there is the innovation attempt, the 'opening bid' of an initiator. It is the central 'character' in the documentary to be recorded; the rest of the story will unfold by following it around through time, and unraveling the web of relations that forms around it. As is recommended in 'grounded' theory approaches, this following around requires the researcher to be open to anything that may cross his path. Remembering innovations' 'constant transformations' as indicated by Akrich et al. (2002a,b) and Czarniawska & Joerges (1996), this research 'object' can take the shape of actions and ideas as well. This fits well with the multidimensional nature of system innovations, involving transformations in practices, cultures and societal structures. System innovations emerging from cascades of new products, services, processes and projects (section 1.2.2), the attempt can be either of these. This leaves the issue of system-innovative significance. Understanding system innovations as 'organization-transcending changes that drastically alter the relationship between the companies, organizations and individuals involved in a system', the question arises whether, for example, the attempted introduction of photovoltaic kits would be relevant to investigate - how widely can its translation sequence be expected to meander? In this respect Czarniawska & Joerges (1996) usefully highlight how especially innovative ideas allow for rapid and widespread translation. *"Translation is speeded up, made continuous and magnified by technology: more specifically, by mass storage, mass reproduction and mass media*

technologies. It is this hybridized humans/technologies network which is the material basis for more complex translation mechanisms: fashion and institutionalization" (11). Considering their potentially wide spread and transformative impacts, many innovation attempts can be relevant to system innovation. This issue of case selection is addressed in section 3.4.

Second, translations tracing also involves attention to the initiator behind the innovation attempt – or, highlighting his part in a drama, the 'protagonist'. The protagonist may be an entrepreneur seeking to seize a business opportunity, an engineer seeking to demonstrate the merits of his invention, or a politician unfolding a bill for social reforms. The initiator can also be a aggregate actor, such as a governmental department, a firm or a social movement. As Akrich et al. (2002a, b) indicate, innovating actors tend to be part of collectives: Even the entrepreneur, the archetype of individualist inventiveness, will generally need to rely on marketing specialists, technology experts and suppliers, for example. This assertion of networked agency also indicates that translations tracing inevitably involves other actors, the translators. Further considering that system innovations are understood as organization-transcending transformations, translations tracing should highlight the involvement of relatively large groups of actors, and pay particular attention to translations by collective actors and institutions – the 'macro-actors', as discussed in section 2.4. This allows to trace wide and encompassing circulations, with accordingly high transformative potential.

Furthermore, translations tracing involves reconstruction of the ambitions of the protagonists; initiators and translators alike. Innovation attempts are undertaken for a reason, and with certain ambitions in mind. With regard to *system* innovation, it is therefore salient what 'system' the initiators feel to be part of, what systemic problems they perceive, and how they envision the attempted innovation to bring a systemic change for the better. The initiator will have to surmount a heterogeneous environment, however. The very idea behind translations tracing is to pay equal attention to the system understandings, ambitions and actions of other actors (translators), and treat these symmetrically as two-way traffic. This reconstruction of ambitions, experiences and interactions is crucial to an immanent understanding of system innovations. Analytical two-way traffic avoids projection of system understandings, and likewise, it requires the researcher to refrain from unidirectional notions of 'success' and 'failure'. Still it is important to assess outcomes, however, for the sake of eventual generalization. The solution is then to combine perspectives: Next to the analyst's assessment of system innovation achievements, attention is paid to the satisfaction of actors' ambitions. Goal achievement of the initiator merits particular attention – not because these goals are more important or more justified, but rather as a consequence of following a particular innovation attempt.

Third, translations tracing is obviously sensitized by the concept of translations. As a relational concept it is not that easy to handle empirically, however. Connecting protagonists, translators and innovation attempts, translation falls in between these observables. Unsurprisingly therefore, the literatures on ANT and social construction of technology bring forward different interpretations of the concept. Considering the aim of theory-building, it is important to conduct empirical investigation and analysis with a relatively stable notion, however. While acknowledging that translation is relational, investigation zooms in onto moments of congealment. A translation then summarizes

what a translator does with an innovation attempt; ignoring it, resisting it, or modifying it. The latter translations can be read from the attempted translation's changing shapes.

Fourth, the distinction of translation *types* introduces more definitive cues for investigation. As discussed, these more theory-laden concepts are a way to 'stretch' the basic translations framework, and provide foothold for theory building. Still, the typology constitutes open-textured conceptualization. These categories do not supplant the process of comparing theoretical insights with empirical observations, but provide starting points for further development of translation dynamic patterns (Charmaz, 2003). The types indicate 'foreshadowed problems', or issues likely to arise (Stake, 2003, 142/143). Instead of reducing the interpretive process to keeping scores of types, the typology sensitizes empirical investigation. It should help to identify protagonists and antagonists, insiders and outsiders, opportunities and pitfalls – while acknowledging that these tend to come in shades of grey. The fate of innovation attempts depends on the diverse ways in which they are appropriated and passed on:

a) Non-translation. Innovation attempts are undertaken in a heterogeneous society. Initiators may therefore target particular translators and try to draft them for their intendedly enriching innovation attempt, but to translators it may still be irrelevant 'noise' - this could manifest in actors conspicuously ignoring an innovation attempt, withdrawing allegiance, or losing interest. According to Luhmann's sobering analysis, especially the more radically transformative initiatives are likely to fall through the stitches of a differentiated society. Reflecting on his experiences in public management, Teisman (2005) indicates similarly that innovative governance arrangements often 'evaporate', the organization-transcending arrangements failing to be consolidated in the constituent organizations' ongoing operations. He describes it as a phenomenon of two-sided self-reference: Receiving organizations failing to appreciate their position within the greater context, innovators overlooking how their plans can be fitted in. This pattern of 'evaporation' indicates how even after initially affirmative translation, non-translation may set in over time.

b) Interference. One 'foreshadowed problem' is that innovation attempts may be left by the wayside as irrelevant, another is that they may be experienced as actual disturbance. In this respect Luhmann explains that external impulses allow a self-referential system to renew itself, beneficial 'irritations' preventing the system from asphyxiating. Confrontations with innovation attempts could thus be the juice for survival, but if the new impulses prove corrosive to system integrity, the innovation attempt can be said to *interfere*. As actors interfered with can be expected to resist, this translation type seems a crucial source of stagnation to the overall process. As Akrich et al. (2002b, 224) indicate, any innovation attempt will invite 'accusations' by other actors. These accusations and counter-accusations are the controversies that 'pepper an innovation's life'. Similarly, Tushman & Anderson (1986) distinguish between innovations that enhance, and innovations that destroy competences of firms. Interference may manifest in a market position challenged, a way of life threatened, a professional identity challenged, or a planning function disturbed (Ferlie et al., 2005). 'Interference' is an occurrence to look out for especially in system innovation processes, as these concern structural changes. It is a likely indicator of what Rammert (1997) called 'structural filters', of running into structural impediments to change (Grin, 2010): In this regard Bijker (1992) tellingly describes how efficiency gains in lighting interfered with utility companies' concerns to keep up the demand for electricity. A

probable challenge for the initiator is to prevent his innovation attempt from succumbing under interferences.

c) Embracement. As theorization of two-way innovation traffic brought forward, an innovation attempt is unlikely to be endorsed for its sheer intrinsic value. Still this remains a possibility, however: An innovation attempt is embraced, possibly not for exactly the reasons the innovators had in mind, but receivers see no reason for adaptation. This translation type corresponds with the 'adoption' of innovations that is central in diffusion models of innovation (see for example Rogers, 2003). This embracement could manifest through objects diffused, ideas becoming fashionable or even institutionalized, or actions becoming mainstream. Predominant embracement could lead to translation dynamics in the form of diffusion patterns, distinguishing, for example, the 'early' and 'late' adopters that can be read off from the typically S-shaped curves of cumulative adoption[2]. Remembering the dictum from Akrich et al. (2002 a,b) that 'to adopt is to adapt', such patterns would be surprising outcomes, however.

d) Modification. Adoption generally involves adaptation; an innovation is appropriated and taken up 'with a twist'. Recipients translate the innovation attempt to serve their own purposes. This affirmative but adapting translation indicates the typical enrollment and network formation around the innovation attempt, or in terms of the theory of self-referential systems, its resonance. Through modifications the innovation attempt diversifies into different shapes: Weaker or stronger interpretations, various courses of action, more or less sophisticated elaborations of prototypes. This 'hybridization' is frequently noted to occur in system innovation in the making (Heiskanen et al. (2009), Rotmans & Kemp (2009), Kern & Howlett (2009)).

e) Alien modification. As indicated with the 'modifications', translation processes are likely to produce hybridizations of an innovation attempt. These hybrids will generally retain the traits of the innovation attempt they were translations of, but not necessarily so. There is a sliding scale between 'embracement' and 'modification', and similarly there are many shades between slight modification and extreme modification. It is therefore conceivable that an innovation attempt becomes translated into something the initiators no longer associate with their innovation attempt, and appropriation becomes alienation: When innovation initiators consider a modification to be 'alien', this can lead back to interferences. This is the 'foreshadowed problem' of the Frankenstein-scenario, in which the innovation attempt boomerangs onto the initiator. It could also result from consecutive modifications, adding up in their divergence from the original. Akrich et al. (2002a, 17) give the instructive example of '*holy texts which, exegesis after exegesis, end up completely changing meaning'*. Heiskanen et al. (2009) mention the same phenomenon under 'the whispering game'. Regarding system innovations, with the great miscellany of initiatives undertaken under the heading of 'sustainability' or 'transition', the phenomenon is known as 'capture': Incumbent 'regime' actors diluting transformative efforts through shallow, system-reproducing modifications - to the point of interference with initiators (see section 1.3.2).

f) Self-translation. The possibility of 'alien' modifications turning into interference is a tragic form of translation. It echoes Luhmann's exposition of 'too much resonance'. Yet whereas his rather structuralist view emphasizes the likelihood of such tragic mechanisms, the sociology of translation is more appreciative of the scope for actors to

[2] Compare the S-shaped transition curve, displayed in figure 1.3.

avoid these. Directing attention to the interplay between innovation initiator, innovation object, and innovation receiver, Akrich et al. (2002a,b) explain that the innovation initiator can seek to avoid interference by 'playing both registers', i.e. by exerting influence on both the translating social environment and the innovation itself. When the innovation initiators are disappointed about the translation process as it goes, they can modify their innovation attempt out of their own. The earlier mentioned letdown of the photovoltaic kits, 'refusing to disseminate' despite their sophisticated design, could be solved by a more flexible design for example, or by distribution of additional customization packages (Akrich, 1992). Through these self-translations, innovation protagonists can reduce interference: A 'foreshadowed solution'. In terms of the theory of self-referential systems, self-translation is indicative of reflection, of innovation initiators seeing themselves in relation to users and innovation object. And considering the many interferences to be expected especially from attempts to achieve *system* innovation, self-translations are informative moments in translation. They allow the initiators to intervene in their innovation attempt's otherwise capricious course.

Having specified the observation of the translation types, this leaves the sensitizing concept of 'synchronization'. As indicated, interference and non-translation could be addressed through the initiator's own adaptations of his attempt – an improved prototype, for example, or just a new bottle for the same wine. More generally, the foreshadowed challenge for multi-actor system innovation processes is to reach attunement, 'synchronization', between initiators and translators. Through an ecological angle on translation processes Star & Griesemer (1989) enriched the translations framework with the concept of 'boundary objects', being *'plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites'* (393). Attention to the formation of such bridging objects and concepts could help identify translation-dynamic patterns. More generally, the 'synchronization' concept raises attention to the likelihood of 'emergent incoherence', i.e. of a cacophony of translations. Leydesdorff (1997) and Rammert (2000) having provided rough outlines of the synchronization concept, the development of translation dynamics could help to unpack its significance to system innovation practice. The procedural details of this theory development are provided in 3.3.

How to observe translations, and through what sources?

Investigation of 'innovation in the making' is an interpretive undertaking. As indicated by its pioneers, translations tracing revolves around 'following the actors', listening to their stories, and being attentive to their collective construction of innovation. Ethnographic recording techniques or participative action research are attractive in this respect, allowing the researcher to share in the uncertainties and ambiguities faced by the protagonists recorded (Denzin & Lincoln, 2003). This corresponds with the intimate handheld-camera documentaries, providing the inside accounts that open up 'black boxes'. Considering the broad scope and potentially long duration of system innovation processes, the adage to 'follow the actors' is difficult to act upon literally however. It requires a great manifold of actors to be followed, and the ground to cover only expands when investigating *several* translation sequences. Having 'stretched' the translations framework to make it suitable for system innovations research, the proximity to the actors recorded is reduced accordingly.

Aiming to record various translations while keeping track of widely meandering innovation processes, the main challenge to empirical observation becomes to maintain

a balance between zooming in and out. Investigations started with the latter: First it took considerable literature review and theorization to identify the traffic management field as a 'black box' particularly interesting to open (see section 1.5). An ensueing task was to select innovation processes relevant to system innovation research (see 3.4 on case selection). This initial phase of circumspection involved the attendance of meetings and symposia, as well as orienting talks with experts to gain a sense of developments in the field. Tracing the leads provided by these encounters involved extensive internet searches: Websites of organizations, innovation programs and traffic-related journals allowed for a certain overview of leading topics and influential actors, and for a basic understanding of traffic management activity in relation to other action fields. Having selected translation trails to follow, zooming in could start by holding interviews with actors closely associated with these innovation attempts. These in-depth interviews then provided new leads to be traced further: Interviewees mentioned other actors and organizations involved, and other events and backgrounds of relevance to the innovation attempt. Reconstruction of their experiences and viewpoints thus helped to unravel the web of translations further: In the course of empirical investigation the list of potential interviewees grew, and so did the array of sources for relevant documentation. Gaining focus onto specific innovation attempts, actors and events, more specific searches could be done through newspaper databases, decision-making accounts, evaluation reports and traffic professionals' journals. Meanwhile, various news letter services secured a constant stream of potentially relevant new developments and meetings to attend.

This alternation between zooming in and out shows more concretely what it means to conduct 'grounded systems research': On the one hand the openness to the leads provided by actors' stories, on the other hand the focus on the wider web around an innovation attempt, and the particular attentiveness to foreshadowed problems and issues. Yet whereas document analysis was the key to charting the variety of translations and the spread of innovation, interviews were essential to gain in-depth understanding of actors' actual translating.

Seeking to reconstruct the experiences of protagonists in the innovation 'drama', conducting interviews seemed to be an obvious technique for data gathering. Far less obvious was how interviewing should be done: The basic idea behind 'grounded systems research' is to ask respondents to recall their experiences with initiating or translating innovations, but also to encourage them to reveal more about systemic problems perceived, systemic solutions envisioned, and sustainability challenges deemed relevant. These foci led to a semi-structured approach to interviewing, helping respondents to disclose their 'reference systems' through the method of 'boundary questioning'. Stemming from Critical Systems Thinking (Ulrich, 1983, 2003), this approach invites actors to unfold their system understandings and their boundary judgements, i.e. their claims about what is relevant and what is not, about what purposes they deem just, and about what interactions matter most. Soon enough this overly structured probing for 'systemicity' proved to yield less insight into translators' selectivity than hoped for, however. This informed a less structured form of interviewing, guided by a concise and flexible topic list. In line with 'grounded investigation' procedures, questioning primarily invited interviewees to tell their stories, with minimal intervention. Typical lines of questioning became *"How did you become involved with…"*, *"What happened after…?"* , *"Could you explain…?"*, *"Could you dwell on that a bit longer?"*. Direction was limited, mainly leading interviewees to focus onto case-specific events rather than themes. The initially abstract questioning lines

evoking puzzled looks, this more moderate intervention helped realize the promise of 'grounded research': Respondents providing rich data, with the researcher helping analytical categories to 'develop themselves' (Charmaz, 2006).

The interviews yielded personal accounts of innovation in the making, showing the translation dynamics as seen by separate players. As is often pinpointed with regard to interviewing however, the ideosyncrasies of the researcher are only one way to contaminate this kind of 'data'. There is also the risk that interviewees slip into forgetfulness, retrospective explanation, or even self-justification that detracts from the reliability of their accounts (Eisenhardt & Graebner, 2007, 28). With respect to innovations the latter is particularly salient: There is the saying that success has many fathers, but failure is an orphan. These 'measurement errors' being unavoidable to a certain extent, they were counteracted by establishing a trusting relationship between researcher and respondent as much as possible: Avoidance of provoking and judgemental questioning, demonstration of genuine interest in respondents' practical dilemmas, and the explicit possibility to say things on and off the record. Furthermore, respondents were given insight into the interview transcripts, and eventual usage of quotations was discussed. These measures arguably reduced the incentives for self-justificatory or secretive reponses. As regards the validity of the eventual case reports, the method of somewhat distanced translations tracing provides powerful 'triangulation': Every innovation attempt having been followed around through multiple accounts of translators[3], a range of documents, as well as informal conversations with actors in the field, the events and constructions of meaning have been recorded from various angles. In Denzin & Lincoln (2003, 8, 66/67) this kind of triangulation is described as 'crystallization' - each translators' account shedding new light on events and evoking new reflections.

How to follow an innovation attempt and unravel a translation sequence?

Considering the particularly large ground to cover in system innovation research, translation tracing involved the continuous question who of the numerous actors to follow. The alternation of zooming in and out yielded an ever-growing list of potential interviewees and leads for document consultation. This process of cumulating empirical leads can aptly be described as 'snowballing': Noy (2008) specifies how such approach to sampling connects interviewing with wider network exploration, and how it integrates respondent selection within an encompassing research strategy of tracking dynamic processes. To zoom in on all of the snowballed leads would have had the researcher succumbing in avalanche, however. Conducting interviews being a time-consuming undertaking (preparations, travel and elaboration of transcripts took approximately two days per interview), additional *purposive* selection was essential. In the same vein, the initially broad scannings through document consultation acquired a more focused character once the outlines of the translation sequence started to take shape.

This need to curb snowballing through purposive selection indicates a more general difficulty of tracing widely meandering translations: This mode of investigation requires the researcher to suppress suppositions about the 'system' to be investigated, as its boundaries and operations are to emerge only in the course of research[4]. The only fixed

[3] This involved 48 transcripted interviews; see appendix for respondents and referenced empirical sources.

[4] As discussed in Ch.1, systemic demarcations are neither innocent nor obvious: 'Systemicity' should not be imposed, and no natural units can be assumed: Even the relatively clear demarcation of an island dissolves under sea-level.

point being the innovation attempt, it is hard to decide when an innovation attempt has been followed extensively enough to consider its translation sequence unraveled. Translation-tracing is open-ended; the snowball of empirical leads rolls on, grows, but has no natural ending point to crash into. On the other hand, Stake (2003, 135-136) reminds that in order to conduct a study of a case, this case better be specified as a bounded system with patterned behavior: This allows the researcher to decide what features do and do not form part of the case, i.e. which translation traces to follow and which not, and how to arrive at a selection of respondents that secures a balanced, convincing way of zooming in. In this regard 'progressive contextualization' (Vayda, 1983) proved useful. 'Progressive contextualization' does not refrain from investigating 'systemicity' and drawing of boundaries, but revolves around flexible demarcations. Changing demarcations yield changing observations, and the latter changes afford progressive insight - constant reinterpretation of the network relevant to an innovation attempt. Through flexible system demarcations 'the research unit question is resolved by showing it to be avoidable' (266/267). In this regard Boons (2008) explains how progressive contextualization helps navigate the particular intricacy of delineating *innovation* systems while understanding the networked character of innovation. More in line with an understanding of *continuous* networks and *patchworks* of systems, progressive contextualization helps produce and examine system definitions by following actors' interrelations. It specifies how 'grounded systems research' can be done by initial focus on a concrete practice, subsequent camera movements to trace outward relations (Vayda, 266), and eventual hovering above what has emerged as a system. In other words, it deemphasizes the importance of treating cases as 'bounded systems', while securing coherent case research by sticking to what Stake (2003) called 'patterned behavior'.

Guided by this notion of 'progressive contextualization' it became easier to chart the meanderings of translation sequences through a network of actors. The idea to follow the 'outward arrows' around an innovation attempt led to a more selective search within the otherwise rather spontaneous snowballing process (*"you know, what is also really interesting for you…"*, many interviewees and other informants often helpfully remarked). Progressive contextualization informed an initial focus on an inner circle fairly easy to identify: The initiators behind an innovation attempt, and then, in dialectical fashion, the actors interfered with or conspicuously non-translating. In terms of detective work, it directed attention towards the 'usual suspects'. Furthermore, the changing shapes of the circulating innovation –that what ties the investigated network together – helped identify what to zoom in onto, and who to interview (Latour, 2005). As Austrin & Farnsworth (2005) discuss in detail, translation tracing resembles detective-work in many ways. The failed innovation attempt becomes the equivalent of the corpse that starts the 'whodunit', for example. More generally, left aside this simplifying view on success and failure, the detective-metaphor conveys how the innovation attempt is the initially solid starting point for translations tracing, gradually becoming unstable and richer in content through the heterogeneity and multiplicity of the network forming around it. This searching could self-propel forever, every translator providing new leads to trace, yet in the course of investigation translators' mutual references closed in on each other. Once the innovation attempt thus started to become saturated through the variety of translations, the cases could be closed as distinct 'innovation journeys' (2.5.3). This intertwinement of mildy focused data collection and

progressive insight corresponds with the 'grounded theory' principles of 'constant comparison' and 'theoretical sampling' (Glaser & Strauss (1967), Suddaby (2006)).

The translation sequences are cases that constitute not so much bounded systems, but rather relatively open-ended processes of network formation[5]. These cases can be described more or less exhaustively, but progressive outward contextualization secures that they contain the main translations that shape an innovation attempt[6]. Considering the choices involved in carving out translation sequences, it is all the more important to elicit how this footage has been assembled into generic translation-dynamic insights.

3.3 Developing translation-dynamic insight

Translations have been traced with a particular kind of documentary in mind. The adapted translations framework is open-textured yet focused, immanent yet attentive to higher-order developments, and oriented towards both understanding and explanation. Thinking through these double commitments led to the understanding of doing 'grounded systems research' **(3.1)**, which helped making consistent choices in the investigative process **(3.2)**. Having accounted for recording procedures, the next step is to render explicit the assembly of footage and production of translation-dynamic 'voice-over', as well as the kind of answers to the research questions this provides:

How to arrive at generic translation-dynamic insights?

Translations tracing, as a two-way approach to system innovation, is particularly attentive to actors' divergent ways of receiving and modifying innovation attempts. Progressive outward contextualization from an innovation attempt yields rich accounts of meandering 'innovation journeys'. Described with a 'vector' rather than 'scalar' understanding of innovation (see section 1.4), attention goes out to the many goals envisioned by actors, rather than the singular trajectory deemed relevant by the researcher. Toning down analytical voice-over, knowledge is produced that primarily conveys the particularities of the case. The case study is then 'intrinsically' interesting, tather than 'instrumentally' meaningful as an example of particular phenomena (Stake, 2003, 136/137). The very tradition of translations tracing has testified the merits of such intrinsic case study: The accounts of the coming-into-being and/or gradual collapse of singular innovation ventures have shown how innovation journeys can be insightful rollercoasters. These 'innovation biographies' can raise intriguing questions and bring forward new viewpoints. Intrinsic cases can later be found to constitute critical cases, Flyvbjerg (2006) reminds - the proverbial 'black swans' that defy beliefs that all swans are white. Initially crafted as a rich but rather impressionistic recording, the intrinsic case then *becomes* instrumental: Voice-over is added at a later stage.

The theoretical choice for translations tracing appreciates the intrinsic relevance of careful recording. On the other hand, more is aimed for than a rendition of impressions. The documentary is also meant to generate insights that extend beyond the unique case. As detective-like work, translations tracing is supposed to yield not only a series of

[5] Compare Yin (1994, 13): A case study is `an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident'.

[6] Whether saturation in the cases has been achieved convincingly can be judged by the reader. Respondents are particularly authoritative referees in this respect; they disciplined the author into careful reconstruction.

interesting and unexpected encounters, but actual detection and discovery as well. As Suddaby (2006, 635) helps articulate, the 'grounded' commitment to careful recording thus differs from the phenomenologists' emphatically intrinsic attention to actor lifeworlds. The case 'documentaries' are to report not just moments of translation, but cohering translation sequences that are saturated with the main translators' modifications. Seeking to carve out patterns and distill translation-dynamic insight, there is an instrumental interest in cases as well. Indicating that intrinsic and instrumental motives can be combined to some extent, Stake (2003, 137-138) also distinguishes a third approach to case study however: 'Collective' case study, deliberately aiming for theory-building on a larger set of cases. Considering the emphasis on comparison, 'intrinsic' interest in the case is then accordingly limited.

Having considered these possible uses of cases, the choice for a nested case design can be appreciated as a way to make multiple use of cases. The crucial point behind it is to retain intrinsic interest in the contingencies of 'innovation journeys', while still allowing for comparative strategies. In this regard Latour (1998) warns that such transfer of particular insight risks eclipsing the case-studies that produced them. On the other hand, Schot & Geels (2008) stress that a multi-trajectory research set-up is crucial to move from description of singular trajectories to explanation of *system* innovation dynamics (see section 2.5). These emphases on either intrinsic or instrumental/collective use of cases remind that translation-dynamic generalization crucially involves choices in the assembly and analytical ordering of footage – the multi-trajectory set-up does not automatically solve the issue of analytical aggregation. In this regard Byrne (2005) brings forward that the use of cases is closely connected to the *kind* of theory-building it is to facilitate. Further considering that societal transformations are complex processes, he argues that theory-building should take into account that causation involves a multiplicity of intertwined factors: Reasoning from the real complexity of systemic change, there is little point in seeking to establish law-like explanations. Projecting linearity onto complex trajectories, this would take aggregation too far. While following Schot & Geels' (2008) insistence on the need for generic and practically instructive insights, Byrne indicates that these can only constitute local, context-bound explanations (see also Buijs et al., 2009). This advises against insurrection of full-fledged translation *mechanisms*: Generic insight being only possible as context-sensitive generalization, it is imperative to maintain intrinsic interest in translation sequences' courses.

Byrne (2005, 105) summarizes his both intrinsic and instrumental use of cases as follows: *"The trajectories of systems are the histories of cases"*. This expression elegantly captures how the tracing of several translation sequences can generate insights in two ways: First, as the rich description and interpretation of unique processes of system innovation in the making. Second, translation sequences as systemic trajectories through time, as evolutionary courses shaped by particular clusters of forces. Generic understanding can thus be gained stepwise: First by delving into the particularities of a case history (the evolution of an innovation attempt), and carving out a narrative that captures its development (a translation sequence). Next, this case history is considered as a result of particular clusters of driving forces, as selectors of the particular evolutionary course. The case thus becomes instrumental by observing it as a particular 'configuration', a combination of characteristics it may share with others (Byrne (2005, 106), (2009)). Treating cases as complex yet comparable configurations thus supports a kind of theory-building that is more context-sensitive than the variable-oriented reductionism of 'scientistic complexity', and more attentive to praxis- instructing

regularity than postmodern relativism. As this approach describes most clearly how to arrive at generic but not *too* generic translation-dynamic insights, this methodological chapter started with the following quotation: *"Much of 'scientistic complexity' is concerned with the dynamic trajectories of individual systems. We as social scientists can deal with – to use the terminology –ensembles of systems. We can deal with lots of cases and see how the configurations they represent can help us to understand the* various *ways in which things have come to be as they are, the* various *ways in which they might be different, and – with luck and the wind in the right quarter – how social action might produce one possible future rather than another."* (Byrne, 2005, 101).

Guided by the idea that translations tracing could yield generic translation-dynamic insight through comparison of configurations, it became easier to interrelate data gathering, analysis and crafting of analytical voice-over. Crucially, the configuration-oriented approach ensured correspondence between progressively contextualizing investigation, progressive generalization in analysis, and stepwise answering of the research questions. The general data analysis strategy (Darke et al., 1998, 284) could be broken down into three steps: First the description and analysis of singular translation sequences in separate case reports, and then the synthetic steps of translation sequence comparison and analysis of intersections.

Understanding the configurational constitution of the generic answers to be produced, the first and foremost task remained to uphold thorough translation tracing: Only sufficiently accurate and saturated accounts of translation sequences could yield credible configurations. As exposed earlier, the translations typology provided cues for investigation. Focusing the 'detective work' onto foreshadowed problems and issues, the typology simultaneously informed progressive investigation and analysis. Marking interview transcripts and documents for apparent instances of translation types, basic configurations could be discerned within the initially confusing whirlwind of translations: They could be recurring or resolved interferences, surprising varieties of modifications, conspicuous absences of translation types, or particular processes that seemed to correspond with the theorized 'synchronization'. The typology did not produce these configurations by itself, however. Even when it sensitized to the occurrence of translations types and allowed for steadily expanding inventories of those, the identification of configurations required constant interpretive work. Interactions falling into several categories and translations proving hard to categorize, the typology could not be handled through 'checking boxes'. In line with the 'grounded' insistence on constant comparison between emerging insight and data, it did not supplant analysis but rather acted as a stepping stone (Charmaz, 2003, Suddaby, 2006). Having detected and interpreted relevant translation moments, there was always the next step to single out relevant *clusters* of translations and identify configurations. These synthesizing processes crucially involving interpretive interplay between induction and deduction, i.e. between application and progressive refinement of translation-dynamic categories, they correspond with what is known as 'abduction' (Willer & Webster (1970, 754-756), Suddaby (2006, 639), Strübing (2007, 561-567)). This abductive process involved rich description, assessment of outcomes and striking patterns, inventory of the main translational forces on the innovation attempt, and finally the identification of typifying translation dynamics (see section 3.5).

The development of separate translation-dynamic configurations was a key task. Starting from intrinsic interest in the respective translation sequences, the eventually established

translation dynamics reflect the cases' *instrumental* significance: The cases' translation-dynamic 'footprints' can be compared as configurations. Having typified the translation sequences through six translation-dynamic patterns each, analytical synthesis involved a strategy of alternating condensation and expansion (Elman, 2009): In the first place, the generation of case-specific patterns was done simultaneously for four cases. Progressive insight in one case could be tested in another. Emergent categories (e.g. 'backfiring'/'synergetic' replication, or the apparently anomalous 'productive use of interference') thus became distinct translation-dynamic patterns through similar occurrences or marked differences in other cases. Expanding the translations typology through the elaboration of patterns, the emerging variety of case-specific patterns had in turn to be compressed. Mildly forcing these patterns into generic categories rendered them commensurable with other cases' patterns[7]. In this analytical process of fitting and stretching the crucial test was to assure that a case-transcending label not only linked diverse but similar events across cases, but also remained intimately related to its generative contexts – the innovation journeys that 'fed' it. As Eisenhardt & Graebner (2007, 30) explain, comparative synthesis thus produced theoretical constructs more solid than would have been possible through single-case study, but also less specific: Synthesis did go at the expense of unique translation dynamics. A remedial strategy for these informational losses was therefore to concentrate not only on regular or 'normal' translation dynamics, but also to highlight accordingly 'deviant' cases: 'Theoretical replication' (Yin, 1989, Flyvbjerg, 2006) is not confined to exact repetition. Similarly, analysis was set to elicit how particular cases constituted 'exemplar' displays of translation dynamics, and to specify how the cases fitted the constructs.

The third step in analysis was to analyze the intersections between translation sequences; an emergent level of analysis relatively independent from separate and comparative analyses. As discussed earlier, it is worthwhile to study system innovation through diverse transformations. A particularly salient further question is then how these diverse transformations add up, and whether their co-evolution yields mutual reinforcements or dampening effects (Schot & Geels, 2008). Byrne (2005) argued similarly for research targeting *ensembles* of trajectories and therefore nested, intersecting cases. The analysis of intersections eliciting the co-evolutionary dimension to innovation trajectories, this mutual influence of evolutionary courses was analyzed by following Luhmann's view on translations: Under the condition of complexity, actors tend to be confronted with a multitude of developments in their surroundings. In order to respond to those in a targeted way, selective distinction between 'relevant' and 'irrelevant' changes will therefore be inevitable - not all changes in the world are relevant to a particular translator. In other words, only when a translation sequence could be noted to be relevant for translators in another translation sequence, the sequences were considered to intersect. By contrast, if translators in the respective translation sequences seemed unaffected by the developments in others, the translation sequences were said to evolve in parallel. Intersections analysis thus extended translations analysis by raising additional questions after translators' responses to a changing environment. Practically it amounted to imagining where and how translators encountered the other translation sequences: *In what ways did these developments*

[7] As exposed in section 8.2, this condensation allowed to discuss 4x6 case-specific translation dynamics under 10 case-transcending translation-dynamics.

constitute relevant changes in their environment? And which other 'relevant changes' affected their translations?

3.4 Case selection: Diverse and potentially intersecting translation sequences

Having specified the general strategy of grounded systems research **(3.1)**, the investigative process of translation tracing **(3.2)** and the analytical steps through which to arrive at generic translation-dynamic insight **(3.3)**, it is yet to be shown what cases were involved and why. Presenting the selected cases at such late stage may seem odd, as these choices are prerequisite for the decisions to trace particular translations and not others. On the other hand, the very approach of progressive contextualization made for a research process in which also case demarcations changed over time: This sequential presentation of methodological issues serving to disentangle what was intertwined in practice, it allows for a more systematic understanding of the reasons underlying case selection. The case studies presented in chapters 4-7 have been shaped by a combination of theoretical-methodological considerations ex ante, progressive demarcation underway, and a good deal of editing ex post. The latter operations having been exposed in the preceding subsections, especially the choices made at the start of empirical investigation merit attention:

As discussed in the first chapter, the choice for case-based research follows from the argued need for an 'immanent' approach to system innovation. As a fine-grained kind of research it would be useful to open the 'black box' of system innovation, and shed more light on the challenges of 'contextual embedding'. More specifically, the aim is to do so with analytical openness, not projecting particular system understandings onto translators' actions but staying attentive to their own understandings. Upholding a 'vector' rather than 'scalar' understanding of system innovation achievements, the cases are therefore selected as 'diverse transformations' rather than 'integrative transitions'. They are not innovative ventures converging onto a particular systemic shift, but attempts reflecting the ambitions of actors in a plurality of 'transition contexts'. The cases thus comprise both 'radical' attempts undertaken by marginal 'niche' players and the 'incremental' endogenous renewal activities often associated with 'regime' players. While adhering to Meadowcroft's (2005, 2009) pleas for 'open-textured notions of transitions', not any innovation attempt qualifies however. Keeping to the common understanding of *system* innovations[8], the innovation attempts should involve *organization-transcending* changes, they should be *multidimensional*, and they should meander wide enough to afford a view on cascading innovation *series* – hence the earlier 'stretching' of the translations framework.

These theoretical considerations also informed the specification of an empirical domain of investigation. The quest for system innovation being motivated by the diagnosis of systemic problems, the recurring struggles around the A4 motorway exemplified how the mobility domain fits such diagnosis. Abundant literature about 'car dependency', 'hypermobility' and self-reinforcing dynamics further substantiated the understanding

[8] Evidently, a more strict and teleological understanding of 'system innovation' would narrow down the population of eligible cases. The definition of system innovation adopted here is non-teleological and not tied to predefined sustainability transitions – the selected innovation attempts all reflect particular understandings of 'sustainable mobility'.

that there are systemic problems of a vast and composed 'mobility system'. Aiming to investigate system innovation processes rather than the higher-order transformations of transitions, the empirical focus was narrowed down to lower-order mobility *sub*systems. Further literature review on mobility systems brought forward various decompositions and identifications of more or less autonomous 'subsystems'. Immers & Berghout (2001) instructively distinguished markets for displacement, for transport, and for traffic, identifying traffic management as a 'mobility subsystem' occupied with the latter. This distinct activity of managing road use (rather than governing societal needs for displacement, the provision of infrastructure or the choices between modes of transportation) seemed an empirical domain sufficiently bounded and limited in proportions: Large enough to be meaningful in terms of system innovation, and small enough to allow for in-depth research.

As briefly exposed in section 1.5, there were theoretical reasons to consider this traffic management subsystem a particularly interesting 'black box' to open up. Its traditional key functions being the accommodation of traffic, i.e. guiding vehicles over infrastructure such that safety and traffic flow are maximally secured, the subsystem can be said to mainly *stabilize* the mobility system, rather than shift its evolutionary course. In transportation research there is even a global (yet not entirely settled) consensus about congestion abatement inducing travel. For similar reasons, researchers of system innovations and transitions have frequently used congestion abatement to exemplify how such system improvement may pose 'pseudo-solutions', only exacerbating systemic problems. On the other hand, others stress the systemic linkage between optimal use of existing infrastructure on the one hand, and reduced pressure for problematic infrastructure expansion on the other. Because of these rivaling claims on the transformative potential of congestion abatement improvements, traffic management seemed a most interesting locus of investigation. Considering further that the management of traffic involves more than throughput, also affecting the social-ecological-technological environment of roads in other ways, the idea to delineate a traffic management subsystem had to be modified. In order to remain attentive to 'diverse transformations' rather than integral system shifts, it would be better to allow translation tracing beyond 'subsystem' borders. Rough indication of a traffic management 'action field' would be a sufficiently coherent search area from which to start progressive contextualization. This heuristic (Abbott, 2004) notion of a distinct *field of action* was further developed through consultation of traffic professionals' literature. A scarce social-scientific study on the rather technical topic helped to conceive of a distinct field with systemic traits, in contact with a variety of surrounding action fields: Glyn Davis (1990) described a group of traffic engineers, charged with traffic light programming. The case study highlights how they saw themselves occupied with a distinct set of activities. Their fairly straightforward task they had to perform in a highly turbulent context of changing weather conditions, complicating construction works and whimsical political decision-making. They saw themselves to be part of a 'complex matrix' of city planning (71), taking its constant surprises as 'external demands' to their problem-solving. Hence the distinction of traffic management as a particular field of action.

Having determined the kind of cases to be selected as well as the empirical search area, a further consideration was to bring the translation sequences' intersections into sight range. Even when these could not be known to occur in advance, what could be done was selecting cases with at least a reasonable probability of intersection. This pre-

programming of emergence was guided by the following map for case-design. Displaying the maneuvering space for pre-programmed emergence, the scheme helped decide what demarcation decisions to make ex ante, and which to leave to progressive contextualization underway. The dotted line representing diverse translation sequences and the outer boundary reflecting their common 'subsystem', the task was to select and demarcate cases with a certain proximity.

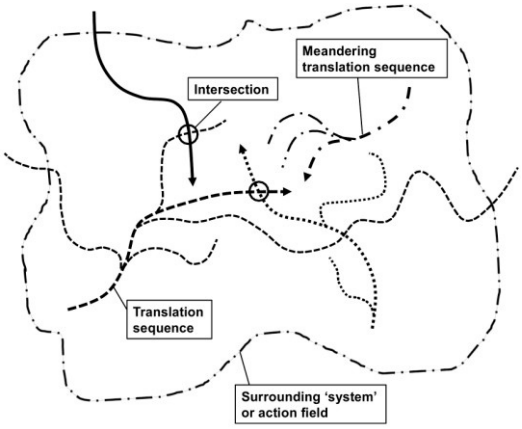


Figure 3.2 Intersecting translation sequences

Figure 3.2 shows how the cases together also form another aggregated case, in which the translation sequences may co-evolve with more or less coherent consequences for a global system. Regarding the meandering translation sequences, the first way to ensure their proximity was to investigate cases within the same country. A second choice, evidently pivotal to the possible occurrence of co-evolution, was to ensure roughly coinciding time spans. This immediately raised a third issue of choosing appropriate time spans in general. In this respect it would be attractive to select historical cases, with translation sequences stabilized and ready for retrospective dissection. On the other hand, the attention to innovation *in the making* rather advised for contemporary, ongoing innovation attempts. This would counter the 'transcendental' tendency to project lessons learned, neglecting what was new to translators at the time[9] – instead, selection of contemporary cases would force research to share in the uncertainty of the protagonists. Further considering that system innovation processes generally take less time to develop than transitions but more time than conventional innovations, the compromise was to select ongoing cases that started not too recently.

Clearly, case selection involved considerable choices ex ante. Moreover, the progressive tracing of translation sequences, the editing of case reports and eventual case-transcending synthesis underline that the presented cases were 'made', rather than 'found' (Walton, 1992). As already implied with the aim to develop generic but context-bound insights, selection was not random 'to avoid systematic bias'. Instead, the cases were actively selected and constructed to 'maximize the utility of information' (Flyvbjerg, 2006, 230). This information-oriented sampling involved more specifically the selection of 'diverse transformations' – innovation attempts waged by actors in

[9] In chess there is the corresponding difference between a 'theoretical novelty' that is new *to the world*, and a player finding himself 'out of book' - confronted with a game situation *he* does not know from literature.

different positions, undertaken with different systemic changes in mind, and addressing different dimensions of traffic management. Referring to figure 3.2, they spring from different 'corners' of the action field: Case selection followed a 'maximum variation' strategy (230). Once comparing their particular translation dynamics and other characteristics, it could further be assessed in which ways cases constituted 'deviant', 'extreme', 'critical' or 'paradigmatic' cases. As Flyvbjerg stresses, a case can turn out to display several of these characteristics simultaneously, when considered from various viewpoints (233): It can be 'normal' regarding one translation pattern, and 'extreme' regarding another.

Seeking a diversity of innovation attempts, an obvious difficulty was to oversee the class of potentially relevant cases in advance. A related challenge was to identify innovation attempts to be associated with a translation sequence. The detective-like work of translation tracing also applied to case selection: It was a process of gathering, listing, selecting and pursuing leads, progressively closing in on what became cases – one by one. Academic literature allowed for a first orientation on broad trends: First of all, Peeters (2003) was most inspiring, drawing attention to the relatively silent and subtle ways in which road design and management shape mobility practices. Furthermore, Westerman (2005) described a few decades of developing 'dynamic' traffic management, Geels (2007) described the formation of a Dutch highway system, Juhlin (1994) and Hajer (1995) pointed out rapid technological changes in the field, and Topp (1995) described three 'self-defeating' traffic management innovations. Beyond academic literature and prior general knowledge of the mobility domain, the most important guidance consisted in field investigations, however. Orienting talks with experts and attending symposia and professionals' meetings helped sort out the fields' main innovations. Subsequent internet searches and professional journals helped specify whose initiatives to link to those innovations. This search process yielded the following innovation attempts as starting points of translation sequences:

1. The Shared Space approach (2001-2009). This was the first innovation attempt adopted as a case, and it actually codetermined the choice for the empirical field. The approach seeking to roll back traffic ordering in favor of human interaction, 'democracy on the streets' and spatial quality, it was interesting as a radical change attempt by apparent outsiders: So-called 'niche' players challenging the traffic control 'regime', apparently aiming for system innovation towards an essentially different relation between road managers, road users, urban planners and enforcement agencies. Directly challenging the control-oriented paradigm in organizing space, considerable interference was expected to occur. Being acquainted with the innovative concept already, the identification of its origin still proved to be difficult however. Structuring a rather diffuse 'cloud' of translations, the case report starts with the reconstruction of the main road through Haren, a village in the north of the Netherlands. Decision-making and implementation took place between 2001 and 2004. Reconstruction involved removal of the separate bicycle lanes and re-pavement of the central square. This is how the municipal authorities sought to enhance the 'spatial quality' of the village centre. Because of the implied break with the traffic separation doctrine, the reconstruction was an early example of what only later became known as the 'Shared Space' approach. The translation sequence is traced along local discussions, the emergence of the 'Shared Space' emblem, and transfer to other places.

2. The 80 km/h zones (2000-2009). The second case was also selected at an early stage. This measure, reducing the speed limit on highways to curb the environmental side effects of traffic, was actually one of the measures considered in the contested A4 highway lane addition – the case introducing the notion of 'systemic problems'. The zones seeming to be geared towards 'greener' rather than more smoothly flowing traffic, they could be considered an attempt for system innovation; an attempted shift towards environmentally responsive traffic management. The attempt seemed radical in introducing a tight and 'interferential' enforcement regime, yet on the other hand it was sanctioned by a dominant player par excellence – the minister of Transport. For a considerable while translations tracing involved a very wide network of actors, seeking to chart a whole population of attempts to 'green' traffic. Part of these measures could be retraced to the working principles behind the 80 km/h zones, but following all these translation branchings distracted attention from the 'stem'. Having made the halfway decision to trade breadth for depth, the case report is more tightly focused on the evolution of the 80 km/h zones themselves: It starts in spring 2003, when the first 80 km/h zone was inaugurated at an A13 highway section near Rotterdam. The zone consisted in a lowered speed limit strictly enforced by means of 'section controls', and had been implemented by Rijkswaterstaat – the road managing agency responsible for the national highway network. The zone was meant to alleviate locally experienced problems with noise and exhaust fumes, and comply with environmental regulations that proved hard to meet. The translation sequence is traced along the first zones' implementation and evaluation, applications elsewhere, changing public support, attempts to adapt the zones, and to the preparations for their eventual phasing out.

3. The Luteijn approach and the 'network-oriented turn' (2002-2009). The third case took a long time to take shape, even when the innovativeness of network-oriented traffic management and mobility policy had become apparent soon enough: The basic principle behind the 'network turn', cooperative management transgressing administrative boundaries, resonated throughout the field. Considering its close association with the congestion abatement agenda, its pertinence to system innovation research was not immediately obvious, however. It became clear only over time that the myriad of inconspicuous collaborations reflected not only an organization-transcending approach to congestion abatement - in certain respects they also signaled a shift to a more systemic view on the issue. Traffic management activities played an important part, but this shift involved a multitude of innovation attempts. Hard to trace back to a particular innovation attempt, the case report focuses on an attempt widely referred to by successors: The 'Luteijn' commission, and its growth model for cooperative and systemic mobility governance. As a seemingly commonsensical proposal issued by a group of well-established actors, it was expected to arouse little interferences. Closer inspection proved otherwise, however. The case report starts in spring 2003, when the public-private commission published its recommendations. These concerned the persistent accessibility problems on the A4, providing the outlines for coordinated, 'networked' governance of traffic flows. The innovation attempt consisted both of a set of ideas and the initiative to have those taken up in a pilot in the Greater The Hague area. The translation sequence (in hindsight rather a translation 'cloud') is traced along this pilot and its subsequent applications in other areas, and along similar but different network-oriented initiatives.

4. The travel information chain (1996-2009). Also this fourth case took concrete shape only at a relatively late stage. From early on, several innovations ranked high as

candidate cases through which to describe the technological changes sweeping through the field: Increasingly sophisticated information systems for traffic control, but also the advent of customer-oriented in-car systems and information services for public transport. As a shifting information landscape the general pertinence to system innovation was obvious, yet it was hard to single out an innovation attempt or initiator from the broad proliferation of innovations. Eventually an influential origin was found in a governmental policy initiative that anticipated and stimulated a public-private system innovation towards 'informed choice' for the traveler. The innovation attempt was formulated as a general enhancement from which no interferences could be expected – on the other hand the new architecture for information provision gave rise to constant renegotiations and struggles. The case report starts in 1996, when policymakers from a sub-department of the Transport ministry launched their plan to enhance travel information provision. Through a more market-oriented approach and the development of a travel information 'chain' they sought to induce technological and service innovations. These would help to meet their future vision of 'informed choice' for the traveler. The innovation attempt was meant to unleash an accelerating translation sequence, guided by governmental vision but propelled by entrepreneurial inventiveness. The policy change involved ideas and actions, and envisaged specific materializations of those. The translation sequence is traced along public and private translations of the information chain, and along the 'subsequences' of traffic management, customer-oriented traffic information and public transport information.

Having been selected for their diversity and progressively demarcated for their information value, these four cases do not *represent* system innovation activity in the field. They can be said to largely cover the field's main directions for system innovation, however: Towards more 'humane' and spatially embedded traffic, towards greener traffic, towards better coordinated and systemically approached traffic, and towards better informed traffic. The translation sequences revolve around particular envisionings of systemic change and particular views on 'sustainable mobility'. In this respect a recurring question was which initiative harbored the most system innovative potential. Interestingly, these assessments changed underway. In hindsight these changing appreciations testify the interpretive added value of translations tracing[10]. The concluding section clarifies how case analyses were built up, involving description, assessments of outcomes and translation-dynamic analysis.

3.5 A case format for translations analysis

As indicated in section 3.3, analysis involves three levels: Separate cases, case comparison, and intersections between cases. As in-depth analysis of separate cases forms the basis for the latter two, the analytical procedure towards these context-bound insights merits particular attention. Moreover, the intended comparison of diverse transformations requires measures to render them commensurable. The case format specifies a process of gradual abstraction:

[10] As regards these normative assessments, the intertwined processes of progressive contextualization and gradually developing insight yielded an enriching alternation of 'Stockholm syndrome' (identification with viewpoints of translators) on the one hand, and more detached 'ivory tower' judgement on the other. Without going into detail on the researchers' experiences, these changing assessments should be visible between the lines of what were intended to be *balanced* case studies.

1. **Description of the innovation attempt.** A description of the innovation attempt marks the starting point of outward translations tracing. It introduces further description of innovation evolution, but also helps ascertain *in which respects* the innovation attempts were diverse: It indicates what the innovation attempts comprised, which initiators launched them, and what change ambitions they had in mind when doing so.
2. **Case description.** After description of the innovation attempt, the camera moves along the accounts of several key translators. Following a grounded strategy, this description stays close to the interview transcripts, without translation-dynamic voice-over. The general ordering procedure is to start with the experiences of the initiating protagonists and then to turn to translators' accounts, connecting their narratives through documentation. This description presents the relatively[11] raw material for analysis. A timeline of events is provided for the sake of overview – also serving eventual analysis of intersections.
3. **Establishment of outcomes.** A prepatory step for analysis is to establish a rough assessment of outcomes. Taking stock of striking events, rudimentary patterns and differing evaluations provides leads for translation sequence analysis, and clarifies why certain translation moments were lifted out and not others. Approaching innovation as two-way traffic, a first question to ask is *whether the innovation was successful in the eyes of initiators and translators*, and whether their assessments differred much. This allows for a multi-sided appreciation of what is the researcher's particular interest: *What was achieved in terms of system innovation?* This assessment from the analytical 'helicopter' serves to facilitate comparative analysis, and to distinguish between shining examples and demonstrations of pitfalls. It also serves the inventory of system innovative changes across cases, which may combine to a greater or lesser degree. A third question concerns the occurrence of *striking basic patterns*; apparent turning points, repetitions-of-moves or accelerations meriting analytical attention. These halfway categorizations and foci only assisting the establishment of translation-dynamic patterns, they no longer play a role in comparative analysis.
4. **Translation sequence analysis.** The case report ends with a cases' interpretation. As expressed through the translations typology, the course of a translation sequence is expected to depend on the particular ways in which an innovation attempt is translated. The sensitizing typology distinguishes between non-translation, interference, embracement, modification, alien modification and self-translation. These translation types acting as foreshadowed problems and issues for translations tracing, another point of attention was whether and how actors managed to 'synchronize' their translations. The construction of translation dynamics focuses first on affirmative and negating translations separately: The most basic distinction of forces that shape an innovation's life. Having highlighted these translation-dynamic dimensions separately, case-specific translation patterns can be carved out. By eliciting the main themes in the cases described, these translation-dynamic 'configurations' form the input for comparative synthesis.

After the four case analyses in Chapters 4-7, the research question after innovation attempts' evolution into system innovations is answered through synthetic analysis, i.e. comparison between translation sequences, and analysis of intersections **(Ch. 8)**. Strategic elements for immanent guidance of system innovation are formulated separately **(Ch.9)**.

[11] Having been developed through focused translations tracing, the footage has been cut and edited.

Chapter 4 Greening traffic; the imposition of 80 km/h zones on Dutch highways

"Once again, mad cows and their prions provide a useful source of insights. There is no way of establishing the facts without organizing epidemiological studies, without shedding light on the networks for selling and distributing animal feeds, without implementing procedures for tracing animal carcasses etc. Society as a whole must agree to take action in order to produce an officially recognized body of knowledge and measurements—in the metrological sense—in the absence of which the existence and geography of the externalities cannot be regarded as defined; that is to say, without which measurements—in the political sense—cannot be taken with any legitimacy."

M.Callon - An essay on framing and overflowing: economic externalities revisited by sociology (1998,13)

4.0 Introduction

In the introductory chapter, the A4 highway exemplified the phenomenon of 'systemic problems'. One of the options to reconcile mobility goals with environmental constraints consisted in the imposition of an 80 km/h speed limit. This chapter describes how a few years earlier, this measure was undertaken as an innovation attempt. The case study proceeds in five steps: First a brief description of what the initiating protagonists sought to achieve **(4.1)**. Second, the experiences of the initiators **(4.2)** and third, those of other actors involved **(4.3)**. Fourth, innovation evolution is assessed for innovation success, system innovation achievements and development patterns **(4.4)**. The evolution of the innovation attempt is analyzed in the final section, highlighting its translation dynamics **(4.5)**.

4.1 The first 80 km/h zone: Overschie

On May 11th 2002 the Dutch minister of Transport and Water Affairs was announced to appear in Overschie, a Rotterdam borough. She was supposed to inaugurate the '80-kilometer zone' on the A13 highway along the Rotterdam borough Overschie: A lowered speed limit compared to the usual 100 or 120 km/h on highways. Figure 4.1 shows how the zone appears to road users.

Figure 4.1 The Overschie 80 km/h zone. (Stadsregio, 2004)

Other than traditional speed measures, the zone entailed the introduction of so-called section controls for permanent speed surveillance over the entire zone. All cars would be subjected to speed measurement, i.e. photographed at both entry and exit points to assess mean speed. Noncompliance with the 80 km/h limit would automatically result in a fine. A month later, a newspaper reporter commented on the measure as follows: *"On the highway along the Rotterdam borough Overschie you're only allowed to drive 80 km/h. This serves a better environment in the residential streets along one of the most crowded traffic nodes in the Netherlands. For the first time Rijkswaterstaat imposes a speed limit on the highway network for this reason. Three thousand car drivers per day don't keep*

to the limit. They get fined. Rijkswaterstaat calculated quickly that there is little point in a desire to drive faster. The extra travel time for the 1600 meters concerned amounts to only 18 seconds." (NRC, 2002).

The measure had been forced through by a group of local residents, the report continued. On April 20th 2001 the minister of Transport had announced the measure to parliament. *"The air quality along crowded highways in urban areas is an issue of concern. Partly in response to the implementation of new European limiting values for air quality in Dutch legislation, bottlenecks have become visible. The Air Quality Decree, pending for resolution on new air quality limiting values, presents me with an important framework not only to seek solutions for existing problems, but also to consider the question how new bottlenecks can be prevented in the future. Structural solution of existing bottlenecks may require far-reaching and costly measures, the realization of which most probably will only come within reach on the longer term –if at all. Nevertheless it is also required to search for solutions on the short term, to improve the air quality in bottleneck situations."* (Netelenbos, 2001). She concluded that homogenization of traffic flow, brought about through a lowered speed limit, would be a promising option: Traffic emissions depended greatly on acceleration and deceleration, after all. The minister therefore announced the 80 km/h speed limit for the A13 at Overschie, and continued: *"Although a positive effect can be expected from a combination of speed reduction and measures to reduce the dynamics in traffic flow, the magnitude of the effect remains surrounded by considerable uncertainty. Experiences with the yields of such policy package, tested by air quality measurements, are lacking thus far."* (idem). The minister therefore urged for monitoring of air quality effects. Assessing the measure's effectiveness, it could be considered for application at other bottleneck sites.

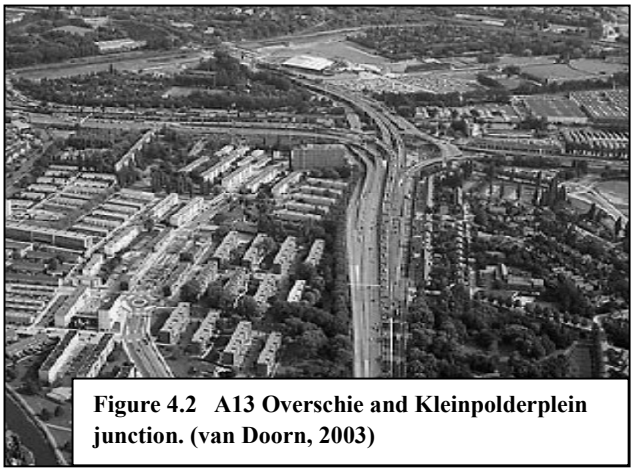


Figure 4.2 A13 Overschie and Kleinpolderplein junction. (van Doorn, 2003)

The A13 '80 zone' was motivated by environmental concerns. The minister expected the zone to yield air quality improvements, even when uncertain. The Overschie situation stood out as an air quality bottleneck. Figure 4.2, zooming out from the view on the A13 itself, shows the A13 and the housing areas at small distance.

The next section describes the experiences of the initiating protagonists; the minister of Transport, and Rijkswaterstaat officials charged with the 80 zone as project leader, researcher or evaluator. The experiences of other stakeholders are described in section 4.3.

4.2 From the Overschie 80 km/h zone to Dynamax

Actually it had been a 'mission impossible' to reach the deadline set for delivery, the former project leader recalled (*1, 1). In 2001 the minister of Transport had promised the Overschie citizens, the borough council and the municipality to take measures on local air quality conditions. Rijkswaterstaat, the executive department of the Transport ministry, had conducted research on a range of other possible solutions, but had found them inadequate for varying reasons. First of all, there were the ongoing deliberations about the A4 Midden-Delfland, the missing link[1] that might divert traffic from the A13. There were also plans for a bypass between the A13 and the A16, which would similarly alleviate the A13 sections in Overschie. In the end, these bypasses could allow for a downgrade of the Overschie A13 into an urban main road. Figure 4.3 displays these infrastructural solutions, with the A13 Overschie between 'Doenkade' and 'Kleinpolderplein'.

Figure 4.3 A4 and A13/A16 projections. (Rijkswaterstaat.nl)

Apart from these infrastructural solutions, they had considered a couple of traffic measures as well: Freight traffic to the Rotterdam harbor complex could be diverted via an industrial area, and they had considered mitigations in lineage and traffic signs (*1, 1,4). In the end, the diversion would be hard to enforce, however, and it could easily entail mere displacement of traffic nuisance to other areas (*1, 7). In any case, after the Minister's decision for the zone by November 2001, he could start his mission as project leader by the end of January 2002.

This meant that he had three months to meet the implementation deadline. Apart from the completion of the noise barriers, his main challenge was to secure effective operation of the speed enforcement system. The idea to serve air quality through lowered speed limits had been known for some time in environmental policy-making, and the necessity of tight enforcement as well - yet he faced the practical problem that the desired section control installations did not seem to be available. To his knowledge, they hadn't yet been implemented anywhere in the entire world (*1, 1). *"…and I've been just very lucky, that the AVV, the test center AVV, (…), they had been busy developing these section controls for years…actually they had a whole system on the*

[1] See section 1.0.

shelf already…tested…certified…and actually almost nobody knew it was there…and they were continuously involved in making agreements with road managers, with municipalities, with public prosecution, with the police, with BVOM…they were busy trying to make a great deal of agreements to have the stuff tested for once…but they just didn't manage…There were always hitches somewhere…then there was this pilot on the A1, then there was a lot of fuss again…and then I came along, asking, 'guys, does something like this exist?'" (*1, 2). The technology in itself was not the issue, he explained. As the section controls were to operate as official detection equipment, however, every nut and bolt had to be certified in order to hold in court eventually. Fortunately saved from this potentially cumbersome and time-consuming trajectory, the project leader could concentrate on a still challenging task: Actually implementing the system.

The section controls had been requested by the minister of Transport, in consultation with her colleague from Environmental affairs. As enforcement installations these systems would reside under the ministry of Justice, however. More specifically, the BVOM[2], the traffic enforcement department of the Public Prosecution bureau, would be in charge of administration. They had been interested in the systems for some time, and were curious whether it could be made to comply with all requirements. As the project leader found out, those requirements were many: Proving keen on fitting in the new enforcement system with their daily operations, BVOM came up with a lot of 'additional demands'. And whereas the project leader himself had acquired carte blanche from his Rijkswaterstaat superior to deliver the minister's promise, many of his BVOM partners proved to have very limited mandates (*1, 2). So in a few cases, he had had to scale up issues to higher echelons. The 80 km/h zone had been a collegial decision by the Ministerial Council, after all.

Notwithstanding the incidental delays and 'additional demands' from his BVOM partners, the project leader acknowledged their pivotal role for his project - and especially for its further operation. Tight enforcement he knew to be essential, only to find out soon that its administration was easier said than done. The zones would have to be fitted in with wider enforcement policy: As controls can be targeted at speeding, at red light trespassing, or at alcohol offenses, they involve prioritizations and policy choices. This is how the project also had him involved in deliberations with the municipal administrative, legal and enforcement 'triangle' on public safety. A practical issue that needed to be settled by the regional and national traffic police was the question whether the A13 Overschie formed part of the Rotterdam highway network or not (*1, 8).

From the side of enforcement, accuracy and meticulousness were essential. As the section controls were based on license plate scanning, they had to comply with regulations on privacy protection. Consultation of the council for protection of personal data[3] brought out that license plate scanning of inbound and outbound cars was allowed, provided that only the cases of speeding would be selected for inspection[4]. As the information was sealed electronically, the project leader had never laid eyes on any license plate number himself. In the beginning the tests had displayed some technical

[2] http://www.bvom.nl/

[3] 'College Bescherming Persoonsgegevens', http://www.cbpweb.nl/Pages/home.aspx

[4] (*1, 11). Other uses, such as criminal investigation, were ruled out. He observed that later on, this stringency started to shift. See also Ch.7 on this phenomenon of 'function creep'.

hiccups, he did recall; cars could 'disappear' through flawed detection. To the project leader, this was not the heart of the matter, however. He considered enforcement a means to reduce speed and improve air quality conditions. At the Justice department they approached the issue from an entirely different angle, he observed: Even apart from legal principles, the practicalities of prosecution alone posed serious grounds to ensure impeccable operation of the section controls. Assuming that 1 or 2% of the cars would be ticketed, and estimating that 10% of fined drivers would make legal appeals, these small fractions would still suffice to generate an avalanche of lawsuits: Given the daily tens of thousands of vehicles flowing through, even small accuracies could overburden the administrative capacity. The project leader suggested to relax the enforcement somewhat to be on the safe side, but got reminded that 'the law is the law' (*1, 8).

He saw with concerns how flawed detection and wrongful prosecution could erode public support, and worried about public resentment about large-scale fining (*1, 7). The cameras could easily become targets for frustrated drivers. Indeed, there had been truck drivers honking their claxons in the night, avenging themselves for the constraining measure. Altogether his fears did not become true, however. In the first place, Rijkswaterstaat had launched an intensive publicity campaign to explain the zone's purpose to protect the health of citizens and children. Second, they had agreed with BVOM that it was crucial to handle prosecution impeccably, and get the fines out right from the start. This would leave no room for doubts about the new surveillance reality. BVOM had also urged to equip the matrix panels with the red-bordered prohibition marks. This would underline the legal status of what might otherwise appear as merely an advisory speed. Not having the particular signs on the shelf, Rijkswaterstaat went the extra mile to 'retrieve' them from elsewhere in the country.

Finally he pointed out how also sheer luck had contributed to project success. At least two chance events had protected the project from potentially harmful media attention. The zone was inaugurated in stealth, to begin with: Less than a week before the official opening of the zone, the national political leader Pim Fortuyn was murdered. The assault had left the country, and especially his hometown Rotterdam, in a tumultuous state. The official opening was cancelled. And later on, in the zone's first year, a software bug in the atomic clocks popped up, and a great number of speeding tickets had to be withdrawn. *"It could have created a great deal of fuss, and it could have meant 'curtains' for the whole section control concept, you could say, if the media had started to delve into it to the bottom…"* (*1, 9). The press release on the error was luckily eclipsed by the fall of the cabinet, however.

After completion of his 'mission impossible' the project leader was dispatched on another mission. After 8 months of intensive monitoring preliminary research findings came out. The NRC newspaper reported local air pollution to have been reduced by 10 to 20 percent, and noise reduced by half (NRC, 2003). Half a year later, in June 2003, researchers from the TNO institute[5] and the Environmental Service (DCMR)[6] presented their final research report, based on monitoring between April 2002 and June 2003. They had found traffic emission reductions of approximately 15-25% for NO_x and approximately 25-35% for PM_{10}. Discounting for background concentrations, this corresponded with 4% and 7% in reduction of total concentrations. They had also monitored noise, traffic safety, and traffic flow effects, but had focused on air quality,

[5] One of the main independent research institutes in the Netherlands. http://www.tno.nl/
[6] The environmental service in the Rotterdam Rijnmond area. http://www.dcmr.nl/

the main reason for the measure. The measure *"...seems to be an effective instrument to reduce environmental effects of traffic, until more source-oriented measures become available, like cleaner vehicles, cleaner fuels, and less road traffic"* (Wesseling et al., 2003, 3-4). The detailed report also specified a great deal of intervening variables; variations in the truck/car mix, traffic flow behavior, and fluctuations in background concentrations. Because of these contextual factors, and with an eye on cost-effectiveness, the researchers recommended to investigate these local conditions first, before considering application of the 80 km/h measure. A matter of 'tailoring', enabled by the measurement and modeling instruments they had developed during the Overschie experiment[7].

On July 7th 2003 the minister of Transport presented the evaluation report to parliament, also including polls among car and truck drivers. She expressed her contentment about the positive effects. By then the Secretary of State for environmental affairs had already urged for a 80 km/h speed limit on the Utrecht and Amsterdam ring roads (NRC, 2003b). The minister announced to establish a framework of criteria for possible further applications, however, considering that apparent success was largely attributable to locational factors.

Four months later, on November 17th 2003, the Transport minister presented the 'policy framework Overschie'. She had accorded the Overschie zone permanent status on October 23rd 2003, indicating the 'experiment' to be no longer an experiment. She considered it successful for its positive effects on air quality, traffic safety, and noise levels, the effective cooperation between ministries and executive organizations, the integral investigation of both environmental effects and traffic flow, and its innovative character, i.e. the combination of speed reduction and section control (Peijs, 2003). The policy framework consisted of conditions and criteria: In the first place, the measure would only be applicable to sites identified as air quality bottlenecks, i.e. sites not in compliance with European NO_2 norms set for 2010. Furthermore, application should allow for win-win situations between traffic safety, traffic flow and environment, with air quality as the primary line of approach. Road users should be sufficiently informed about the motivations for the measure, and application should be endorsed by local authorities. Criteria were 'substantial' contribution to air quality standards compliance, in the same order of magnitude as achieved in Overschie, contribution to reduce noise peaks (especially at night), contribution to even traffic flow, fit with local highway and secondary road network, improvement or at least no deterioration of traffic safety, cost-effectiveness, and enforceability. The evaluative framework would be brought to bear on a list of bottlenecks. And considering that *'...already had become clear that an Overschie-like measure would not be suitable for all bottleneck locations'*, she issued an 'innovation program air quality'. Furthermore, she would start investigations on more flexible speed limits, as requested by the minister of Justice.

The changes in speed limit policy had their history, a policy advisor and researcher from the Rijkswaterstaat research department explained. In 1988 the uniform 100km/h highway speed limit had been elevated to 120 km/h, with occasional exceptions of 100 km/h and 80 km/h in case of hazardous road situations. But whereas enforcement of the uniform 100 km/h limit had been 'fairly poor', the 100/120 arrangement was accompanied by strict enforcement and intensified public communication. Because of

[7] Wesseling et al., (2003, 28). The report also mentions their earlier on-site research within the framework of the European HEAVEN-project.

technological achievements, people had started to feel relatively comfortable with driving at high speeds - a feeling of safety belied by traffic safety wisdom, he added (*2, 1). Through tightened enforcement traffic speeds on the highway network had remained fairly constant. In the same period, speed limit policy had started to become more responsive to exceptional circumstances; automated incident detection was transmitted almost instantaneously to road users, with matrix signs displaying adapted speed limits. Similarly, road works could be accompanied by temporary 70 or 90 km/h speed limits. *"But if you think about it, you think to yourself, well, I could apply this on a somewhat greater scale, we have this, so to say, momentum with maximum speeds, and, would it be feasible to say, yes, we should be heading for a concept of variable speed limits, responsive to actual circumstances…"* (*2, 2). Such a dynamic regime could be used for various goals, he indicated. The concerns about air quality and noise in Overschie had been an immediate occasion to run an experiment.

At his department they had already pondered over alternative enforcement schemes for some time. And in the Overschie situation, section controls were indispensable. Roads have their design speed, he explained; the highway lay-out of the A13 he considered at odds with a 80 km/h speed limit. For this urban highway, somewhat narrowed down by the noise shields, 100 km/h would be adequate (*2, 15). Ideally, the 80 km/h limit would therefore be consolidated by a downgrade to an urban main road.

They had investigated emission effects for 80 km/h, 90 km/h and 100 km/h limits, and found significant differences according to vehicle types. This also meant that the lowering of the speed limit could achieve only limited environmental gains by itself. Yet as they had also paid considerable attention to effects on traffic behavior, they could attribute the 'Overschie-effect' to several factors: The speed reduction accounted for a quarter, another quarter resided in the *homogenization* of flow enforced by the section controls, and a third quarter consisted in the fact that congestion had been shifted back on the A13, out of the populated area of Overschie. Their analysis of the 'Overschie-effect' had informed the ministerial 'evaluation framework Overschie' (*2, 3).

On October 29th 2004 the minister of Transport addressed parliament on the flexibilisation of speed limits. She sketched how polls amongst road users continued to bring out a societal dilemma on speed limit policy. Accessibility, safety and livelihood ambitions proved hard to reconcile. She took the polls to convey that *"..broad public support can be counted upon if the maximum speed would be raised, and a limited support in case it would be lowered. At the same time, the same road user thinks this does not apply to the highway section next to where he lives"* (Peijs, 2004,1). That having said, she reinstated the policy of '120 where possible, and 100 where needed'. She expressed willingness to meet the pleas for a speed limit raise from 100 to 120, on several sections with lay-outs more suitable to 120. But the Council of State verdict on road expansions[8] holding for speed limits as well, such would only be possible when cars would become cleaner and more silent. The possibilities and costs of noise-proofing measures would be investigated. For similar reasons she could not grant the pleas for a raise to 130 km/h (Peijs, 2004,3). Furthermore, she announced a speed limit reduction for the A13 sections adjacent to the Overschie 80-zone: Reducing the speeds from 120 km/h to 100 km/h would secure a more gradual transition with the Overschie 80-zone. Next, she addressed the issue of possible wider application of the '80' measure:

[8] See the introduction in section1.0.

Applying the 'policy framework Overschie' to 10 air quality 'Hot Spots' identified by the Institute for Environmental Hygiene (Blom et al., 2003, sites displayed in figure 4.4), four sites remained eligible for application. Selection had been no trivial matter, the research report indicated: *"The impact assessment for the speed lowering's effect on air quality, noise and traffic flow has been based on highly detailed 'state of the art' models. The use of models, rather than measurements is unavoidable, as we are looking for effects of a measure on sites where it hasn't been implemented yet"* (AVV, 2004, 4). Travel time reliability was added as a criterion, reflecting the user-oriented governmental white paper on mobility, the Nota Mobiliteit. The sites selected were the A10 West, a part of the city ring of Amsterdam (6km), the A12 Utrecht ring (albeit only over a stretch of 1,8 km), the A12 Voorburg, near The Hague (2,4 km), and the A20 in Rotterdam (2,4 km). The A2 Waardenburg was indicated as a suitable site as well, but was rejected for the low number of citizens affected (AVV, 2004, 28). The selection was based on site-specific traffic flow forecasts, the research report further abounding with caveats on both measurement and modeling. Technical ex-ante considerations and predictions could not be decisive to determine the feasibility of actual implementation, however: Other relevant aspects to be considered were public support, the way of implementation, traffic-technical effects, network effects and synergy effects. *"These aspects may carry more weight than a quantitatively positive effect on air quality."* (28). The four 'epigones' of the Overschie 80 km/h measure were opened on November 1st 2005.

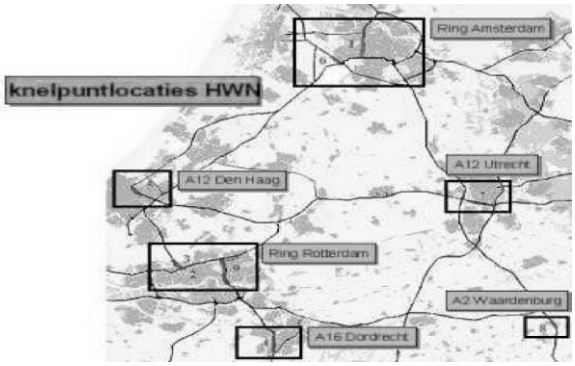


Figure 4.4 Air quality Hotspots on main road network. (Peijs, 2004)

The effects of these epigones were closely followed by the media. On the day of opening, the Algemeen Dagblad newspaper reported the zones to have 'barely an effect' (AD, 2005). A week later, the Secretary of State for environment noted this heading to have confused the issue, reminding parliament that the few percent improvement of local air quality conditions should not be underestimated: *"The measure's effectiveness as regards reduction of traffic emissions by 10 to 20% is certain; improvement of local air quality conditions varies, and is dependent on background concentration and distance to road axis, but with an order of magnitude of 2%, the measure's effectiveness is comparable to alternative measures that may be taken, but will only become effective over time."* (van Geel, 2005). An LPF[9] member of parliament confronted the Transport minister with the aforementioned newspaper report, inquiring whether she monitored the

[9] The 'Lijst Pim Fortuyn' was the populist right-wing political party formed around Pim Fortuyn, who was assassinated by an environmental activist in 2002. Environmental measures were not popular with the LPF.

zones for congestion developments and driving behavior, whether she acknowledged the risk that drivers might drive even slower than the speed limit, resulting in more queues, and whether she monitored air quality effects. And after these investigative questions, the questions followed whether she would be ready to reverse the measure in case queues would augment, and if she would be ready to withdraw them in case the desired air quality effects would fail to occur. And if she wouldn't, why not? Answering the questions the minister confirmed to monitor on the parameters mentioned, also recapitulating the positive effects forecasted on the basis of site-specific research. As regards the risk of congestion induced due to overcompliance, she pointed out how in Overschie this effect waned over time; drivers had grown accustomed to the situation. And as regards withdrawal of the measure: *"If it turns out over time that queues have augmented due to the measure taken, it will be reconsidered. Reconsideration will also take into account the measure's effects on air quality and traffic safety. Possible reconsideration will be based on monitoring conducted for the coming time"* (Peijs, 2005).

With political and public opposition augmenting and the environmental Secretary of State standing up for the measure's relatively substantial gains, the minister of Transport relegated the issue to monitoring and the policy framework established earlier. Meanwhile, the Rijkswaterstaat/DVS researchers had continued their investigations on the 'Overschie effect'. As had been urged for vigorously by environmentalists and authorities on the decentralized levels, Rijkswaterstaat/DVS had examined the scope for applying the 80 km/h zones on entire ring roads. The DVS researcher earlier introduced had been the project leader: They had modeled combinations of 'compact driving' through narrowed road lining and 80 km/h limits. It all was well more complicated than it might appear, he explained patiently. Yet the special thing about the dossier he indicated to be it's highly controversial character, with very outspoken proponents and opponents. As he expressed himself carefully: *"…automobilists[10] are generally not very keen on measures that constrain one's driving behavior, and a speed measure is of course an…is of course experienced as a constraint on one's driving behavior. And when asked, about half of the people say, 'well, to me this is not really necessary…other measure, please'. Still, on the short term we don't have that great a set of options to do something about air quality…"* (*2, 10). He indicated that within the heated polemic, it was important to do a pure, factual evaluation. Unbiased evaluation he believed to be possible, though its translation into policy-making and politics he considered another thing. Building forth on the Overschie analysis they had formed an interdisciplinary team to cover the wide range of aspects involved, merging the respective outcomes into a broad societal cost-benefit analysis (*2, 10/11).

Application on entire ring roads was not just a matter of replicating Overschie success, he explained. The study had brought out a range of 'odd' effects. The Overschie effect proved to be undermined by evasion effects, i.e. by traffic seeking refuge on the secondary road network (see Stoelhorst et al., 2006 and Stadsregio, 2004 for details). And even when these evasion effects remained elusive to modeling, he did consider that

[10] He actually said 'autorijdend Nederland', an expression often used to denote a discourse coalition of car drivers, the motorists' association, center-right and conservative political parties, employers, freight transport operators and newspapers. The rivaling environmentalist discourse coalition features environmentalist citizens and NGOs, left-wing political parties, academics, and newspapers. See further in 4.3.

the study urged for parsimony. He noticed that on the side of the Rotterdam municipality, the initial enthusiasm had made way for a more cautious stance already. On May 29th 2006 the minister declared most of the '80 on the ring' scenarios to fail against the Overschie evaluative framework. As regards 'compact driving' she was more enthusiastic: *"This study did yield the insight that compact driving on a few continuous trajectories on the ring roads may be useful, and can be made to fit in. This will expectedly have an almost neutral effect on air quality. Therefore I would like to bring forward the research findings in the network analysis processes, when for every separate city ring (cost-)effectiveness, network effects and transition effects of these measures should be scrutinized"* (Peijs, 2006a).

While the investigations on extended application on ring roads were underway, the polemic on the Overschie epigones had only exacerbated, however. In January 2006, the critical questions posed just after their launching were followed by stronger assertions of adverse congestion effects. The VID, a commercial traffic information provider, had published their congestion data over the first six weeks of the 'epigones', eagerly published by the Telegraaf newspaper. An MP confronted the Transport minister with the data, repeating earlier inquiries after possible reconsideration of the measure. The minister didn't give in, dismissing the data for the insufficient period of monitoring (Peijs, 2006b). A political climax started on April 3rd 2006 however, when the VID presented alarming congestion developments for the first quarter of 2006. Their good news was that these trends signaled an economic upswing. Highway congestion intensities had increased 19,2% on average, compared to the same period in the previous year. The 80 km/h zone at the Rotterdam A20 westbound marked a rise of 33,7 %, implying it did 'a poor job, as regards traffic flow'. The eastbound section scored only 12,9 %, but there the temporary closure of a bridge might have given an overly rosy picture. Together the four new 80-zones displayed a rise of 28,8%, with the A-10 West zone in Amsterdam displaying even a decrease[11]. MPs commented on the national news with passionate pleadings: The VVD (liberals) spokesman stated that clearly, the 100 km/h speed limit had to be restored, the 80-zones only increasing congestion levels. By contrast, the PvdA (labor) spokesman pointed out that the Amsterdam A10 zone displayed even a relative decrease in congestion. Considering the evidence inconclusive, he considered it wiser to await the evaluation reports[12]. MPs stood in line to interrogate the minister: The CDA spokesperson (Christian democrats) claimed not to be against the measure - provided they actually worked. He reminded that similar numbers had been published three months earlier. Referring to the VID reporting, he indicated that the argument of 'drivers needing to become accustomed' did no longer go. His party was not willing to await the evaluations for three more months – these would only confirm the conclusions of malfunctioning (van Hijum, 2006).

In her response the Minister pointed out some nuances in the effects reported, also remembering the parliamentarians that the VID had presented only raw data acquired from her ministry[13]. She also reinstated that the zones were there because of the air quality problems, and not for congestion abatement. In her analysis, the Voorburg A12 stood out as 'evidently bad', especially outbound. She announced to present an

[11] Radio interview with VID spokesperson Patrick Potgraven, 04/04/2006.
[12] NOS evening news bulletin, 04-04-2006.
[13] At several occasions the minister questioned the authoritative status of this commercial traffic information provider's analysis. This attitude will become more understandable in Ch.7 on traffic information provision.

evaluation and possible mitigations by the end of the month, as thus far, air quality effects had been based on calculation, rather than measurement. As regards the other three new 80 km/h zones, she kept to the evaluation period initially agreed upon (van Hijum, 2006).

"Research in a policy environment is no unencumbered research", he understated with a smile (*3, 9). As a noise and air quality expert working for the Air Quality Innovation Program, he had become involved in the 80 km/h zone evaluation processes. The general difficulty to uphold scientific integrity in a policy environment was by no means new to him: His position involved conveying inconvenient truths to policymakers, but also decision support. After a 'rough picture' sketched by the VID, after only 3 months, they were already summoned to come up with data. By April, another 2 months later, congestion effects were still visible, but not as alarming as earlier on. At least air quality gains were positive. After three months you just *can't* be conclusive about neither congestion nor air quality, he explained their difficult situation. Beside seasonal variation, random variation and variation in traffic levels, there were the statistical requirements for a sufficient amount of data (*3, 10).

Despite these methodological considerations, the minister lived up to her promise, presenting her interim evaluation report to parliament on April 26th 2006. The report brought out significant variations between the different sites: Only at the Voorburg A12 air quality effects indicated slight deteriorations. The Rotterdam A20 and especially the Voorburg A12 confirmed suspicions of adverse traffic flow effects however. The latter displayed a 69% increase in congestion level, compared to measurements before the 80 km/h zone. The traffic-stifling effects could largely be attributed to the particular configuration of ramps. On these two 'complex merging sections', strict enforcement of the 80 km/h limit hampered merging maneuvering. The reduced traffic dynamics could yield to a capacity drop up to 10%, the minister indicated (Peijs, 2006c). She announced immediate remedial measures for the Voorburg A12 in the form of lineage, signs and rearrangement of buffer strips, negotiations with local governments about traffic light reprogramming and possible adaptation of the Voorburg ramp. For the Rotterdam A20 she announced inventory and implementation of traffic-technical remedies. That having said, she continued under the heading of 'reconsideration 80 km/h measure'. She would adjust the measure on a case-by-case basis, which would require a Traffic Act resolution, however. The adjustment would thus have to be tested for possible deterioration in air quality or noise levels, and decisions would be open to appeal. Legal procedures and impact assessments she indicated to have started for the A12 Voorburg outbound, preparing for possible adjustment to a 100 km/h limit (Peijs, 2006c, 4).

As the Rijkswaterstaat researcher explained, the phenomenon of the 'complex weaving sections' had shown them all the more why the Overschie measure was no panacea for all situations. The capacity drop was especially worrisome given the non-linear effects, generating disproportionately great congestion formation[14]. Together with researchers from the TNO research institute they had conducted extensive analysis of driver behavior. This 'Human Factors' research also included observing the complete environment of road lay-out, linage and signs as experienced from the driver's seat. This is how they found that drivers were inclined to stick to the right, how they tried to be 'on

[14] As a rule of fist, every 5% capacity reduction yields a 15% increase in congestion (*2, 6). As he explained on a (capacity, speed) diagram, it seemed to be a phenomenon of system 'hysteresis'. See also Ch.5 on the growing acknowledgement of road network vulnerability.

the safe side' by keeping to a speed of about 72 km/h and refrained from overtaking, and how this induced truck drivers with their speed limiters to overtake them. All in all, he had been surprised to see it happen that manifestly: *"We just couldn't have possibly thought this up beforehand,…"* (*2, 7). As analyzed by Harms (2007), the weaving problems involved a wide range of variables: Intensity per sections and per lanes, densities, average speed and speed variations, following behavior, weaving behavior, lane usage: The 'Overschie-effect' proved not easy to replicate.

The Voorburg A12 case had been especially complex to assess; certainly not an experiment under controlled conditions, he laughed. They had also investigated the phenomenon of diverting traffic[15]. Around the moment the 80 km/h measure was taken, not only had more capacity been created inbound, but also information panels had been placed that allowed drivers to compare travel times with those on the alternative N11 (*2, 5/6, see also Ch.7 on travel information). Whatever the precise causes of the A12 traffic flow problems, it had become clear that the combination of the 80 km/h limit and the section controls was unfortunately stifling traffic flow dynamics. One option would be to 'let off some steam' in peak hour, temporary raising the limit to 100 km/h. He had suggested it, but understood that such would be counterintuitive: *"Outside rush hour…when nothing much is going on, when it is quiet…we drive 80, for the sake of air quality, and at the edges of the peak, when it is becoming more crowded, …No, then you have to bring some dynamics into traffic, and you're allowed to speed up a little bit. That is hard to explain to the road user who thinks, when it becomes a bit more crowded, I'll adapt by myself, by myself I'll slow down a little…"* (*2, 14). A more flexible speed limit would be a feasible option, he continued, also for administrative reasons: As restoration to the 100 km/h limit required a cumbersome Traffic Act procedure, the 80-zone arrangement had effectively turned out as a 'straightjacket'.

On May 31st 2006, a month after her 'reconsideration', the minister promised parliament to establish a plan to develop dynamic speed limit arrangements (Peijs, 2006d). She presented the strategy on October 28th in the same year, announcing a new round of tests. Technical advances and rapid ICT development, as had been foreseen around the time of the Overschie measure, had brought the goal closer. Furthermore, the 2005 Mobility policy framework had presented Dynamic Traffic Management as a prominent ambition. Noting how dynamic speed arrangements fitted in with the recent policy emphasis on road use optimization, the Minister announced thorough investigation of the options available (Peijs, 2006e). On February 20th 2007 she returned to the issue of dynamic arrangements, indicating that the required amendments of the 1994 Road Traffic Act would consume considerable time. This is why she sought first to amend the experimentation article, reducing the length of the procedure required for experimentation. Experimentation would be monitored for the effects specified in environmental legislation, but would be freed from the impact assessment procedures required in the case of actual implementation. The heavier procedure for implementation would be started in case of experimental success (Peijs, 2006f).

Four months later, her successor specified the experimentation set-up, and indicated test sites. *"Research aim is to gain insight in the effects (safety, traffic flow, and environment) and the behavioral aspects of dynamic maximum speeds. Also the consequences for road management and network management[16], such as shifts in tasks*

[15] See earlier how this effect led to rejection of the pleas for application of the '80-measure' on ring roads.
[16] See Ch.5 on the rise of 'network management'.

and investments required, will be charted. On the basis of experiences it can then be determined in which cases, in what fashion, and under what conditions a dynamic speed limit is a feasible instrument for future network management. As side constraint has been taken, amongst others, that in cases of serious excess of the norms in urban areas, in principle no proposals for speed limit raises in the 100 to 120 km/h range are proposed" (Eurlings, 2007a). Two weeks later, on June 26th 2007, he briefed parliament about the adjustments on the The Hague/Voorburg A12: The new model required for the specific arrangement had become available, the measures had been taken as proposed by his predecessor, and local authorities would deliberate on noise-reducing measures (barriers, noise-dampening asphalt) to allow for a 100 km/h limit with section controls. Furthermore, final evaluation of the other 80 km/h zones would be completed by summer, and discussed with the authorities on the decentralized levels before their presentation to parliament. The minister intended to use the findings as input for the dynamic speed experiments and the Voorburg A12 adjustment.

On June 23rd 2008 the minister gave his reaction to the final evaluations of the 80 km/h zones. Summarizing decision-making on the zones, he indicated that 'also his predecessor had had the ambition to improve traffic flow within livelihood constraints'. This was why he intended to experiment with dynamic speeds on the Voorburg A12 outbound and the Rotterdam A20 north section. *"In case the experiments show positive results, I foresee the 80 km measure to come to an end. With dynamic maximum speeds I expect to meet the same objectives as with the 80 km zones. The great advantage of the dynamic speed limits is the flexibility, compared to the rigidity of the 80 km measure. Because of this, the measure can be employed at times and places where it is most effective"* (Eurlings, 2008a). On January 19th 2009 the minister was visibly pleased to open the first 'Dynamax' site, as the dynamic speed experiments were called, on a highway section between Bussum and Muiderberg. A news bulletin about it started as follows: *"'Driving faster when possible, driving slower when necessary', the slogan of the Ministry of V&W [Transport] goes, but, when* is *it necessary? And when is it possible? If the weather is bad, you have to slow down…and, also, when the air is filthy, you have to drive more slowly…… is it crowded on the road, one has to drive slower. And, sometimes, under ideal circumstances, one is allowed to go a bit faster."* After which the minister added, *"Everybody knows this situation, you have to drive a long way home late in the evening, on a deserted highway, often a very broad highway, one faces this speed limit, and wonders, why do I still have, now, late in the evening, to drive only 80, or 100…"* (NOS, 2009). The first Dynamax experiment was set up with specific attention to traffic flow effects. Two other experiment sites were targeted at air quality and weather conditions, and the Voorburg A12 and Rotterdam A20 were to follow with specific attention to traffic flow and air quality effects. Unlike the 80 km/h zones that were all targeted at air quality objectives, the Dynamax experiments each had their specific line of approach (NM, 2009a, 32).

In the above news bulletin the minister presented Dynamax from the driver's perspective - unlike the earlier awareness campaign for the 80 km/h zones. As the air quality expert indicated, the switch to Dynamax need not entail an essential difference in the technical sense, though: A dynamic regime would not preclude the possibility for a permanent 80 km/h limit. Still, the shift away from the 'rigid' 80 km/h zones constituted a major administrative and political difference, he acknowledged (*3, 6/7). In this principled discussion, the present minister was clearly inclined towards the more flexible regime. Actually the ideas about dynamic speed limits had been hovering

around for some time already, he continued. Traffic psychologists had stressed that users should *understand* the rules they were subjected to, and the principle of the 'self-explaining road'[17] had come up. Especially from the safety perspective, a dynamic regime was appealing as a way to respond to actual circumstances; whether it rains or not, for instance. Then there were the calls for local speed reductions out of livelihood considerations, and by the end of the 1990s, experiments had tested whether speed limit adjustments could yield traffic flow gains. And finally, within his Innovation Program Air Quality, they had started to consider dynamic arrangements as a an instrument to play into the daily average PM_{10} norms. The air quality gains of the Dynamax pilots he expected to be less than had been achieved on the successful 80 km/h zones – yet from the traffic psychological perspective, he considered it a prudent approach (*3, 5/6).

In September 2008 a group of traffic psychologists published an article in 'Verkeerskunde', a journal for traffic professionals. They explained the particular difficulties of changing speed limits, highlighting the unruliness of human behavior as a pivotal factor. For successful implementation of measures demanding different behaviors on the side of the road user, they formulated the following pivotal requirements: Road users should be able to *understand* the measure, they should be able to *act* accordingly, and they should be *motivated* to adapt their behavior (Tertoolen et al., 2008). Implementation of dynamic speed limits should therefore acknowledge that the reasons for the speed changes are not immediately obvious to users. Speed reduction responding to rain forecasts would be confusing if the rain did not present itself to users. Similarly, traffic flow and environmental effects tend not be immediately obvious either; they should be fed back to road users through information panels. Moreover, the reasons behind the measure should be communicated extensively through a publicity campaign. The campaign would have to be sustained over a long time; due to habitual behavior, the message was likely to 'wear out' easily. Speed lowering for air quality reasons they indicated to be particularly difficult to communicate. In any case overly patronizing communication should be avoided, for its evocation of resistance. More in general, they warned for counterproductive effects due to psychological 'reactance' of road users. Road users could seek to 'catch up' further down the road, or even get irritated by the intrusion on their freedom. Rijkswaterstaat's research department had therefore issued a tool for project managers to chart the behavioral risks. The internet application would be derived from a similar instrument developed by the ministry of Justice, to check for the enforceability of governmental measures. A crucial factor in any case would be the 'often subconscious influence of the road layout', however: *"In case of a drastic reduction of the speed limit, the contrast between what is being required and the behavior evoked by the road's image augments. (...) The inclination to adapt driving behavior to the road image is hard to suppress. Therefore the speed indications need in any case to be reinstated repeatedly, and the particularity of the situation needs to be emphasized."* (Tertoolen et al., 37).

Traffic psychological insights informed the Dynamax experiments to take the road user's perspective explicitly into account, a perspective less prominent when the 80 km/h zones were waged. More generally, the innovation attempt was appreciated through a great variety of perspectives. The perspectives of a few pivotal innovation 'translators' are highlighted next.

[17] See also Ch. 6 on Shared Space

4.3 Traffic, Health, Revitalization and Driving freedom

Two days after the start of the Overschie 80 km/h zone, the chairman of 'Healthy Overschie', a group of local citizens concerned about the A13's detrimental health effects, indicated to be 'slightly content' about the measure. He hoped to have further deliberations with the Minister soon, and discuss her ministry's research findings. And even though a 'terrible lot of things had yet to be done', he did want to compliment the minister for quick implementation, despite the involvement of so many organizations (AD/Haagsche Courant, 2002).

Their deliberations with the Transport minister had started well before 2002. In 1997 the ministry of Housing, Spatial planning and Environment had started the 'City & Environment' program. The program was established to investigate the increasing frictions between protection of environment and health on the one hand, and the governmental ambition to concentrate housing in the urban areas on the other; the 'paradox of the compact city' (Stad & Milieu, 2009). An integral approach was to enable a move from a norm-oriented to a multidimensional, quality-oriented approach. *"The experiments reside under the Experiment Act City and Environment. According to this act experimental municipalities are allowed to diverge from (environmental) legislation in case this leads to more efficient land use and moreover, if it improves the quality of life in the area."* (Evaluatiecommissie Stad & Milieu, 2004, 7). The program had an interactive set-up, actively engaging residents by means of panels. The later 'Healthy Overschie' emerged out of one of those.

In 2009 the spokeswoman for Healthy Overschie still remembered vividly how the immediate surroundings of the A13 turned out to be in the 'red zone'. This was the outer category of pollution levels: Impact assessment on the A16/A13 bypass had revealed considerable NO_x emissions, and the 'City and Environment' program had established concentration categories. So however ambitious and integral the proposed plan to reconcile housing ambitions with environmental standards, they had refused to be 'bought off'. 'No fiddling with health', the critical residents had said. And they had received considerable media attention and support of, amongst others, the provincial authorities (*4, 2). The housing scheme for the Kleinpolderplein was indeed cancelled. Unfortunately the 'City and Environment' quest for alternatives came to a halt as well, however, partly due to their critical attitude.

At the time she had warned the group not to let themselves be used as a battering ram for the city authorities, who sought to push through their infrastructure schemes. To her assessment the A4 and the A13-A16 bypasses would only shift problems onto others[18]. But whereas the Rotterdam municipality joined them in their march to The Hague to acquire support for the infrastructural schemes[19], she felt they left their citizens in the cold as regards a traffic diversion that resided under their own discretion. Both before and after implementation of the 80 km/h zone, she saw local politicians 'shedding crocodile's tears' over the health hazards to citizens. While ignoring health problems,

[18] The minister explained in a letter to the citizens that the schemes primarily served accessibility.

[19] On August 4th 2000 it was reported how the Rotterdam traffic alderman and Overschie residents had managed to pry loose a financial reservation for the A13/A16. The same article quoted an Overschie citizen, expressing his frustration about the politicians' long-lasting failure to deliver the A4 Midden Delfland. *'Apparently they favoured lapwings and Egyptian geese over the people in Overschie'* (NRC, 2000a).

she saw local officials especially concerned to counter the public image of Overschie and Rotterdam as polluted areas (*4, 4/5).

She recalled how the citizens had practically forced the Minister to come up with measures for the A13. Next to a group of intellectuals, there had also been the group of residents in the immediate vicinity of the highway. A close community of people living there for generations, and a somewhat different type of people too. Having little faith in the borough council and the Rotterdam authorities to take sufficiently timely action, they had started a petition, and were set to march straight to the minister. To back their cause, they threatened to block the A13. She was trusted to conduct the correspondence with the minister. From the 'City and Environment' period she could bring along the knowledge on the health effects of traffic: Living next to the A13 amounted to 'passive smoking of 16 to 17 cigarettes a day', researchers had found out (Hegger & Slob, 1999, 4). This provided the citizens with a catch phrase that proved compelling: Soon Overschie was visited by one camera team after another. The regional television sent along a camera team to a meeting with the minister, and *"once you have the media along with you, you have effectively won the battle already"* (*4, 5). This was how the 'inconceivable' happened. On April 20th 2001 the Minister informed parliament about the planned Overschie 80 km/h zone. After deliberations with her colleagues from Justice and Environmental affairs and with the provincial and Rotterdam authorities, she hoped to have the zones implemented by early 2002 (Netelenbos, 2001)[20].

The 'passive smoking' of the Overschie citizens, the traffic-related health hazards, had been new to him as well. As a toxicology and labor hygiene expert he had used to know air quality problems as indoor phenomena. Between 1993 and 1996 a group of Wageningen University researchers had started making discoveries on the subject (Brunekreef et al., 1997). On the basis of this time series research, he had become involved in investigations of children's lung functions. And the vicinity of highways did seem to matter. After broader research in 1996 he and some Rotterdam Health Service colleagues had 'zoomed in' onto specific locations. This is how they became involved in the 'City & Environment' process as advisors. Looking back, he considered their crucial contribution to have been the 'translation' of their findings into terms more understandable to citizens and administrators, establishing a 'common language' on the 'passive smoking of 16 to 17 cigarettes a day'. *"And that common language, or perhaps rather a common reference image,…the interesting thing about the image is that it doesn't say anything absolute about what is acceptable. Imagine living together with a smoker…can't he smoke at all? Or maybe one? Or can he smoke outside? Or…It means that it leaves open…how do you want to deal with that highway?"* (*5, 11).

This way of looking at the problematic also implied that even below limiting values, health effects came into the picture. At the time, the common view was that as long as norms were complied with, health was not an issue. He remembered that not all stakeholders felt comfortable with Health Service involvement: Hadn't the whole program been initiated to explore the scope for development within and possibly across environmental regulations? The citizen organizations had felt empowered in their case against the A13 situation, however. *"So then it was no longer just about housing*

[20] Netelenbos (2001b), see also section 4.1. The announcement followed an earlier request for 80 km/h zones on 16/11/2000. NRC (2001) quotes the minister of environment claiming emission ceilings to be impossible to meet, entailing draconian measures. In the extreme case, they might even require demolishing affected houses in Overschie and in Amsterdam near the A10.

development, but also the existing situation came on the agenda…and then of course the story of the schools came along. As that little school building, 'the Rainbow' in Overschie, just next to the highway, was of course also a symbol for something which many people considered undesirable." (*5, 3-4). And once research had put health firmly on the agenda, Overschie residents had been very active to promote their cause and several MPs had publicly showed their allegiance, the pressure on the minister to take measures had taken great proportions, he remembered.

Also after implementation of the A13 80 km/h zone, monitoring studies had led him into some occasional contacts with Rijkswaterstaat researchers. Generally they were constructive people, he recalled, very concerned about the validity of findings. Still he remembered the difficulties to acquire the traffic data required for modeling. Rijkswaterstaat seemed to guard the data like a treasure, much to the despair of their project leader at the time. They had had to reach for the highest echelons to have the data disclosed; a very defensive attitude, he noted. It had only been once environmental norms had become tied to spatial development that they appeared to regain interest. Yet even then, they seemed to be preoccupied with the constraints on road construction. Looking back on the 80 km/h zone process, an important difficulty had been that the solution had to come from a party 'not really willing to cooperate' (*5, 11/12).

How and why, exactly, the minister had decided for the 80 km/h zone in their borough the Overschie borough council administrator and public official couldn't tell. Deliberations had gone via the municipal authorities. At one moment they had been caught somewhat by surprise; all of a sudden, they had to think up where the zone should actually start (*7, 1). The borough council administrator and public official concerned with the dossier supplemented each other: The administrator did remember how the 'Healthy Overschie' group had effectively sown the seeds for the measure. In charge of spatial ordering affairs at the time, the administration had done a lot of efforts to have the 'City and Environment' project. In the end a motion was accepted against housing in the 'red zone'. And given the word, the public official continued to explain that in Overschie, they had never managed to get beyond that decision: *"…and because of that, the housing program kept being halted. Probably you entered Overschie passing a barren plain*[21] *next to a gas station, that is the most fantastic example…demolishing has taken place, but then the new air quality legislation showed its face around the mid-1990s…and it hasn't come to rebuilding since."* (*7, 5). Apart from the 80 km/h zone that was outside their control, they had sought to achieve air quality gains within their discretions: Traffic measures where possible, but also experiments with in-house fine dust filters. They welcomed any experimental abatement measures becoming available, and watched closely the infrastructure decision-making processes that might alleviate the A13 situation one day. Air quality, the borough administrator explained, was 'one of the elements making up livelihood' (*7, 6). From 45.000 inhabitants just after the second world war, the borough had gone back to 16.000, with considerable impact on service levels and community life. The constraints on renewal, potentially accounting for 2500 to 3000 inhabitants, made themselves felt (*7, 8) [22].

Time hadn't stood still since the implementation of the 80 km/h zone, however. The national cooperation program on air quality (NSL) had created more maneuvering space.

[21] See Google (2010) for the 'barren plain' mentioned.

[22] Overschie had also been selected as a ´Vogelaarwijk´, a national urban renewal program, as a borough eligible for special investments to counter impoverishment.

And partly thanks to cleaner cars, air quality itself had improved as well. At one point they had consulted the Environmental Agency and the Health Service on the possibility for building on a former industrial area. The response had surprised them: *"And how did it turn out? Air quality will comply…even now already…so even when you build within 100 meters…Of course, expectations had always been that once we would start building there, we would transgress the limit of where it is allowed…(…) There the limit, which we thought to be at approximately 100 meters, proved to be at only 60 meters at that point. Well, we had never expected that…as it had been in a standstill for years we had thought, 'it's not going to work anyway'…"* (*7, 6). The restraining contours of the air quality 'red zone' having receded towards the highway, the noise contours had actually surpassed them to become the decisive factors for reconstruction ambitions (*7, 8).

A public official from the ministry for environment, spatial ordering and housing (VROM) knew all about the many political, legislative and technological developments accounting for these shifting contours. Having been occupied with international negotiations about air quality policy, she recalled how the first European air quality directions had anticipated upon technologies that at the end just hadn't become available. And especially the particulate matter (PM_{10}) norms for 2005 the Netherlands just could not meet (*6, 1-2)[23]. Unlike the air quality standards themselves, tightened European binding agreements on vehicle emission standards proved extremely hard to arrive at, however. And as the Dutch government attempt to move ahead in standard-setting ran counter to competition rules, the scope for measures had effectively been reduced to traffic-oriented 'stopgap remedies' (*6, 7).

In the Netherlands the particulate matter concentrations had become problematic for two reasons, she explained. First there had been the health scientists relating the concentrations to premature deaths. Second, the Dutch court of appeal tested development plans against the EU norms, which had an increasing number of infrastructural and constructions plans barred or halted immediately. Initially, the health concerns and the development concerns created a division between the Transport ministry on the one hand, and the ministry of Housing, Environment and Spatial planning on the other. Gradually they had converged on a shared understanding, however: Even apart from the issue of acceptable health hazards, in any case the norms would have to be met (*6, 3). This how the ministries jointly arrived at the national cooperation for air quality (NSL) program. This program would provide the argument to the European Commission to grant derogation, allowing Dutch government the time for innovation and preparation of more cost-effective measures[24]. The NSL consisted of formalized agreements between central and decentralized authorities on bottleneck situations and measures to be taken. The program would subsidize half of the necessary investments, ex-post. Meanwhile, the two ministries continued to place different emphases - following from their different missions: *"Well, our nuance is a little different, we consider this 80 km/h a good measure in itself…but to us the air quality gains are of primary concern…Eurlings [the minister of transport] judges it for the traffic flow effects achieved, and in the cases where traffic bottlenecks emerged, he didn't consider it the proper instrument..(…)…and now the compromise is that experiments with flexible speed limits are conducted, and we will just have to see what*

[23] She also explained that despite comparable pollution levels in London, Ruhrgebiet and Po plain industrial areas, the Dutch situation still stood out for the relative lack for surrounding areas with low pollution levels.
[24] For details on the NSL, see (NSL 2010)

comes out of that…" (*6, 8). She expressed some doubts on the flexible arrangement's potential, but admitted not to be an expert on these matters. And also the decentralized governments had the liberty to choose their measures – as long as they would deliver the results, one way or another.

The mobility campaign leader of Milieudefensie (Friends of the Earth) had followed the changes in air quality regulations closely as well. As he recalled, Overschie citizens had had no *legal* grounds to demand the 80 km/h zone at the time they waged their protests. In 1999 there had been the European guideline, elaborated in the Air Quality Decree in 2001. The guideline had introduced norms, and also obliged governments to do all what could reasonably expected to improve air quality on excess sites (*8, 1). The 2001 decree had been rather rigid, he acknowledged, practically foreclosing even the most marginal construction activity. In 2005 it was supplanted by a more flexible arrangement. This did introduce the phenomenon of 'balancing', however. A road enlargement that worsened air quality a little could thus be offset by application of a 80 km/h regime[25]. They had considered it a dubious principle; positive measures shouldn't be used to compensate for *negative* effects. They had lost the struggle on that one. Then in 2007 the Decree had been replaced by the new Law on Air Quality, introducing the clause that projects would be allowed provided the deterioration in air quality would not exceed the 3% - the 'not to a significant degree' clause. And finally the EU had opened the possibility for member countries to postpone compliance with the norms, provided they demonstrate convincing proof of efforts. All in all, he saw their juridical means to block infrastructure expansions decreasing (*8, 8).

He was clear about their essentially defensive strategy; they used the legal register to the full to pressure administrators. They had used the Air Quality Decree inventively to load a considerable burden of proof onto road construction plans. He noticed how all too often, the air quality benefits of traffic flow improvement seemed to be used as levers for expansion strategies – strategies *they* sought to counter for their traffic-inducing effects. *"…the thing I observe in the political discussion generally, not only about the 80 km/h measure, but also as regards the feasibility of extra asphalt, is that more and more, people hammer away at the point that improvement of traffic flow would necessarily be beneficial to the environment…Well, that remains to be seen…in the first place, what 'environment' are we talking about? Is it air quality, or climate change? Those are different issues…And then again, is it really always the case? As, you can maintain that traffic jams are harmful to the environment, and it has to be acknowledged that this is true, as it is of course a bad thing to have these cars smoking in a standstill, but, when improving traffic flow all too greatly, this could very well entail that* that *much extra traffic is generated that it even leaves you worse off. And well, then you have the other issue of how to assess the congestion as a societal problem…"* (*8, 4). The congestion problems he considered to be grossly overrated, with many politicians 'caught by fear to alienate voters who themselves knew better' (*8, 4/5).

As regards the 80 km/h zones they had started with the political route, he explained. The Overschie people had started action by themselves. Once the Overschie zone proved to be that successful, they had taken it up as a spearhead in their strategy, as a promising ploy to address national government on its environmental choices. They had visited the Overschie citizens to learn from their experiences, and made inventory of other sites

[25] They had undertaken legal action against the A4 Leiderdorp/Burgerveen lane addition, for example.

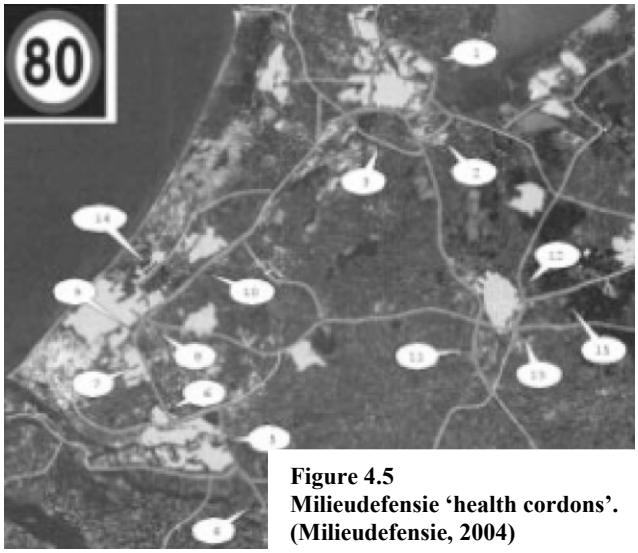
where norms were exceeded. Apart from that, they found it important to pursue especially those cases where they could connect with action undertaken by the citizens themselves (*8, 4). The national campaign came about through a manifold of local initiatives. Citizens started petitions, prominent researchers backed the calls for the 'health cordons' on the urban highways, motions for 80 km/h zones were passed in several cities, and aldermen expressed their allegiance. In October 2004 Milieudefensie published a booklet that bundled the various adhesions (Milieudefensie, 2004). The campaign for more widespread application of the 80-measure had Milieudefensie formulate a proposal for 'health cordons' to be rolled out. The proposal specified application sites in various of the major cities in the Randstad urban area, including integral application on the Amsterdam and Rotterdam ring roads.

The ministerial selection turned out otherwise, however, eventually selecting only four sites of the 'Hotspot' long-list. *"And what happened then…what went especially wrong in The Hague, was that more congestion happened…but more was going on there, the very traffic situation had been mitigated there…. And actually minister Peijs seized the bad example to claim:[mimicking] 'well, we're getting more congestion, we shouldn't do it!'"* (*8, 3). Apart from the Minister 'seeking to get rid of the new 80- zones as quick as she could', he saw a more general 'political unwillingness' and 'tunnel vision' on the side of national government and Rijkswaterstaat. Didn't the proposed integral applications on ring roads at least prevent a patchwork of speed limits from coming about? After all, they had noticed that for the five sections where it had become operational, the effect augmented with the length of the section. The alleged effect of counterproductive diverting traffic their 'adversaries' had never substantiated (*8, 2). The disappointing course of the political process had them revert to the juridical strategy: They would start with the request for a traffic decision to improve air quality. Rijkswaterstaat, as the responsible road manager, would then have to convince the Council of State *why* the request could not be granted. Still the State retained the choice over the instruments through which to serve air quality improvements; this limited the scope for the juridical strategy (*8, 1,12). The lack of political support for the 80 km/h measure still surprised him: *"…we said, a measure sounding that promising, that is so difficult to raise anything against, …then if you consider that other measures on environment and transport, that they evoke* much *more resistance, as they hurt the car driver a lot more…This is only a matter of releasing the accelerator a little, hardly a far-reaching concession"* (*8, 11).

Notwithstanding Milieudefensie's opinion that it was hard to raise anything against the 80 km/h zones, the minister of Transport expressed a clear preference for dynamic arrangements. In June 2008 he announced his wish to phase out the zones over time; a 'knee-jerk for the car drivers', a highly critical newspaper comment read (Trouw, 2008). Meanwhile the BVOM, the Bureau Traffic Enforcement, had also started to employ the section controls on other sites. Apart from Overschie and the four 'epigones', they had placed seven other section controls to serve traffic safety[26]. These systems formed part of an encompassing traffic surveillance apparatus: Together with the various surveillance cameras and observation cars they indicated changing practices in policing. As the BVOM website explains: *"In the Netherlands speed is controlled intensively. Speed controls take place for three reasons: In the first place for the sake of traffic safety, as in any traffic accident, speed plays a part. The environment is a good second*

[26] See http://www.trajectcontrole.nl/, inventory for 31/12/2009. Accessed 30/03/2010

reason: The higher the speed, the higher a vehicle's fuel consumption, the higher the CO_2-emission and the more noise. The third reason is mobility. Congestion is less likely to occur when road users keep to roughly the same speed. Moreover, the chance of accidents diminishes, and that saves traffic jams as well: Near 13% of traffic jams can be attributed directly to an accident." (BVOM, 2010).



1.Ring A10 Amsterdam, 2. Gaasperdammerweg, 3.A9 through Badhoevedorp and Amstelveen, 4.A16 through Dordrecht and Zwijndrecht, 5. Rotterdam 'diamond' (A4,A20, A16, A15), 6. A13 Overschie, 7.A13 Delft, 8. A4 Rijswijk, Leidschendam, Ypenburg, 9. A12 Voorburg-Noord, 10.A4 Leiderdorp 11.A2 Vianen, Nieuwegein, Utrecht, Maarssen, 12. A27 Utrecht, De Bilt, 13. A12 under Utrecht, 14. A44 Wassenaar, 15. A28 Zeist (Not indicated: Eindhoven and Nijmegen).

Figure 4.5
Milieudefensie 'health cordons'.
(Milieudefensie, 2004)

Depending on the degree of speed excess, noncompliance would be met by a fine or even withdrawal of the driver's license. Even before the Overschie 'premiere' of seamless, automated surveillance, the intensity of speed enforcement met with disapprovals, however, for the overly eager issuing of fines. On February 20th 2002, two MPs from the VVD (liberals) party asked critical questions on the number of tickets issued the year before. They also reminded the minister of their earlier discussion on 'nonsensical fines' and the 'national speed tax'. And beside their interest in the quantities, they also inquired about the fines' allocation (Hofstra & Niederer, 2002).

Especially the automated speed surveillance evoked resistance, ranging from slight irritation to almost militant resentment. The 'flashing service' website was established as 'your guide against pointless flashing', its mission statement reading: *"The hunt-down like detection of speed offences by the police and the neglect and/or tolerance of other more urgent matters had aroused a deep aversion with many citizens in this country. Under guidance of Traffic Officer of Justice (...), the most advanced techniques are being applied to punish those who lose sight of their speedometers for even a blink of a second. This has yielded the treasury many billions already. And this 'line of business' has an annual growth of 16%"* (Flitsservice, 2010). The cynical characterization of speed enforcement as a 'line of business' was underlined through the display of a 'grabometer': The application indicated the revenues created by the various section controls since their installation, with live updates of the cumulative amounts. Furthermore, the elaborate site featured a forum, legal aid for the wrongfully fined, an overview of surveillance sites and license plates of surveillance cars, news on traffic items, adds for radar shields, and online exchange of sabotage techniques. Especially the

large collection of users' reports expressed vividly the frustration of drivers; meticulous registration of detection equipment, and belligerent vocabulary. The following comment, taken from a report published under a nickname, expresses how the Overschie 80 km/h zone challenged drivers' feelings of fairness: *"Since the section controls at Rotterdam Overschie a better environment starts with government, and surely not with yourself. It is remarkable that the Overschie residents themselves don't experience any hindrance from the section controls. Along the ramp from the neighborhood onto the A13 in the The Hague direction the people from the neighborhood do not encounter the section controls. So from this ramp you can blaze along as you please, and overtake everybody. Inequality before the law, but worth the try!"* [27]

The website hosts indicated not to take responsibility for individual postings. Substantiating their own position on enforcement, the founders argued how the widespread speed enforcement could not be justified through simple reference to traffic casualties; next to speeding, they also indicated alcohol abuse and failure to give priority to play their parts. Moreover, responsible traffic behavior is not only a matter of compliance with speed limits, they held. That having said, the suspicion remained that the speeding surveillance also served other goals than those proclaimed: The car as 'cash cow'. On January 22nd 2010 an MP for the 'Freedom party' (PVV) voiced it strongly, addressing the minister of Transport: *"Are you familiar to the fact that both section controls and separate speeding detection installations along highways can induce congestion and unsafe situations, as people hit the brakes to prevent themselves from being flashed? And if yes, don't these disadvantages outweigh the sole advantage of sponsoring the treasury?"* (De Mos, 2010).

After the timeline of events, innovation outcomes are assessed in section 4.4.

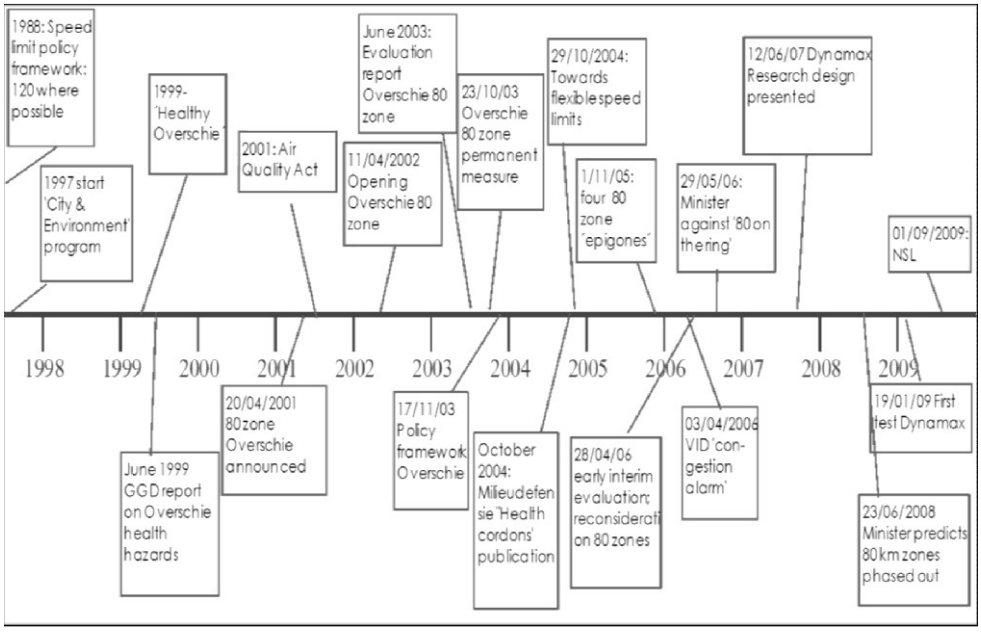


Figure 4.5 Timeline 80 km/h zones

[27] To be found under the 'reportages', 'Overschie A13'.

4.4 Innovation outcomes

4.4.0 An initial ordering of footage

Having described the innovation's circulations through the experiences of various initiators and translators, a rather chaotic picture arises. The first step to gain understanding of this innovation journey is to step back, and take stock of some basic characteristics. Ordering this relatively raw material through initial assessments of outcomes and development patterns helps establish striking events, salient issues and rudimentary patterns. These can be used as leads for subsequent translation-dynamic analysis **(4.5)**. The following three questions help to develop a basic overview of the innovation journey as a whole: *Was the innovation attempt successful, as perceived by initiators and stakeholders* **(4.4.1)***? What was achieved in terms of system innovation* **(4.4.2)***? What basic innovation patterns can be distinguished* **(4.4.3)***?*

4.4.1 Innovation success

One question relevant to any innovation process is what its yields were, and whether it met expectations. Yet considering the aim to approach innovation as two-way traffic, it is important to consider that 'success' and 'failure' are in the eye of the beholder, and that evaluation of success is bound to be ambiguous and contested. Hence the question: *Was the innovation attempt successful, as perceived by initiators and stakeholders?*

In this respect the case only confirms the relevance of bidirectional observation. The 80 km/h zones met with clear proponents and opponents, and it is easy to observe how they used widely diverging criteria for their assessments of innovation success: First of all, the minister of Transport initiated the zone as a remaining short-term option, for lack of structural alternatives. From early on, the initiators took the Overschie zone as a mixed blessing: Successful in terms of environmental gains, yet liable to failure in terms of traffic flow and the sensitive issue of enforcement. In the light of this mixed 'success', application on other bottleneck sites was thoroughly monitored. Somewhat in contrast with this intendedly evidence-based 'outroll', the course of innovation evolution was marked by heated emotions: On the one hand the cries for action by the Overschie residents and the advocates of the 'health cordons', pressing the minister for widespread application. On the other hand there was also a broad societal coalition that was critical about the zones, or even strongly opposed. The section controls evoked sometimes strong resentment amongst car drivers. A first observation on innovation success is therefore that 'success' was **deeply controversial**.

Beside the contested merits and goal achievements of the zones, it can be observed that at least the zones were implemented timely and as intended – there was little argument about that. Behind the scenes the Rijkswaterstaat project leader achieved a major feat in ensuring timely delivery of a properly functioning 80 zone. His account revealed the many technical, organizational and political complications that had to be surmounted for this 'mission impossible': The apparent simplicity of the innovation attempt, the installation of a matrix board above the road, was deceiving. In spite of the considerable complexity, both in installation and operation, no calamities occurred (traffic accidents, defective administration of speed tickets). This achievement released the minister from a burdensome dossier attracting considerable media exposure. A second observation on innovation success is this **smooth implementation**.

Overschie evaluations led to enthusiastic reactions and broad societal support for further applications. The minister turned the Overschie zone into a permanent measure, and established the policy framework Overschie. The framework reflected the evaluation findings that experimental success depended significantly on local factors, and specified conditions for application: Only where necessary, and provided no negative side-effects could be expected to occur. Four sites from the bottleneck long-list remained eligible for application: Far less than urged for in the societal calls for 'health cordons', but in line with the parsimonious approach set in 2001. A third observation on innovation success is this occurrence of **diffusion**; the attempted **innovation** was **followed up**.

A further striking observation is that assessments of innovation success changed over time, with a distinct downward trend. Instead of simply replicating Overschie success, the four 'epigones' displayed great variations in effects. Especially the Voorburg A12 and the Rotterdam A20 showed adverse side effects on traffic flow. The 'congestion alarm' in spring 2006 started a heated politicized debate, even running ahead of the monitoring process. The initially widely endorsed 80 km/h zones became under pressure as a cause of congestion. This demise of perceived success was marked by the Minister's 'reconsideration' in June 2006. She initiated remedial measures but also speeded up the trajectory towards dynamic arrangements. A fourth observation on innovation success is this **declining endorsement**.

The case displays a remarkable combination of initial 'success' and eventual 'failure': After the 'reconsideration' of the zones' feasibility the minister faced the juridical fact that the zones were hard to withdraw in the face of environmental regulations. The innovation became a millstone on the neck; a 'straightjacket', as a Rijkswaterstaat researcher expressed it. This made itself even more felt once Milieudefensie started to employ air quality regulations to wrest loose the measure they still considered successful. Having become a doubtful asset, in 2008 the Transport minister announced the innovation's expiry date to be closing in: A fifth observation on innovation success is that the innovation attempt became **phased out**, only a few years after its launching.

4.4.2 System innovation achievements

One question is the innovation journey's significance in terms of various actors' ambitions, yet another is its significance in terms of *system* innovation – the typically organization-transcending changes that alter the relations between actors, and mitigate dominant cultures, structures and practices. Instead of moving the camera between various initiators and translators, this rather involves the researcher's helicopter view on the changes in the network as a whole: *What was achieved in terms of system innovation?*

Considering the eventual trend towards phasing out, the 80 km/h zones' significance in terms of system innovation is not easy to assess. One striking circumstance is how the governmental innovation owners treated the measure as one amongst others: The zones came into the picture for a lack of structural solutions to the Overschie air quality bottleneck. The initiators were anticipating infrastructural solutions and cleaner vehicles, but the combination of air quality regulations, citizen protests and media exposure called for immediate action. As dynamic arrangements became available they could eventually be phased out, however. The national policy package NSL coordinated and balanced all air quality measures with projects deteriorating air quality, and gained time for compliance with environmental standards. This arrangement thus allowed for systemic optimization on the difficult choice faced by the Transport minister in 2001: Potentially

suboptimal yet immediately effective ad-hoc solutions on the one hand, and structural source-oriented yet longer term measures on the other. A first observation on system innovation achievements is that the zones were only **temporary solutions** amidst a broader system innovative development.

Yet despite its short-lived history, the innovation attempt still has contributed to system innovation in several respects: First of all, the zones became symbols for traffic-related health hazards. As the account of the Health Service researcher brought out, the seriousness of these hazards was initially hardly evident to the public. Through the zones millions of drivers became confronted with the issue; extensive media coverage and the campaign for the 'health cordons' only reinforced this problem awareness raising. Not only in Overschie, but throughout the country citizens started to approach their administrators with questions about traffic-related health hazards – irrespective of compliance with environmental norms. So even when the calls for health cordons were not granted, this articulation of traffic-related health hazards, and therewith the acknowledgement of systemic mobility problems, remains. A second observation on system innovation achievements is this **problem articulation**.

Apart from their immediate merits in terms of problem-solving, the zones also spurred an experimentation trajectory. Monitoring of the various effects brought together researchers from various disciplines: Traffic management, environmental studies, health/toxicology, traffic psychology. Despite considerable difficulties to control conditions, the experimental findings were accepted as a basis for the 'Policy framework Overschie'. Investigations on possible applications elsewhere could build forth on the instruments, methods and measurement developed during Overschie monitoring. The initial assessments of relevant situational factors could soon be tested on four other sites. The discovery of the 'complex weaving sections' induced further 'Human Factors' investigations; the 'Overschie effect' proved to depend crucially on traffic behavior and the specific road lay-out. Investigations got a further impulse through the calls for integral application on ring roads. The different combinations of '80 on the ring' and 'compact driving' broadened the knowledge base. The scenarios brought out, amongst others, the complexity and relevance of diverting traffic, i.e. of counterproductive spill-over effects on more densely populated areas. A third observation on system innovation achievements is this **interdisciplinary knowledge production**.

As is often stressed in literature on system innovations and transitions, experiments like the 80 km/h zones are not only significant for their immediate gains, but also for the learning effects they induce. The aforementioned problem articulation and knowledge production are typical examples of this. Beyond knowledge production on the scope for 'greening of traffic', new innovation attempts followed [28]. The Dynamax experiments connected the air quality research program with the dynamic traffic management main stream; multidimensional investigation of the scope for traffic management responsive to actual conditions. The IPL innovation program was another research line to investigate and develop traffic-oriented air quality measures. Moreover, the principle of 'greening' traffic through enhancement of flow became a common practice. (As remarked critically by the Milieudefensie campaign leader, this apparent win-win has the downside of inducing traffic. The environmental benefits of avoiding 'stop-and-go

[28] Brandt et al. (2009) took the history of the 80 km/h zones as exemplar for a more general shift in the relation between traffic and environmental policy. The incorporation of air quality goals in traffic management retained the basic principle of the 80 km/h zones: Flowing traffic as relatively clean traffic.

traffic' he acknowledged, however). A fourth observation on system innovation achievements is this incitement of **new innovation attempts and 'spin-offs'**.

Finally, it needs to be noted that the 80 km/h zones' significance to system innovation extends into various directions – and not necessarily in favor of a 'greening of traffic'. The case report also describes how the zones may eventually be survived by the section controls, as efficient speed control enforcement instruments. Even when the environmental grounds for the instrument are diminishing, the Traffic Enforcement Bureau may continue to deploy it for traffic safety reasons. The increasing automated surveillance being especially unpopular as 'hidden taxation', the ensuing resentment amongst drivers may lead to counterproductive 'reactance' however, as pinpointed by traffic psychologists. In this respect the zones may even prove to have had a counterproductive contribution to 'greening' system innovation, eroding public support and goodwill – the Dynamax move towards flexible speed limits can then be considered a system innovation achievement in its own right. A fifth observation is that the innovation attempt formed part of a system innovative development towards **new surveillance practices**; **spillover to another domain**.

4.4.3 Innovation patterns

Moving the camera along a variety of actors yields a multitude of views on what is difficult to decipher as an ordered sequence of events. Setting up a timeline is one way to order the footage, another is to observe whether the capricious innovation journey displays apparent turning points, repetitions-of-moves or accelerations: *What basic innovation patterns can be distinguished?*

The question after the innovation's 'success' immediately brings forward a striking development pattern as well: The Overschie 80 zone was initially widely received as a success, then turned into a permanent measure and 'diffused' to other sites, and only soon after the minister of transport reconsidered the 80 zones. The most striking pattern in innovation evolution was this sequence of rising and declining enthusiasm, of **hype and disillusion**.

Also striking is the rather odd course of apparent 'innnovation diffusion'. Enthusiasm started to decline soon after the four 'epigone' zones had been installed. Even when they acknowledged the 'Overschie-effect' to be highly context-dependent, researchers were still surprised by the adverse traffic flow effects, and the phenomenon of the 'complex weaving sections'. The concept proving to be far from a panacea, a second observation on innovation patterns is this **troublesome replication**.

Declining enthusiasm did not only a reflect failing replication, however. A Rijkswaterstaat researcher explained they had not only to deal with methodological and measurement difficulties, but also with the experiment's high political sensitivity. Their research findings turned into a political lucky bag (see Trouw, 2006), stakeholders 'shopping' in evaluation results. Indicative of this **politicization** were the events following the 2006 'congestion alarm', where MPs started to run ahead of monitoring results. By contrast, the Dynamax tests carried considerably less political load.

Finally, the case diverged from the usual picture of initiators only seeking to enroll others: After the 2006 'congestion alarm' the Transport minister reconsidered the 80 km/h zones. Next to remedial measures for the defective zones she also took measures

anticipating future withdrawal. Withdrawal conferring a considerable burden of proof posed by environmental legislation, the zones became a 'straightjacket', as a Rijkswaterstaat researcher expressed it. To the proponents of the 'health cordons' however, the minister seemed to have seized the opportunity to part with the measure all too eagerly. They took to legal procedures to wrest loose the measure. This is how an odd configuration of antagonists and protagonists arose, with a **reluctant innovation owner** pressured to deploy an innovation that had lost its appeal.

4.5 The 80 km/h zone translation sequence

4.5.0 Developing translation-dynamic insight

Having assessed innovation outcomes, it becomes easier to distinguish rudimentary storylines within the innovation journey. Yet as theorized in chapter 2, a key to understanding the course of innovation evolution is to consider the particular ways in which an innovation attempt is translated. Circulating through a polycentric society, an innovation transforms, and engages translators in different ways. Theoretically, certain *types* of translations can be expected to occur: Starting from a basic distinction between 'affirmative' and 'negating' translations and further differentiating within these categories, the discovery of translation-dynamic *patterns* can be enhanced. Distinguishing between 'non-translation', 'interference', 'embracement', 'modification', 'alien modification' and 'self-translation', translations tracing was sensitized to several foreshadowed problems and issues[29]. Another point of attention was whether and how actors managed to 'synchronize' their translations. This initial categorization helps to carve out case-specific translation patterns: Construction of those involves first a closer look on the occurrences of interferences and non-translations, shedding light on the counter-forces encountered by initiators **(4.5.1)**. Next, the embracements, (alien) modifications and self-translations elicit rather how the innovation attempt was met affirmatively, and did manage to spread **(4.5.2)**. Having highlighted these dimensions separately, case-specific translation-dynamics can be established **(4.5.3)**. These 'configurations' form the input for comparative analysis.

4.5.1 Innovation ignored or resisted: 'Non-translation' and 'interference'

The idea behind these categories comes primarily from Luhmann: An innovation attempt may be very promising and meaningful to its initiator, but in a differentiated society translators are likely to receive it as irrelevant or even as disturbing. In the first case translations are marked as 'non-translation', in the second case as 'interference'. The latter category is especially salient, as it highlights the counter-forces the initiators ran up against.

In this regard the initial success and later diffusion of the innovation attempt suggest that non-translation and interference were not the dominant types of translation. On the other hand, the later phasing out and the overall hype & disillusion pattern are hard to understand but through consideration of non-translation and interference. Similarly, the initiator's disenchantment with the innovation, the odd picture of the 'reluctant innovation owner', can be understood better by examining the interferences encountered.

[29] See sections 2.5 and 3.2 for more extensive description of these sensitizing categories.

As regards non-translation, an important circumstance is that the vast majority of actors were not in the position to materialize or copy the zones: The **Transport ministry** and its executive organization Rijkswaterstaat, as manager of the national main road network, had **exclusive decision power** over innovation diffusion. This powerful actor being the only one that could materialize the zones, enthusiastic translators advocating further roll-out were to some extent comdemned to non-translation. They had to devise strategies to persuade the innovation owner into materialization of new zones. The Ministry having to operate within political and legal constraints and translators being able to manipulate the framings and appreciations of the zones, they could still mould the zones to a considerable extent.

Another form of non-translation can be noted in the declining popularity of the zones. The initially broad societal and **political support crumbled** over time. Either through the failing 'epigones', through growing sensitivity to congestion problems or through declining salience of the environmental issues that legitimized the zones, the staunch supporters of Milieudefensie saw allies relapse into non-translation: Voters, but also the officials of regional and local authorities, for example.

Apart from non-translation setting in over time, the evolution of the attempt was strongly affected by the interferences the zones evoked, however. It can be understood as an attempt to overcome a long-lasting tension between traffic and environment[30]. The decision to wage the innovation attempt can be traced back to the vehement campaign of the 'Healthy Overschie' civic protest. Likewise, the innovators had to negotiate with their colleagues from the environmental ministry, the latter stressing the importance to comply with environmental standards. Once the initiators started to explore phasing out, the protagonists thus found that this would interfere with environmental regulations on air quality and noise. This **interference with environmental standards** was only reinforced by translators in favor of more widespread application: Milieudefensie's legal appeals to the Council of State actually had several other transport initiatives barred.

From the beginning on the initiators were aware of the innovation's interferential character. The imposed 80 km/h limit implied not only a deviation from general speed policy, it also amounted to a break with the road section's 'design speed' – the speed invited by its lay-out. The investigations by traffic psychologists only confirmed the immense steering task implied when seeking to surmount this **interference with infrastructure** and its in-built use.

Anticipating upon this interference with infrastructure, the innovators chose an innovative form of tight enforcement, so as to bridge the gap between 'natural' and required speed. As the project leader found out, however, the implementation and operation of these section controls brought along a considerable potential for further interference. He had to reach an agreement with the enforcement organizations about redistribution of responsibilities: The innovation had to be fitted in with other enforcement operations, the section controls had to be made watertight, and the eventual handling of the fines entailed a considerable administrative burden. Even marginal hiccups in the system generating large numbers of errors, the ministry of Justice feared administrative overload, or the serious political risk of winding up into media scandals. 'The law is the law', they therefore held against a more lenient

[30] In fact, the A13 highway's course through Overschie gave rise to interference from early on: At its opening in 1936, the mayor of Overschie refused to show up (NRC, 2000a).

approach to enforcement. Even when this **interference with enforcement** did not manifest very strongly, it did decrease the initiators' maneuvering space.

Even when major scandals around the 'fining machines' did not occur, the section controls did evoke resentment. As 'hidden taxation' levied through intrusive techniques, they impinged upon car users' sense of freedom and privacy. The automated fining of even relatively marginal speeding offences added to the already widely shared frustration about government exploiting the car as 'cash cow': An MP voiced this clearly, 'seeing no other benefit from the section controls than sponsoring the treasury'. The speed restriction and the 'fining machines' thus served as perfect symbols for the subjugation of the car driver. And even when a part of the car users could sympathize with the reasons behind the measure, public support was fragile. As the minister of transport noted in 2004: *"...broad public support can be counted upon if the maximum speed would be raised, and a limited support in case it would be lowered. At the same time, the same road user thinks this does not apply to the highway section next to where he lives"* (Peijs, 2004a). Because of this **interference with car users**, the section controls were a permanent political liability.

Apart from the resentment against the section controls and the problematic divergence from the speed 'invited' by the highway, the innovation attempt also became increasingly known as a 'congestion inducer'. The 2006 'congestion alarm' and the subsequent political debate mark how the initially perceived 'win-win' of greener and smoothly flowing traffic broke down. The traffic-hampering side-effects of some of the failing follow-up zones displayed the attempted innovation's **interference with traffic flow**.

The above interferences shed more light on innovation success, system innovation and basic patterns. It becomes understandable how the innovation became so controversial: More than a speed lowering over only a short stretch involving negligible delays, - a matter of 'releasing the accelerator a little', as the Milieudefensie spokesman expressed optimistically -, the measure impinged upon deeply felt rights and freedoms: The innovation attempt was very prone to politicization. Moreover, the interference with infrastructure and its design speed indicates that interference with car users was to some extent inevitable. From a traffic psychological point of view, the innovation attempt implied an uphill struggle.

Apart from interference with car drivers and infrastructure, the initiators had to manage the interferences with environmental regulation and enforcement. Despite being the innovation owner, the minister of Transport had to maneuver within a Transport-Environment-Justice triangle in which mutual interferences were looming. Yet the interference with traffic flow as brought out by the 2006 'congestion alarm' must have been particularly embarrassing for the initiators: A Transport minister apparently purposively inducing congestion, the abatement of which was a core policy objective at the time, finds him/herself in a tight spot. The congestion alarm also marked how the innovation attempt ran into **self-interference**.

4.5.2 Innovation adopted or adapted: Embracement, (alien) modification and self-translation

These categories stem primarily from earlier studies into the translation of innovations. They highlight that even when an innovation is not ignored or resisted but engaged with more affirmatively, this generally occurs not as 'adoption', but rather as adaptation. In

the first unlikely but possible case, translations are marked as ‘embracement’, in the latter it is marked as ‘modification’. If adaptation diverges markedly from the innovation intended by initiators, it is marked as ‘alien’ modification. Finally, adaptations by the initiators themselves are set apart as ‘self-translations’.

Eventually, the 80 km/h zones may turn out as one of the many innovations that perish in evolution. In the light of the many interferences and the self-interference generated, phase out is perfectly understandable. On the other hand, despite this abundance of interferences, the innovation attempt did manage to diffuse. As mentioned, diffusion relied ultimately on the initiators’ self-translation, and on the ‘persuasive powers’ of enthusiastic translators. Translation analysis can specify this ‘persuasion’:

The ‘embracements’ can account for the initial hype-despite-interference. First of all, the measure so dearly wanted by the Overschie citizens had to pass a large diversity of actors in order to become launched at all: The embracement of Environmental Affairs and the ministry of Justice was crucial, but also the support of provincial and municipal governments was important. And as became especially clear a few years later, the innovation attempt also required a parliamentary majority behind it. Furthermore, the reports by the media (missing out on the ‘juicy story’ of the temporary section control failure) added important embracement. This is why the ministry of Transport had campaigned to bring home that the measure served the health of children. And last but not least, various experts gave their stamp of approval, affirming the Overschie zone to be a dearly needed ‘bottleneck solution’. Initially the innovation attempt was thus met by **initially massive embracement**: A legitimizing counterforce to the interferences, some of which had not surfaced yet. Even when not immediately materializing in diffusion of the zones, massive embracement did transform the innovation attempt. In 2001 the Transport minister had stressed the experimental status of the zone. Thanks to massive **(scientific, political, public, media)** embracement, this experimental status could be changed into the status of a permanent ‘measure’. Throughout the evolution of the innovation attempt the translators accorded the zones various status: ‘Experiment’, ‘measure’, ‘ad-hoc measure’, ‘instrument’, ‘occasion’, ‘option’, ‘concept’, ‘straightjacket’ or ‘regime’. These more or less enthusiastic, cautious or critical references reflect in a nutshell the controversy around the innovation attempt, concerning both its status and its feasibility. Despite its solid physical appearance the innovation attempt was thus moulded through legitimizations and delegitimizations.

Considering how embracements moulded the innovation attempt shows the sliding scale between embracement and modification. Several distinct modifications can be distinguished: First of all, there were the embracements that sought to transform the Overschie experiment not only into an experimental success, but also into a ‘measure’ or ‘policy option’ ready to be implemented elsewhere; **modification into an ‘environmental measure’**. Second, the Overschie borough administrators’ account revealed that to them, the solution of the air quality bottlenecks was also important for urban revitalization. Also the innovation initiators themselves were occupied with the development restrictions incurred through environmental regulation – more than with environmental or health effects, several respondents stressed. Next to the modification into an ‘environmental measure’, there was the **modification into a ‘norm compliance solution’**. This modification, restricting application to sites where environmental norm compliance was problematic, was laid down in the ‘policy framework Overschie’. The divergence between the above modifications helps understand the controversy and

politicization that occurred; the modifications differ in the definition of the problem the innovation is to solve. By contrast, the monitoring resports and the various researchers investigating the zones sought to stick to the facts. They sought to gain knowledge on the 'Overschie effect', the phenomenon of the 'complex weaving sections' as a clue to the mysterious context-sensitivity, and the merits of the traffic homogenization principle in general. The Rijkswaterstaat researchers sought to maintain an scientific attitude, upholding the **modification of an 'experimental trajectory'** amidst a turbulent politicized debate.

The 'environmental measure' modification stands out amongst these modifications, as the campaign for the 'health cordons' was particularly vehement. It built forth on the earlier translation process set in motion by health scientists, the Health Service, the Environmental Service and an earlier air quality monitoring program: The articulation of traffic-related health hazards. Overschie citizens' campaigning aimed for more than norm achievement, and so did Milieudefensie's national campaign. Baptizing the 80 km/h zones into 'health cordons' they stretched the concept, making it into an instrument for a fundamental 'greening of traffic'. Eventually Milieudefensie even pressured the reluctant innovation owner legally, seeking to wrest loose the desired health measures. Considering how this put the ministerial initiators into a difficult situation, the **'health cordon'** concept amounted to an **alien modification**.

The zones were also 'captured' in another way. Initially, the traffic enforcement department of the Ministry of Justice proved hesitant about the zones, being concerned about possible interferences. Yet once these risks were actually suppressed, they could embrace the zones, and especially the section controls. Translating the 80-zones as effective enforcement instruments, they materialized several section controls out of their own. No longer restricting application to air quality bottleneck sites, this implied a notable modification, confusing the original innovation purpose. And especially as the section controls evoked interference with car drivers that could boomerang onto the 80 km/h zones, this **'enforcement instrument'** can be considered an **alien modification** as well.

Finally, in contrast with these affirmative modifications, there were also translators that twisted the basic concept in a wholly other way. As discussed earlier under the interference with car drivers, the zones with their section controls were also often framed as 'fining machines', serving no other purpose than to extort further revenues from already subjugated drivers. The responsible minister did repeated efforts to defuse these allegations and set the record straight, highlighting the motivating rationale to comply with environmental standards and be responsible about citizens' health. Considering the delegitimizing effects of this **'fining machines'** modification, it was **alien** to the initiators as well.

As becomes clear from the above modifications, the initiator's exclusive control over materialization did by no means guarantee control over the translation sequence. Through a series of self-translations the initiators sought to keep their intended trajectory on track:

The most prominent **self-translations** were the **four follow-up zones**. The preceding selection process involved other translators as well, however. Apart from the embracements and interferences pulling at the Transport minister's envisioned trajectory, there was also the longlist of air quality 'Hotspots' established by the RIVM environmental research institute. Against overly enthusiastic modification into 'health

cordons', the innovation owner could use the 'policy framework Overschie'. The framework subsumed application criteria, reflecting both the scientific parsimony of the 'experimentation trajectory' modification and political side-constraints to circumvent interference: Cost-effectiveness, and the condition that no adverse traffic flow effects should occur. The policy framework served to stabilize the translation sequence, and to parry alien modifications. Setting the 'Overschie-effect' as benchmark, the **policy framework** was a **self-translation** circumscribing future materializations. The framework informed the rejection of the **'80 km/h on ringroads'** proposal for example; this self-translated modification did not materialize.

As became apparent in the course of self- translation, however, the **four 'epigones'** proved to be **imperfect copies** of the original. Due to context-dependent interference levels, replicability was limited: The interferences with traffic flow indicated that self-translation had actually yielded *self*-interference. Opponents of the 80-zones being eager to hold the less successful self-translations against the very concept, the Minister responded through remedial treatments for the problematic zones - reducing interference: Adaptations in lineage and traffic signs, rearrangement of buffer strips, and negotiations with local governments about traffic light reprogramming and possible adaptation of the Voorburg ramp. Similarly the A20 underwent scrutiny for ways to enhance 'weaving'. More generally, the zones underwent a host of sometimes inconspicuous self-translations: The implementation of the Overschie zone involved a slight narrowing of the road surface due to the insurrection of noise shields, for example, simultaneously reducing the problematic gap with design speed. Another significant measure was taken on the A13 between Overschie and The Hague, reducing the speed limit from 120 to 100 km/h; this smoothened the transition towards the 80 km/h zone. These **remedial self-translations** add nuance to the view of a 'reluctant innovation owner', apparently only waiting for disburdening falsification.

Finally, the **Dynamax** experiments show most clearly how self-translation can help avoid interference. Taking to heart the traffic psychological lessons on interference with users and infrastructure, these were refinements over the 80 km/h measure - integrating ambitions of greening traffic with the intended shift towards dynamic traffic management. Tellingly, the minister introduced the Dynamax experiments from the driver's perspective, distancing himself from the 'rigid' 80 zones. With this change of perspective the minister underlined how dynamic arrangements could be embraced for their user-orientation. From the standpoint of translators favoring a 'health measure' modification, this **user-oriented self-translation** can be considered a dilution of the original. Yet for the innovation initiators it primarily reduces interference.

4.5.3 Conclusions on the translation sequence

Having highlighted the ways in which the innovation attempt was ignored, resisted **(4.5.1)**, adopted or adapted **(4.5.2)**, innovation outcomes can be appreciated as results of a chequered translation sequence. Considering the apparent occurrences of translation types and further interpreting the fit between these theoretical constructs and the process described, translation-dynamic patterns can be identified. Overseeing the translation sequence as a whole, the case displays the following striking translation dynamics:

First of all, the phasing out of the 80-zones can be understood as a result of mounting interference. With traffic-psychological hindsight, the particularly **deep interference** with infrastructure and car users made the attempt an uphill struggle. Operation within the Transport-Environment-Justice triangle added to the potential for interference, restricting the initiators in maneuvering.

Interference was initially counterbalanced by massive embracement, strengthening the innovation initiators in their decision for diffusion. Soon after this self-translated diffusion, the 2006 'congestion alarm' posed a major disillusion, however: Through the signalled interference with traffic flow the initiators wound up into an embarrassing situation: The case displays the striking phenomenon of what can be called **self-interference**.

Third, the interference with traffic flow was found to depend on contextual factors, the 'complex weaving sections'. Overschie success thus proved even more difficult to 'replicate' than already suspected. In the politicized debate that followed, opponents of the zones understandably seized the failing follow-ups as falsifications of the very 80 km/h zone concept. Imperfect **replication** thus even **backfired** onto the original innovation attempt.

Fourth, the innovation initiators did not only encounter interference and embracement. They found out soon enough about translators' eager modifications, pulling apart the intended evidence-based trajectory through various and often 'alien' modifications: Not only the 'health cordon' and the 'enforcement instrument' modifications, but also the 'fining machine' translation was remote from their intended innovation. The initiators even encountered the situation that translators sought to wrest loose the innovation by legal means. Yet however odd this configuration of protagonists and antagonists may be, it is only exemplifies the more general pattern of translators seeking to disenfranchise the innovation 'owners' – to initiators this dynamic appears as **capture**.

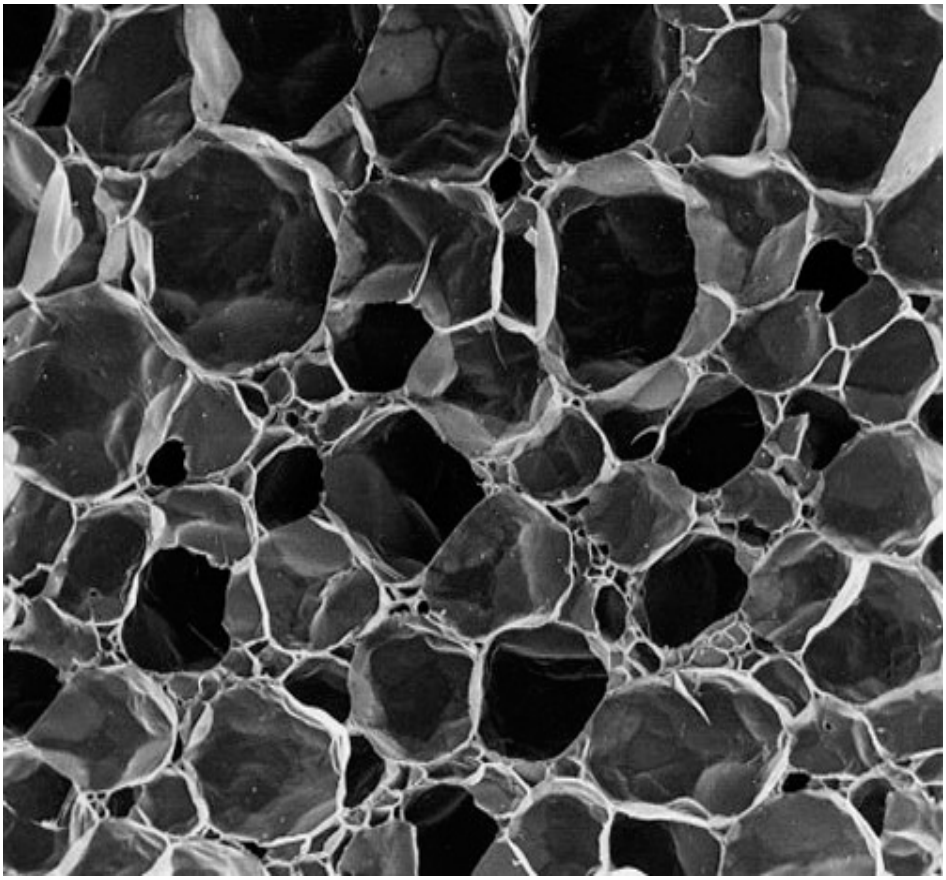
Fifth, the innovation initiators clearly had to deal with a turbulent 'test environment'. A series of more and less conspicuous self-translations marks how they sought to navigate it. Supported by intensive monitoring and modeling they engaged in a systematic handling of interferences, materializing in various remedial measures, knowledge production and generation of new innovation attempts. Yet the self-translated phasing out of the 80 km/h zones and the move towards dynamic speed arrangements stands out: Less rigid and more sensitive to the experience of drivers, it can be appreciated as learning from encountered interferences. On the other hand, the experiences of citizens living next to road seem to be backgrounded somewhat: Those favoring 'health cordons' wonder whether this compromise constitutes a **self-translated dilution**.

Sixth, against the modifications that accorded the innovation attempt ideological significance, the 'policy framework Overschie' was an attempt to synchronize translations, and stabilize the translation sequence. Still the innovation initiators could not keep the politicizing genie in the bottle. However often the minister reinstated the true objectives behind the zones, controversy about their actual, latent or desired functions remained; **synchronization proved difficult**. Similarly, the Health Service's attempt to stage an open debate through the metaphor of 'passive smoking' could only align a limited set of actors.

Chapter 5 Taking a 'network-oriented turn': The Luteijn recommendations

"Die Schaum-Metapher bietet den Vorzug, die topologische Anordnung von kreativ-selbstsichernden Lebensraum-schöpfungen im Bild zu erfassen. Nicht nur erinnert sie an die gedrängte Nachbarschaft zwischen zerbrechlichen Einheiten, sondern auch an die notwendige Schließung jeder Schaumzelle in sich selbst, obschon sie nur als Benutzer gemeinsamer Trennungsinstallationen (Wände, Türen, Korridore, Straßen, Zäune, Grenzanlagen, Durchreichen, Medien) existieren können. So evoziert die Schaumvorstellung sowohl die Ko-Fragilität als auch die Ko-Isolation der in dichten Verbänden gestapelten Einheiten."

Peter Sloterdijk - Sphären III; Schäume (2004, 255)



5.0 Introduction

In recent years both the Dutch traffic management field and mobility governance at large have witnessed an upswing of 'network management': Traffic management and mobility policy no longer confined within administrative boundaries, but targeting road networks integrally. The 'network-oriented turn' refers to a manifold of initiatives aiming for such integrated governance. This case study describes a prominent innovation attempt among those: The recommendations of a public-private advisory commission installed by the minister of Transport, the practical application of which became known as the 'Luteijn approach'. The case study proceeds in six steps: First a brief description of what the initiating protagonists sought to achieve **(5.1)**. Next, the experiences of the initiators **(5.2)** and other actors involved **(5.3)**, and fourth, those of actors involved in other 'network-oriented' innovation attempts **(5.4)**. Fifth, innovation evolution is assessed for innovation success, system innovation achievements and development patterns **(5.5)**. The evolution of the innovation attempt is analyzed in the final section, highlighting its different 'translations' **(5.6)**.

5.1 The Luteijn approach

On October 16th 2002 the Dutch minister of Transport installed a special commission to address the persisting mobility problems on the A4 highway; the 'Luteijn commission', named after its chairman. The commission was actually the third in line to address the congestion problems on the 'A4 corridor'[1]. In 2001 its predecessor, the commission Blankert, had investigated the accessibility of the western 'Randstad' area, especially with regard to the A4 corridor and its surroundings. The commission pointed out that these congestion problems originated around the urban nodes, and were caused by the rapid influx of traffic during peak hours. Both main and secondary road networks were insufficient to meet this peak demand. The commission recommended an approach addressing both road networks simultaneously. Eventually a combination of infrastructure expansion and pricing would ensure the balance between supply and demand: A 'mobility market', to be taken up as public-private cooperation. The minister subscribed to the commission's main message, the necessity of a mix of measures to meet traffic flow and accessibility problems along the A4 corridor. She added that 'unconventional measures' would be considered, and that the recently started trajectory for road charging would be leading (Netelenbos, 2001a). After consulting the employers' association[2], the minister charged the commission with the task to develop the outlines of such mobility market, and chart its possible contribution to solving mobility problems. This would involve inventory of current and future mobility problems in and around the A4 corridor's greater cities, examination of ways to influence mobility demand and capacity supply, and specification of public and private tasks. The most feasible model would then be elaborated further. Additionally, the commission would investigate the missing links in the A4, while avoiding overlap with ongoing initiatives (Commissie Mobiliteitsmarkt A4, 2003, 6).

[1] see the introduction in Ch.1
[2] http://www.vno-ncw.nl/Pages/Default.aspx

The commission featured actors from both the private and the public sector. The latter had both national and local government representatives, so that the main road and the secondary road networks could be addressed integrally. Apart from a coordinating group consisting of high-ranked public officials, public and private working groups were formed to work in parallel. The latter united in the Private Network Mobility market (PNM). Out of these separate investigations of problems and solutions, the commission came out with its recommendations in May 2003. "Movement through cooperation", it was entitled. It stated to follow the Blankert commission, identifying the combination of peak demand and insufficient capacity as main cause of the mobility problems. The Luteijn commission laid emphasis on travel demand rather than capacity supply, however, not occupying themselves with the A4 missing links. They had taken the Greater Haaglanden area as their search territory: Local road administrators had engaged in joint problem analysis already, thus posing a favorable condition for more encompassing cooperation (Commissie Mobiliteitsmarkt A4, 2003). The area demarcation is displayed in figure 5.1:

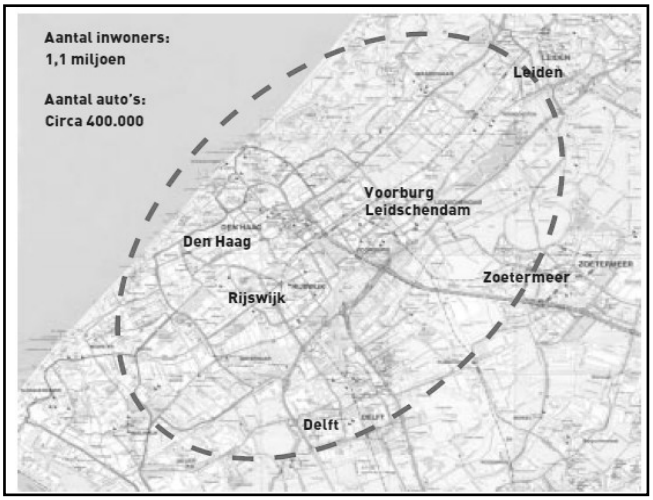


Figure 5.1 'Luteijn' search area. (Comm. Mobiliteitsmarkt A4, 2003)

As indicated earlier in figure 1.1, the A4 runs from Leiden to Den Haag, then bending southbound for Delft until the Midden-Delfland 'missing link'. The demarcated area reflects how the commission approached the mobility problems in the area as a regional problem, with traffic flow problems on the A4 as a resultant: Perceiving the regional network to suffer from exceptional delays in peak periods, they diagnosed a critical overload. Road users were reported to be increasingly disturbed by unreliable travel times, with limited trust in government's capacity for adequate action (9). And while acknowledging the area's mobility problems to be essentially determined by spatial and economic factors towards dispersal and longer commutes, the commission also identified a few specific barriers:

- Commutes take their course irrespective of administrative boundaries. (The area contained 13 road managing authorities and three public transport providers).
- Information and knowledge is also organized along the lines of national, provincial and municipal borders, and is therefore incommensurate to the task.

- The mobility approach is focused mainly on road schemes addressing local problems, but not on utilization of the total system or on management of demand.
- The private sector is insufficiently acknowledged as problem owner or solution provider.
- Employers and employees have insufficient sense of urgency to start action (11).

From this array of problems there followed a number of actions: Cooperation between road administrators and public transport operators; user involvement; establishment of a strategic agenda for integrated mobility policy; information exchange and involvement of the private sector. As the report summarized the commission's approach: *"Redefinition of the problem from 'main road traffic flow' to 'regional commutes' also implies the necessity of a turn towards an area-oriented approach"*. (11). As the minister had requested, the commission elaborated a model for their 'area-oriented approach' actions. The model, inspired on a model earlier implemented successfully in California, was based on the following principle: *"Cooperation, between road administrators mutually and with the private sector, is a learning process served best by a step-by-step approach. Relatively simple measures have to be the start. The visible results of those will create trust. This trust is the basis for taking up more complex tasks."* (16).

Activity cluster	Public sector	Private sector
6. Joint Mobility Policy	*Integral mobility plan for the region, including spatial planning and economic aspects *Benchmark setting	-
5. Integrated Regional traffic and mobility management	*Joint planning and implementation of regional mobility policy in its entirety	-
4. Capacity expansion	*Deliberation and joint decision on the larger infrastructural projects	*Construction/exploitation infrastructure
3. Road utilization; operational management	*Management of supply and demand *Analysis of travel motives *Chain mobility *Coordination of time tables *Local infrastructural improvements *Improved signage *Dynamic traffic management and travel information *Traffic light optimization *Alternative routes *Coherent parking arrangements, coupled to mobility management *Pricing of amenities	*Development alternative fringe benefits *Alternative collective transport options, incl. P+R *Regional mobility broker (employers-employees) *Integrated public transport and road traffic information *Development Dynamic Traffic Management *Network development; private sector as co-responsible
2. Management of disturbances	*Joint planning and implementation of maintenance *Organizing management of manifestations/special events *Incident management *Regionally organized slippery road abatement	*Integral incident handling *Information services on incidents *Road management contracts based on travel time guarantees
1.Information and communication	*Knowledge on users *Knowledge on system *Knowledge exchange among road managers *Communication (administrators, users)	*Market research travel motives *Information connections between network managers *Haaglanden Knowledge system development.

Figure 5.2 Luteijn growth model. Adapted from Comm. Mobiliteitsmarkt A4 (2003)

The model would first be applied in the Greater Den Haag area ('Haaglanden'), but should be applicable in other urban regions as well; analysis of the particular network would allow for fine-tuning. Figure 5.2 displays the growth model that later became known as 'Luteijn's ladder'. The 'operational' activity clusters 1-3 would be taken up immediately by a 'mobility team', under supervision of a administrators' board. The latter would also develop the more strategic clusters 5 and 6.

The next section describes the experiences of the protagonists especially appointed to lead the 'mobility teams', the 'mobility managers'. The experiences of other stakeholders are described in section 5.3, and section 5.4 features accounts of other networked approaches.

5.2 Promoting 'Luteijn': SWINGH, NEXUS and BEREIK

The Luteijn commission sought to build on earlier 'networked action' in the Haaglanden region, but expected their model to be applicable in other urban regions as well. Description starts with SWINGH in Haaglanden **(5.2.1)**, followed by NEXUS in the adjacent Rijnmond metropolitan area and the eventual merger of the two initiatives into BEREIK **(5.2.2)**.

5.2.1 SWINGH

On June 23rd 2003, two months after release of the Luteijn report, its recommendations led to the establishment of a project organization called SWINGH: 'Cooperating in Greater The Hague'[3]. The arrangement was ratified by the municipal governments of the Haaglanden city region, the province of South Holland, the South Holland department of Rijkswaterstaat, and the Leiden region. SWINGH was to generate projects, bring parties together and have them work out solutions. On May 10th 2003, a local newspaper featured an article about the governmental incapacity to deal with regional congestion problems. The article opened with a sketch of a well-known exemplary problem: The A13 at the Delft junction. On peak days for the nearby IKEA-outlet, congestion at the ramps hits the highway itself as well. The problem depends largely on the traffic lights at the adjacent crossing, preceding the ramp. *"The municipality, however, sees little reason to adapt the crossing. The situation is clear and safe on regular days. Why should a municipality be concerned with highway congestion? Isn't that national government's responsibility?"* (Haagsche Courant, 2003). In his reaction, the South Holland province deputy admitted such lack of cooperation to be blocking effective action all too often: Administrators endlessly discussing discretions and financial responsibilities, municipality councils pressing their administrators to defend the local interest maximally, and more generally, authorities waiting for the other to make the first move in only mounting joint problems. *"His new traffic bible is called 'Movement through cooperation' and has been presented this month by the national commission Luteijn. The advice provides for a decisive 'Mobility team', in which road managers, public transport operators, entrepreneurs and consumers cooperate, so as to use the existing budget more effectively for congestion abatement".* The deputy indicated to understand perfectly well the possible skepticisms about this newly established body. *"I don't want discussions about discretions. The citizen has no interest in quarrels amongst administrators."* (idem).

[3] 'SamenWerken In Groot-Haaglanden'

The former ‘mobility manager’ recalled well that before his mission started, the ‘mobility market’ commission had operated under considerable tension. First its predecessor, the Blankert commission, had refuted the idea to provide for an ‘A4 flow route’. That commission had found out soon that the infrastructural investments envisioned by its predecessor made little sense; the A4 itself was not the heart of the matter, as the problems originated in the adjacent urban areas. The Blankert commission had suggested the ‘mobility market’ idea to address those, urging to install a commission to elaborate the concept. *“Well, and that was the Luteijn commission, set up as a public-private venture…And once the commission was actually installed, the Balkenende-I cabinet started as well, claiming ‘movement before pricing’, and then the entire kilometer-charging project got discarded. So, the very pricing instrument disappeared, the moment the ‘mobility market’ commission was installed. Well, and then the second incident was the public inquiry on fraud in the construction sector that really started to have its effects, with people lifted from their beds here and there… it did the atmosphere in the public-private commission little good.”* The respective public and private working groups, they hadn’t proceeded ‘that harmoniously’. To the private sector working group the ideas about ‘improved guidance of intra-urban mobility’ were hardly appealing, lacking any hint of investment impulses. Moreover, things seemed seriously headed for the dreaded ‘let’s cooperate better’ – just another noncommittal initiative. In any case, chairman Luteijn had sought to end the proliferation of commissions and reports, and really set something in motion instead. That is how the commission arrived at the little blue booklet with its concrete recommendations (*9, 1).

As the SWINGH mobility team they had really needed to prove their added value, and defy predictable skepticisms about ‘adding just another governmental layer’. In his first moments as ‘mobility manager’ he had had to maneuver particularly carefully: *“We decided to put our stakes on a rapid pace, hoping not to commit any fatal blunders in the first few months. Because we had a direct entrance to the administrators, and the public servants weren’t too happy about that. Such was not done. So two deliberation moments emerged, one with the administrators, and one with the public servants…let’s say, the officials’ gate. And of course, the public servants, in their turn, would have their meetings with the administrators. But in a nice way, we did not offend the public servants, and quite soon we could present the administrators some concrete projects that could be taken up…so they would be visibly…so that they could show what they were busy doing in the region. Well, and that’s how the public servants’ benefit of the doubt was gained, and the administrators started to enjoy it that much, that…that SWINGH wasn’t brought down. Especially the first half year of SWINGH…we would enter a board meeting without knowing whether an hour and a half later we would still have a cooperative arrangement. Such was the will to cooperate amongst administrators”* (*9, 2).

Careful maneuvering had already started with the way the Luteijn report had been formulated, he explained. Luteijn had been so clever to avoid naming where the growth model was implicitly heading: a Transport Authority. In the same vein the SWINGH mobility team had sought to avoid any impression of a quest for power. Rather than nibbling on the existing institutional constellation, they moved between the lines. A powerful ploy to circumvent discretion-oriented public servants they found in the Luteijn concept of ‘management of flows’: *“Actually we didn’t have a clue what we were talking about…but we described it as looking through the windshield, or looking from the train, entering Den Haag, so, a trip as experienced by the end-user, regardless*

of any road administration discretions, or public transport concession areas, whatsoever. So that is how we could describe problems encountered on the way to Den Haag - and scrape together the money with it, as that was always the issue…You defined the problem, gave a solution, started to search for the money that of course was never there, ..and then there would be always two or three parties joining the table - as it was part of their problem. But never the other way around: We never approached a municipality or a province, to see whether we could help them solve a problem - always from the user's perspective." (*9, 3). Asserting the primacy of the flows over administrative boundaries proved compelling; there was an unmistakable logic behind it. Its self-evidence – the above newspaper article easily captured it in a few sentences - they could use to have administrators cooperate: It would be very embarrassing once the public got word of their missing out on obvious easy picks. Confronting administrators, irritating mildly and playing into feelings of shame and pride, they secured support for their initiatives (*9, 5).

In need of visible achievements, they selected quick wins to keep SWINGH going. And as the Luteijn commission had already noted, they hadn't needed to start from scratch: Road managers in the area had already engaged in joint network analysis, for example. At the end of 2002 'Netwerken voor Haaglanden' had been taken up by the province, metropolitan government, Rijkswaterstaat, Den Haag and surrounding municipalities. Unlike the integral Luteijn approach, the project was concerned with traffic management only. It followed the method of 'network-oriented road utilization'[4], and aimed to identify current and future bottlenecks in the area's road network. As indicated in the partners' final report, their project had fitted well with the SWINGH initiative. Their study had contributed primarily to the development of integrated regional network planning, but also 'to management of disturbances', and 'development of integrated mobility policy' as indicated in Luteijn's model (Netwerken voor Haaglanden, 2004, 4). The study charted traffic flows area-wide, distinguishing main and secondary flows. The corridors were elaborated next, indicating bottlenecks, according priorities and prime responsibilities per project. Figure 5.3 displays one of their traffic flow charts, indicating the main flows and infrastructure for 'mobility areas' in Haaglanden and surroundings.

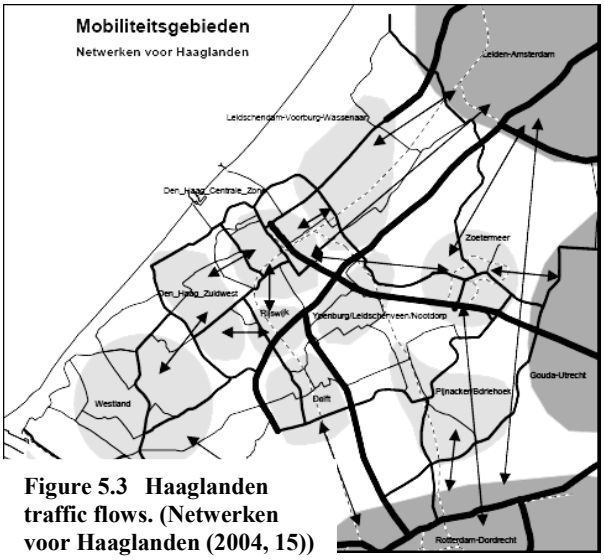


Figure 5.3 Haaglanden traffic flows. (Netwerken voor Haaglanden (2004, 15))

Netwerken voor Haaglanden thus provided for the network analyses and programming the Luteijn model sought to have developed. Quick implementation and tangible results being of primary importance however, the first SWINGH projects took on the bottlenecks in the network. One of the early projects

[4] Described in more detail in 5.4

consisted in a joint quick-scan by Haaglanden road managers. Focusing on the connections between the main and the secondary road networks they established a shortlist of 18 bottlenecks (van der Voort, 2005, 1). Subsequent interviews with road managers and on-site observations led to enriched problem analyses. Next, the analyses were captured into fact sheets, containing a description of the situation, problem diagnosis, exploration of solutions, action plan and cost/benefit estimations. In some cases they brought forward solutions missed out on earlier, in other cases solution proved impossible under given constraints. In those cases at least problem closure was achieved, as a basis for future decision-making. The quick-scan project had generated many insights, the leading consultant reported: Many traffic light installations proved to be outdated, and inflexible. Furthermore, coordination between adjacent road managers had often been suboptimal, traffic installations sometimes residing under a different jurisdiction than the corresponding road segments. And finally he noted how traffic light optimization tended to be a rather marginalized activity, physical road design taking precedence. Earlier involvement of traffic light programmers would have prevented a great deal of bottleneck situations from coming about, he held. Taking stock of achievements a year after finishing the quick-scan exercise itself, the experiences with 'Luteijn' had been positive. *"The idea behind 'Luteijning' is that problems are not only talked about, but that serious efforts are made to resolve them."* He noted concrete measures to have been taken in more than half of cases, either as traffic light reprogramming, prohibition of left-turns or conduct of simulation studies. *"A number of recommendations turns out to be impracticable on the short term. One-sided closure of a residential street proves to meet with considerable societal resistance, for example, and as regards cooperation, implementation appears difficult on the short term in case the road manager isn't the problem owner."* (3). Notwithstanding these complications he evaluated positively however: Traffic light specialists from different jurisdictions had started having regular meetings, and administrators had become mutually accountable regarding bottleneck situations.

The mobility manager explained how, slowly, he had come to see why these bottlenecks had not been taken up before: The administrative organizations were roughly divided between 'policy' and 'implementation', the latter providing the former with input. Implementation issues would thus not reach administrators directly, and this went especially for traffic light programming: "*…if you, in an earlier life, have been a really bad person, you will become a traffic light man in the current. This is a department receiving hardly any esteem. So it is felt, 'let's not expose our ideas too much to our policy colleagues…cause it won't be received anyway'. And these policy colleagues feel no urge at all to bother the board with the utterly mundane."* (*9, 4/5). He noted a gap between those who knew about the bottlenecks, and those had to decide over them, and in this case his direct access to administrators proved particularly useful: *"And then something very logical happened…from my perspective…a few administrators said, 'What?! Hasn't this been taken care of yet?!' Something quite bizarre for the traffic light guys: 'Gee, my advice is being heard'…"* And continuing with an example: *"On the A13 outbound, the afternoon peak hour, there was a 3-lane section, and one of the three lanes was structurally jammed. So by the time peak hour actually set in, this road had already broken down for a third, only two of the three lanes functioning. That was really expensive asphalt you had there, because at the end of the ramp, there was a red signal. And there the question was, whose traffic light is it, actually? So all the traffic light guys gathered…everybody looking at Rijkswaterstaat, like, traffic lights at the end*

of the ramp, those are Rijkswaterstaat's…'No', Rijkswaterstaat said, 'we handed it over to the Rijswijk municipality some five years ago'. The Rijswijk traffic light guy frowned and said, 'wait a minute, but that has been annexed by Den Haag three years ago'…So that is how the Den Haag public servant found out that this jam occurring day in day out, that it was actually his responsibility. Well, it was a matter of opening this box, adjust the traffic lights a little, and the highway was in flow again. Well, imagine, I presented such anecdotes to administrators, who were really appalled to see that things had been organized that poorly, in their areas, and that it was that easy for them to do something about it." (*9, 5).

This is how the street level public servants, knowing their work to be appreciated, gained enthusiasm for SWINGH action. Moreover, he also noted how their administrators came to find out more and more about the operational intricacies of their infrastructural networks. Increasingly amazed about the sometimes counterintuitively apportioned responsibilities (provincial bridges in Rijkswaterstaat roads, and vice versa), they became answerable to another about them, and could even share a laugh about their less fortunate contributions to overall network performance (*9, 6).

SWINGH found another quick win in incident management. A quicker handling of incidents would target directly the problem emphasized in the Luteijn analysis: Network vulnerability, with local disturbances reverberating through the network into disproportional delays. Rijkswaterstaat had developed incident management already in 1996, the incident management coordinator explained, but until 2004 it had only be applied on the national main road network. The South Holland province had been very keen to introduce the procedure in their province, as a typical SWINGH initiative. Incident management would be a visible effort to serve the road user, and do something about the incidental queues, the 'unplanned' congestion (*10, 5). Through his earlier participation in the 'Haaglanden accessible' initiative he became project leader for SWINGH: *"Well, I went along to SWINGH, and there they were looking for projects having success…and to roll out Incident Management through the whole municipality and province, that area, that was a good one, of course…It's a success story…if you're starting a project, you have to make sure you're having success stories…and that will attract other things…so, that's how it happened…"* (*10, 8).

On July 1st 2004 the South Holland deputy could publicly announce cooperative incident management to be 'rolled out' over the province, with representatives from five other provinces eagerly watching. Arranging activities in parallel, rather than sequential order proved to yield substantial time gains: As the project leader explained, proper incident handling requires a lot of coordination: Accidents may require on-site police investigation, and also the ambulance and even the fire squad may be involved. The road might need repair, too, and vehicles and debris must be removed before traffic can retake its course. These actions require aid services and salvaging companies to reach the incident site as soon as possible, and coordinate their actions optimally. Removal of vehicles, and especially trucks, involves insurance companies and transport operators as well. All in all, the pace of incident handling relies on a large group of actors, both from the public and the private sector. *"Well, you have to imagine, these agreements came about as it took a long time for the parties to arrive at the scene and come into action, there were a lot of improvements to be made there…Initially the police would inspect the scene, only then to inform the fire squad, the ambulance…well, that is how they would start action, and then, in the fortunate case, the road manager would be called to*

assist, but in the unfortunate case he wouldn't, and the oil would be blown off the road onto the banks, and well, the repair of the road furniture would take too long and then the salvagers wouldn't always come immediately…" (*10, 3).

Efficient incident handling requires all involved parties to know exactly what to do and what to expect, he stressed. Compliance and conformity were therefore imperative, leaving no room for alternative approaches. As this was not always easy for parties to accept, his main challenge was to smoothen things out and ensure coherent and uniform operation. Apart from coordination between the public services involved, another challenge had been posed by the salvagers, essential actors to clear the road for traffic again. At first it could happen that a salvager would take considerable time to reach the incident scene, coming from places remote from the scene - the same region as the freight company that happened to be involved, for example. *"Before it was like listening to the radio, and when hearing the police making mention of an accident, then three or four salvagers would arrive, and the first to hook it, would get it…Well, that situation has of course been reorganized now through the tender of the alarm centers…(…) So, it is a cooperation, private-public…one of the nice examples, I think it is."* (*10, 4). Already in 1996 agreements had been made to prevent these ill-coordinated situations from happening. The car insurance companies, Rijkswaterstaat, and the shipping and freight organizations had established foundations for cars and trucks respectively. The introduction of incident management on a certain road would then be tendered to only one salvage company. The arrangement established clarity, but also curbed the salvagers in their business. The project leader recalled well how the arrangement had aroused considerable discontentment. The salvage companies had had considerable difficulties to accustom themselves to tendering. And even though they were well organized as a line of business and participated in the incident management deliberations, still some of them remained fiercely opposed to the arrangement. Understanding these concerns, it concerned people's businesses after all, he considered it of utmost importance to handle the issue with courtesy. Indicating a road for the incident management arrangement would only happen after close scrutiny – also as a matter of decent engagement with the salvagers.

The smoothened incident management procedure turned out to yield benefits well above investments - even more than estimated beforehand. The project leader had started it in the Westland region, where he had developed the relevant contacts already. Next, the same process was repeated for the other flows towards Den Haag, each time showing the partners that cooperation could really work. Within SWINGH he had been one of the public servants with direct access to the administrators. Even when understanding the administrators celebration of successful projects, he considered too much boasting about it to be out of place, however. The successes better be considered steps towards more encompassing integration, he felt, with mobility funds bundled under a single mobility manager. The requisite devolutions of power proving to remain difficult, he considered SWINGH and the later NEXUS and BEREIK arrangements important precursors to such integration. All these cooperative initiatives had yielded their improvements, having people trust each other more, and getting acquainted. *"…with all these collaborations it was the same thing, that they could meet in a* different *way, that they would have these brief encounters, and could say informally 'ah, and this is what should be done'…if they would say it* formally*, they would immediately be completely tied, yet informally they can grope a little, only to make agreements later and implement them…and then people say sometimes, 'this BEREIK, what is it really, and do they*

really have a say'…Well, they don't, but every now and then they get things done." (*10, 10). In the various projects he had done, collaboration always had had to come from the participants themselves. Success should never be the project leader's feat: Instead, he always made sure that also the relatively marginal participants could report gains for their constituencies, and put their administrators in scoring position.

Another SWINGH feat was achieved in slippery road abatement (see figure 5.4 below for this activity of sprinkling salt). As a project leader in road management explained, it had been a typical SWINGH project, taking collaborative handling of operational issues as an avenue towards more encompassing policy integration. *"You just could read off, outside, that road manager A did a certain road section and that road manager B did the adjacent section…not necessarily the same night: They could also think, 'well, it's not that slippery to go out sprinkle the salt, it's not really urgent'…and then you had these situations that descending the A12 motorway that was perfectly passable, one would suddenly face the secondary road, glittering in ice…And there we made the agreement that we should really seek to prevent this from happening, and that the road user, as government's client, will not see these differences in the road…and that is a matter of road design, capacity, and the way you go about sprinkling, and then we jointly established this routes for sprinkling. And once you're gathered around the table for it, then you start to perceive the conveniences, like, 'hey, if I would stop my route here, that would save you the big tour to take care of that little patch as well…"* (*11, 1). After rescheduling the routes for the salt sprinkling lorries, they had moved on to consolidate and broaden the agreement. They had automated the routes, made a joint contract with the weather service, and the province and Rijkswaterstaat had jointly made their purchase from salt suppliers - thus pulling through what started as only an operational agreement. Still she considered it somewhat odd to be actually marking successes with these operational easy picks: *"To the public it's just not very logical one has cut up the network into so many governmental organizations…So even if you can make a big leap, government-technically, even then the outside world will say, 'yes, to me it was nonsensical anyway to have three road administrations around my municipality', So, how to explain this? Actually it speaks for itself not to have these boundaries, to society…"* (*11, 8/9).

Figure 5.4 Slippery road abatement

The economizations springing from this joint salt purchase, they were by no means marginal, the mobility manager stressed (*9, 10). SWINGH managed to keep up the pace without stumbling, he explained. Resistance was lower than expected, and no blunders had been committed. He admitted naiveté about his initial thought of SWINGH as a project organization, however. Of course the existing organizations would not have their coveted projects taken from them by this quasi-metropolitan government. SWINGH thus became a networking organization, and not the monster taking over. All in all, some 150 people from different organizations were involved with the projects. Delegates from other regions came to observe the process, expressing they could not imagine such organization operating under their administrators. *"But we weren't an organization…we were just a group of people enjoying to take things on together"*. (*9, 9).

Whereas the boundary-crossing projects were catching on and administrators started to endorse SWINGH, private sector involvement fell short of his expectations however. From the start they hadn't been too happy about the commission's outcome, the initiative for cooperation lacking the infrastructure investments hoped for. He also recalled how the employers had limited sense of problem ownership at first, considering tax paying their primary contribution to accessibility solutions. The Private Network Mobility Haaglanden (PNM) had handed over a list of projects out of their own, however. He had also seen how gradually a more enthusiastic involvement emerged, the SWINGH way of cutting red tape and getting things done creating goodwill. PNM acknowledged such cooperation to be essential (Stadsgewest Haaglanden, 2006, appendix).

A concrete project taken up by the private sector was 'ICT in Accessibility': Private sector activity in traffic information had been aimed for already in the 1999 The Hague Telematica plan, yet even in 2002, consultants had signaled the market to be not yet ready for it. Perspectives for a business case being limited, a public-private arrangement would have to follow from governmental initiative (Stadsgewest Haaglanden, 2006, 22/23). Both Luteijn's public and private working groups had identified traffic information provision as a promising 'mobility market' aspect: It would contribute both to the operational and the strategic levels of 'Luteijn's ladder', and it would involve both public-public and public-private cooperation. Meanwhile, the Laan commission had shed further light on public-private management of the 'information chain'[5], and Rijkswaterstaat was planning pilots on travel time expectation. After market consultation the parties agreed to embed the Rijkswaterstaat pilot in the project, to avoid redundancy and join resources in Luteijn spirit (28).

'ICT in Accessibility' was amongst the 'first tranche' of SWINGH projects. In the second half of 2003 the partners had several meetings to prepare an open, i.e. not overly specified, tender. PNM had urged for such set-up, to leave more room for entrepreneurial innovation. After discussions challenging the intended coordination by the SWINGH mobility manager, responsibility for the tender was laid in the hands of Haaglanden metropolitan authorities. This ensured that government would be a unified, predictable partner, avoiding possible delays from parallel decision making processes. The negotiations stopped between January 1st and March 31st 2004, when the contractors drew up the tender behind closed doors (32). After decision making on its specifications

[5] (24/25), see Ch.7 for evolution of the 'information chain'

the process continued with initial selection of competitors, explanation, bidding, negotiation with selected bidders, and negotiation with the contracted party. By March 23rd 2005 the winning Triplevia consortium (the Traffic Information Service (VID), Vialis traffic systems and the German Planung Transport Verkehr) signed a definitive contract (42). They were to develop a regional traffic information system within half a year's time, and keep it in the air for at least two years. Throughout 2005 they had regular meetings with their principals, reporting progress and discussing obstacles. By December 2nd 2005 most of these problems were solved, and the 'Haaglanden Mobiel' service could be opened with festivities (46). The service comprised a multi-modal route planner, a phone service for additional information, news bulletins on regional radio and television stations, information through dynamic information panels, and 20 webcams displaying actual traffic conditions on a number of sites throughout the region. Combining data from detection loops, traffic lights, cameras and the movements of taxis, the consortium arrived at the envisioned user-oriented information on travel times (Vialis, 2010).

All in all, both public and private partners voiced positive reactions on this 'shoulder-to-shoulder' project (Potters & Mihaylova, 2005). There was general agreement on the feasibility of open tendering, and on the preceding public-private deliberations. Public sector respondents were more positive on the whole. The project had managed to keep up the pace, partly through the decision to have responsibilities concentrated with one governmental body. The lack of administrative control they considered worrisome. On the other hand, several private sector respondents remained critical about the governmental capacity to act in unison. Despite being positive about the overall process, they pointed out the limited cooperation of municipalities and some shifts of course underway (Stadsgewest Haaglanden, 2006, 57-61).

Another private sector initiative was the development of a mobility marketplace for the Zoetermeer-Den Haag flow. The idea eventually took shape in the 2006 'Rush Hour Avoidance' project (Spitsmijden, 2010). It was an off-beat initiative, the market incentives consisting not in unpopular tolls, but in rewards for commuters to avoid peak hour. RHA was set up initially as an explorative pilot to find out about users' responses to the incentives, but soon it was followed up in various forms and places.

The ICT in accessibility tender and the Rush Hour Avoidance project had been especially useful in creating enthusiasm amongst the private sector partners, the mobility manager recalled. Both projects were excellent occasions to demonstrate entrepreneurial creativity. Next to the supply of innovative solutions, the private network also started to acknowledge the considerable gains to be made in the demand for travel: Mobility management. Initial frustration about the evaporating infrastructure made way for a cooperative attitude, understanding that steering on travel choices was by no means a marginal undertaking. *"The employers in the Den Haag region had reckoned they spent twice as much on mobility as the road managers together, as the public sector…well, these were real eye-openers to them. Then you aren't talking fictitious calculations, but real money: Cars, parking spaces, travel expenses…and it added up to some 1,4 billion euros annually, those are considerable amounts. Of course not all of it can be pried loose, but still it is a stack sufficiently large to manage a bit more efficiently. And what you have now, in Den Haag, there is a mobility broker, there's people paying for it, several of the larger employers, the employers' association invests, the minister invests…I have high expectations of this, it would be a good thing for it to become*

successful. Then you've built up credit with some little public-public items, funny innovations like a tender in travel information, introducing an incentive with Rush Hour Avoidance on the A12…I mean, this is really risking your neck, all of a sudden this area turned into an exciting experimental zone, rather than some tedious public-public cooperation. The substantive thrusts, they will have to come from 'organizing mobility differently', on a really solid financial basis." (*9, 10/11).

Next to the quick wins in traffic management, incident management and slippery road abatement, information provision and mobility management were visible SWINGH feats[6]. As a network organization they made sure the partnering organizations could boast successful projects, and endorse the SWINGH approach. SWINGH had built up by 'keeping things light', the mobility manager explained. They posed no threat to the standing organizations as they weren't a true organization or structure, but rather a group of people 'enjoying to take on things together'. The looseness proved to have its downside as well, however: *"This was both strength and weakness. It all stuck together through the people. When I left, my successor came, (…), and she was unlucky that quite soon after, elections broke out…so the administrators were gone. Well, this era between administrations…one didn't have the dynamics I encountered".* (*9, 9).

In October 2007 the SWINGH evaluations brought out similar ambivalences. The parties involved were unanimously positive about several feats achieved in four years of SWINGH: Lowered thresholds between the public and private sectors, mistrust taken away, useful contacts made, and SWINGH's 'platform function' was considered a major attainment. *"Parties have become attentive to each other's problems and work constructively in projects towards joint solutions, without throwing the problems over the fence to their neighbors."* (SWINGH, 2007, 4). This constructive attitude the parties considered typical for SWINGH, noting proudly its evolution into a 'best practice' adopted by other regions. Despite cheerfulness about overall achievements, there were also worries that these might eventually evaporate, however. Evaluations of the proceedings in the 'second term' under a new administration were markedly less positive, revealing a downward trend. With only a few exceptions, the parties agreed that SWINGH achievements be institutionally secured. It would require continued efforts, but how to proceed? Using input from aldermen, the private network, public officials and project leaders, the evaluators found greatly diverging views on the elements to be preserved, and the defects to be remedied: The aldermen on the south side had earlier preferred collaboration with the adjacent Rotterdam region (15), but their colleagues on the Leiden north side pointed out the looming disconnect with *their* region: The functional coherence of the Den Haag-Leiden-Schiphol axis would be worth playing into (10). The feasibility of further private sector involvement yielded a mixed picture, largely reflecting political affiliations. Generally concrete actions on the private side were considered disappointing, but according to some it had just not taken off *yet* (16, 22).

The private network actors were especially enthusiastic about the pragmatic and aligned approach of small projects, and the renewed attention to basic affairs such as traffic lights, bridge opening regimes and slippery road abatement (26). They did signal a process of wearing out however, with visibly declining commitment of administrators.

[6] Another success-story was the eventual realization of the 'Harnasch Knoop', a crucial junction in the network involving several governmental tiers. SWINGH mounted the Luteijn ladder also through road construction and the concomitant cooperation in financing.

Moreover, they still saw many wins missed out on, due to a fragmented government. Congestion prognoses spelling disaster, they pleaded for more central steering of the regional traffic system (28/29). About their own contribution they were convinced to have really moved beyond immediate self-interest. The private network they considered to have functioned well as a knowledge exchange network, admitting that the project-based approach had narrowed its scope (30).

The Official Council considered the improvement of personal relations to have been the primary achievement; especially with regard to the conflict between the province and the city region authorities (34). SWINGH had proved its value by starting from the 'other', i.e. the content side, thus countering the repeated calls for new structures and discretions the officials had become used to. Still, *"not everybody was as successful in highlighting SWINGH's added value within the home organization. Now the price is paid for that. Especially the province of South-Holland is somewhat reluctant to continue with SWINGH."* (36). Private sector involvement had left much wanting: Employers were seen to discover slowly how mobility management could actually yield significant cost cutbacks. Except for a few dearly wanted frontrunners, talk seemed to be hardly followed by action, however. In the end, the Council members noted how PNM and SWINGH had taken their own courses with their own agenda-setting and own audiences, attempts to connect those having been somewhat in vain (38). Also for consumer involvement they could note only a few positive results, but the consumer panel had only been established at a later stage. It had never been a prominent element of the SWINGH approach, they realized. Generally they endorsed user involvement as a principle, but doubts about its practical merits remained. To begin with, citizens were noted to work in different places than where they live. This made them elusive to the area-oriented approach, whereas representation through NGOs would still be far from perfect. Some warned against the risk of raising expectations that could not be met (39). Consumer consultation would be in better hands with the municipalities. Finally, they agreed that SWINGH should be reinvigorated, and maintained as a modus operandi. And so they agreed to team up with the Rotterdam region for Randstad South Wing cooperation – despite the risk of resuscitating aversions against centralized mobility authorities, and despite doubts about The Hague-Rotterdam cooperation in general.

Meanwhile, the Luteijn approach had already been taken up in the Rotterdam region in 2004, where evaluations were held a month later. The next subsection describes this 'NEXUS' arrangement, and the subsequent 'BEREIK!'.

5.2.2 NEXUS & BEREIK

The Luteijn approach also caught the attention of governments in other regions[7]. Just like in Haaglanden, the adjacent Rotterdam Rijnmond region could build on a cooperative structure established earlier: In 1996, the Rotterdam region authorities and the ministry of Transport had initiated the Rotterdam region Congestion Plan collaboration. A combination of small measures in traffic management and mobility management was to reduce congestion on the region's highways; employers, freight transport operators, the motorists' association and the traffic safety association joined in

[7] See for instance the Eindhoven region (http://www.bbzob.nl/project/index.php) and the Utrecht/Eemland region (Tanja & v/d Veen, 2005). BBKAN in Arnhem/Nijmegen actually preceded SWINGH, and was later continued with SLIM: http://www.slimopweg.info/. See 5.4 for national policy on regional network analyses.

(NRC, 1998b). As this 'Fileplan' arrangement had already taken care of many easy picks, the Luteijn partners sought for a new approach for the more demanding tasks.

In 2004 the province of South-Holland, Rijkswaterstaat and the Rotterdam metropolitan authorities initiated the pilot 'Luteijn North Flank Rotterdam'. It was a small-scale application: The Luteijn-style 'mobility team' covered an area in the north of Rotterdam, enclosed by the A12, A13 and A20 highways – an area with considerable network challenges, given the many infrastructural and spatial plans drawn up for the area[8]. The mobility manager started a consultation round along governmental and private sector actors in the area. Governmental actors sketched the changes ahead, visualizing the projected changes in traffic flows by traffic models. In a second round, the employers' representative organizations were invited to draft employers from the region, and have them indicate the bottlenecks they encountered in their daily experience. A few members from the mobility team later wrote: *"It was striking that the users did not so much signal new bottlenecks, but rather, they laid different emphases. (…) The problem analysis from the user's perspective acted as a mirror to the administrators"* (Voerman, Schermer & van Veggel, 2005, 2). Next, governmental actors jointly set up a list of measures. The list featured rearranged road deviation schemes and information to users, but also a breakthrough on a road extension plan that had divided governmental parties for years. *"Laying their wishes and expectations out in the open, the Rotterdam region, Rijkswaterstaat and the province jointly arrived at a solution"* (idem).

The pilot's successes created allegiance for this area-oriented approach. Looking back 5 years later, the mobility manager was still content with his version of the Luteijn approach: *"The pilot North Wing, it was called, where we started working in a small sub-area to have some experimentation…and there, in the end, people came to the conclusion that, if an area, a sub-area, is put center stage, and from there on you get parties around the table, jointly develop a problem definition, and then go looking, which are the interrelated measures to take…that this has its impact, that it works…that it helps to bring about a considerable bit of acceleration and innovation, that new kinds of issues will arise, that new types of problems will arise, and that people will start looking for solutions in a different way…"* (*12, 2). And so he got the subsequent mission to build up an organization for the whole region, elaborating on the Luteijn pilot and renewing the 'Fileplan' arrangement: NEXUS, starting on January 1st 2005[9]. NEXUS was a 'light' organization structure, and no formal legal persona. The partners installed deliberation councils on administrative and official levels for accountability, but NEXUS initiatives would be taken by the mobility team. The team was recruited from the partnering organizations, led by an independently appointed mobility manager.

NEXUS continued with the table-concept. The mobility manager was eager to point out the richness of the 'table' concept he had developed: He explained it was a concept naturally bringing people together, who could be invited and received at the table by a 'table host', who obviously would ensure a suitable table 'arrangement'. Depending on the area, the table would gather different guests around it. Joint problem analysis would yield a 'cooperation agenda', which in turn would organize action and have the table guests take on responsibilities for projects. The 'table' approach diverged from SWINGH's focus on metropolitan-level commuting flows. Deliberately so, he explained, as management of flows he considered *'conceptually,* analytically*, just very*

[8] See also Chapter 4 on the 80 km/h zones.
[9] http://www.verkeerenwaterstaat.nl/kennisplein/3/2/323109/Nexus.pdf

nice, but a bit remote from everyday reality, from administrative reality' (*12, 4). Of course, the flows would have to be investigated in problem analysis, but in themselves they didn't offer much foothold in getting people around the table. In SWINGH the flows had eventually turned into mere labels for projects, he had noticed. *"Flow managers, this was more of an organizational form* within *SWINGH…and the tables are more the way how you engage with* outside *partners."* (*12, 4).

Eventually NEXUS featured five 'tables' in areas of different scales. In each case the tables had followed from initiatives by governmental actors, bringing forward problems they considered in need of a 'table' approach. Apart from that, NEXUS had also set up tables on other grounds: First, a thematic traffic management table, on a scale well beyond that of the area tables. Second, two platforms for consumer organizations and for entrepreneurs: The experiences with the pilot had brought out the importance of tightened relations with consumers and companies. Third, an innovation table, not tied to a specific area and meant to bring parties together for accessibility improving innovations in the Rotterdam region.

In a newsletter his successor explained that NEXUS no longer worked with the annual plans and project lists of the earlier 'Fileplan' arrangement: *"This is now supplanted with agreements about modus operandi, and the concomitant working programs and targets. In that regard NEXUS should be considered only a supporting structure that stimulates and facilitates cooperation between parties."* (NEXUS, 2005). Acknowledging the value of bringing people from different branches and sectors together, NEXUS was a 'process-oriented' organization. The tables could be initiated both by the partnering organizations and by external partners, but they wouldn't be sustained indefinitely. The 'tables' she accorded a distinctly transitory character, 'guests leaving the table after dinner, and making place for new guests', and the number of 'courses' depending on the specific area or theme (3).

By the end of November 2007, approaching the end of its three years, NEXUS held its evaluations. Taking stock of the experiences of the different administrators, public servants, consumer organizations and entrepreneurs yielded a striking miscellany of views, but the evaluating bureau did arrive at overall conclusions: *"In the last two and a half years Nexus has managed to set in motion many things, but this hasn't yet resulted in clearly noticeable improvements. The successes of its interventions can be counted on one hand. Its role of initiator and organizer of meetings is appreciated. As yet this is effectuated in tackling mobility problems to only very limited extent, however."* (NEXUS, 2007, 21). Still, the evaluators noted a generally felt expectation that more and better cooperation would improve management of mobility problems. Also the wish to have NEXUS continue its efforts was generally shared – but in what form, exactly? The evaluators noted how NEXUS had not succeeded to create a clear picture of its goals, its achievements, or what it meant to achieve. They recommended that a mobility manager take this up, and pay specific attention to communication (21/22).

Both evaluations and expectations proved to diverge greatly: The mobility team sought to avoid leaving the impression of snatching projects, but in some cases they eventually found themselves as the main problem owner. Also the combination of NEXUS deployment and working for the home organization did not yield the synergy hoped for. Instead of cross-fertilization and missionary work in the home organization, mobility team members also harvested time shortage and difficulties to have their achievements acknowledged. The many personal changes in the team had certainly not helped, the

members indicated (NEXUS, 2007, 6/7). Administrators and directors were content with NEXUS' promotion of the cooperation spirit, but also stressed the importance of short-term results and keeping the pace. The area-oriented approach was to avoid an overcrowded administrative arena, and enable decisive action. From entrepreneurial quarters the organization of cooperation got applause, but the way some individual companies had been approached had led to disapproval in a few cases. In general, a new platform of public-private deliberation they accorded little added value, however; NEXUS should primarily ensure shared commitment among governmental parties and development of customer-oriented mobility policy (idem, 8, 15). The mobility NGOs were generally positive about the initiative, but voiced disappointment about their input in the cooperation agendas. Finally, especially the representatives from municipalities indicated that NEXUS did help establish the desired direct inter-organizational contacts. They valued especially NEXUS' boosting function, even when monitoring and safeguarding of actual implementation could be improved (idem, 7-9).

For a large part, the criticisms pertained not to what NEXUS did, but to what it didn't. On the other hand, the mobility team members expressed it was difficult enough to do what they did, minding NEXUS affairs only on a part-time basis. Noting the differences in expectations held within the NEXUS network, the evaluators pinpointed the importance to communicate better the ambition level, the scope and the identity of NEXUS: *"As regards cooperation, NEXUS should express more clearly why and when it undertakes action and what result it is aiming for. It is not sufficient when NEXUS envisions this for itself – it should be recognized by the environment. That environment is complex already, which makes clarity a first requirement. At the moment NEXUS is fairly invisible to many. In case of mobility problems, only the few get the idea to 'call NEXUS'."* (NEXUS, 2007, 19). The evaluation thus pointed to renewal and refinement of the Luteijn arrangement, and certainly not to its termination. And as the founding fathers of the arrangement had stressed the importance of keeping the pace through projects of manageable proportions, the evaluation did not point to any drastic jumps on the 'Luteijn ladder'. After the SWINGH evaluations, their mobility manager was looking for a replacement to round off the last phase. This is how the consultant involved with the Luteijn pilot and NEXUS set-up returned. He accepted the invitation, but insisted upfront that SWINGH better not be considered something to 'round off', but rather be treated, as Luteijn said, as a learning process (*12, 2/3). Given the space to pursue his ambition to investigate possible prolongation of the cooperative arrangement, he noted a growing movement towards cooperation on an even higher scale: The Randstad North Wing[10] area around Amsterdam needed a counterweight in the South Wing, the word went amongst Den Haag and Rotterdam administrators. So as a 'pragmatist', he proposed to have SWINGH and NEXUS merged for starters, covering already most of the South Wing area.

[10] The 'wings' are the poles of the Randstad area displayed in figure 5.5, the North Wing consisting of Amsterdam, Almere, Zaanstad, Haarlem and the Schiphol airport area.

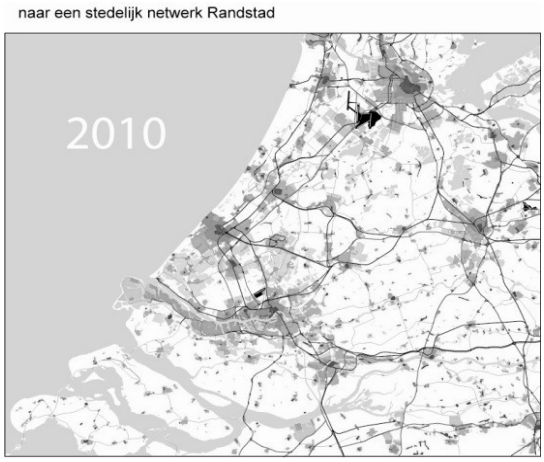


Figure 5.5 Randstad north and south 'wings'

On January 10th 2008 the process took off with a 'strategic discussion SWINGH/NEXUS'. The participants agreed that the momentum was there for the organizations to grow towards each other, both evaluations pointing out the need for a new impulse (Twynstra Gudde, 2008, 3). Parallel brainstorm sessions led to the following general consensus: *"SWINGH/NEXUS creates room for experimentation, is occupied with binding, guidance and negotiation between enterprise, consumers and governmental organizations, and working together with a problem-oriented, executive approach"* (5). The respective elements required action differentiated according to scale level. The general idea of 'thinking differently' would apply to the Randstad South Wing level, the innovation track should have a national exposure, but the goal-orientation would have to manifest on the level of specific areas: *"Mind the scale – problems should be recognizable to parties involved"*. Results and visibility of projects were essential, the participants had concluded. The whole endeavor relied on the commitment and enthusiasm of administrators and those directly involved with Luteijn action (7).

BEREIK thus emerged as a hybrid between the SWINGH organization structure and the NEXUS 'table' concept. Beside the area tables, it also featured 'innovation tables' and 'theme tables', following the idea to differentiate activities to scale levels. The working plan for 2009 emphasized that the BEREIK-mission need not be confined to these tables: Boosting inert projects, its core task, would require flexibility, and involve activities both within and outside of the tables. Similarly, BEREIK would support other cooperative arrangements in the area[11] while acknowledging some other arrangements to fulfill parts of BEREIK's function. In fact, the working plan enumerated several functions: 'boosting projects requiring extra energy to take off, or fragile innovative projects', 'coherent area-wide policy', 'Rotterdam-Den Haag linkage', and 'connection with private sector and consumers' (BEREIK, 2008a, 5/6).

BEREIK had its official launch in March 2008, inaugurated with a manifestation. 'Get into the ring', the invitation read (BEREIK, 2008b). In a boxing entourage, with a few officials entering the ring dressed up as true boxing icons, the people of the

[11] The South Wing platform and the Verkeersonderneming, for instance. See 5.4 for the latter.

NEXUS/SWINGH network were reminded that Luteijn cooperation was a learning process. And it was not finished, the parting mobility manager stressed: *"In order to arrive at decisions, and achieve your goal, you have to dare to speak out. Until now, cooperation has been rather benign, the well-known 'polderen'*[12]*. Focus was on what binds parties. But as cooperation has started to speak for itself, and we have come to know each other better, it is no problem to tell the other the truth, every now and then."* (10). Address the tensions instead of avoiding them, the boxing entourage was meant to convey. It was not to be confused with a street fight, the mobility manager explained later. *"…as BEREIK, to my opinion, this is seeking the tension, and sometimes the oppositions, too, so as to take on the role, like, 'people, we have said together that we consider this project important, now* I *am observing that a certain party does not live up to the agreements, first I will present it to the Official Council, if not resolved there, the rule of the game is, that I, as mobility manager, will go straight to the administrators…this is not about circumventing anybody, it is just a rule of the game we agree on…"* He had not failed to notice that this was easier said than done, though: "*…and that was one of the basic patterns new to people, also for the people in the team… many are coming from a culture where it is deeply ingrained in the genes, is* my *conclusion, that 'If I have to escalate, I'm not doing my work properly', so as to keep on, as long as possible…whereas a model like BEREIK is actually nothing else but a gentle way of escalation…"* (*12, 6). He saw how many people active in BEREIK seemed to have internalized 'Luteijn': Striking to him was their ability to maintain the balance between their work for the network organization and that for the home organization. Since his involvement in the earlier pilot, he saw an increased ability to 'switch hats', i.e. to represent 'network interests' within the mother organization and vice versa, and alternate between the two positions. Also the managers within the standing organizations seemed to have undergone such learning processes, left aside considerable individual differences.

After half a year in office as mobility manager, his successor described BEREIK less combatively as a 'lubricant' between organizations (*13, 9). It involved assessment of the need to scale up issues or have them discussed in other committees, keeping people up to date, making sure that problems be communicated on appropriate abstraction levels, preventing the mobility team members from getting overloaded, keeping acquainted with developments in the wider mobility field, and ceremonial activities (*13, 4). *"…many things are going on…You're a generalist, but with regard to some aspects you still need to know how a project really fares…so every now and then you have to be able to take this deepening step.. and to strike the balance, also time-wise, is a craft in itself…"* (*13, 7). To keep the tables going almost required omnipresence, but in several respects her task was lessened: Projects were finished, processes were institutionalized and issues got embedded in other initiatives. Incident management, Rush Hour Avoidance and mobility management were examples of matured initiatives that could leave the tables. Mobility management she saw to have taken off significantly since it was started up in the SWINGH period, partly because of other initiatives such as the Taskforce Mobility Management[13]. More generally, the exchange between area, innovation and thematic tables seemed to work. And as throughout the

[12] 'Polderen' refers to the Dutch corporatist tradition, the cooperative 'poldermodel'. The term is often used pejoratively, emphasizing the lack of decisiveness.

[13] A national-level initiative for mobility management, with covenants signed on the decentralized level. http://www.tfmm.nl/

SWINGH/NEXUS/BEREIK period people had gotten to know each other and 'knew to find each other', some of the connecting needed no longer to be minded by the mobility manager. Ideally, it would become inherent to the partner organizations' operations, and BEREIK would become superfluous (*13, 9). She paid specific attention to ensuring that people could combine BEREIK tasks with their work in the home organization, the efforts of which she considered worthwhile. *"To me the most important thing there is to jointly establish this win-win situation…and of course, you shouldn't be deploying people on totally alien territory, without any use to the mother organization whatsoever. It has to be connected with each other somewhere. And if it does, I think one will only gain by importing this broad outlook into the own organization…and people are noticing."* (*13, 7).

The Luteijn approach was adopted under SWINGH and NEXUS, eventually merging into BEREIK. The innovation attempt had mobility managers as specially appointed protagonists, but was intended to be the work of a manifold of actors from the standing organizations. The next section highlights some of the latter's experiences.

5.3 Working with Luteijn

As the South Holland transport deputy in the first period of SWINGH, he had had good experiences with this 'first-aid dressing construction' (*14, 7). He had been pleased to have had a trailblazing mobility manager seeking to explore his new 'playground' to its very corners. Only in a very few cases he had had some doubts about these fresh initiatives; the mobility manager had always been feeling out the preferences of administrators, and had called them really often, as agreed upon (*14, 3). In case he wouldn't get through with the bureaucracy, he was to reach the administrators directly, as they were the ones to keep the process going. And once the public servants started to notice their administrators were serious in their cooperative ambitions and disapproval of 'partition-thinking', they came to endorse it too. So a lot of 'off-beat' problem solving got done, and investments went really quick (*14, 2). The key partnership between Rijkswaterstaat South Holland, the province and the Den Haag alderman proved to be very rewarding: The exceptionally good inter-organizational relations allowed them to approach the ministry in unison, considerably heightening their eligibility for the hard-fought infrastructural funds. Smiling he recalled the amazement of ministerial officials, bewildered about the surprisingly well matching priority lists handed in by the partners. *"And the projects we had drawn up, they really* worked*, as they were driven by content, and not by power, or position. They also tended to be very easy to handle, and innovative…".* It had been the content-driven approach that had *allowed* them to be innovative, he added (*14, 3).

The decline after the elections he had also observed himself. The administrators involved could hardly be blamed for this, he considered, in view of the basic fact that 'aid constructions' wear out. Withdrawal of only one of the partners was enough to break the chain of commitment, he explained the fragility of the cooperation. *"Once one or several administrators loses belief in it, first the worse situation of before has to return, before it is felt again that [the cooperation] is necessary and desirable…and I regret that."* (*14, 6/7). Precisely because of this fragility he had always favored a transport authority to unite regional transport policy. To his frustration administrative discretions were arranged such that even the construction of a road or bicycle path was

really asking for trouble – the province holding the funds, the municipality being in charge of zoning, for example. He sketched how the many interdependencies in a fragmented government kept on clogging decision-making, and deplored how national government still had not managed to pass appropriate legislation: Somehow, power relations had to be rearranged to allow for decisiveness (*14, 7).

His enthusiasm for SWINGH pertained to its stimulation of public-public cooperation; the 'mobility market' concept he considered interesting but 'academic'. Pursued consequently, a market-based approach would have ambiguous consequences, he pointed out, the threats to public transport services in sparsely populated areas exemplifying the attendant market failure. Private sector involvement had been fashionable at the time, he added. There was some real enthusiasm from a few private sector actors, but to him it had also been a bit of a window-dressing affair. Unlike some other administrators, he didn't believe that the private sector network could bring a substantial contribution – even when he considered himself a socialist with relatively little principled objections against it. The point was more that he just had failed to perceive the relevant business cases, nor had the private sector parties been able to demonstrate those convincingly. And some private parties realized that themselves too, he said; for them the network was more of an occasion for social networking and acquisition, in order to secure a front row position for the moments it would come to real business – the set-up of a national road pricing system being an important example. Even apart from the potential for private sector contributions per se, the private sector network had just not been the right arrangement for it to come out. For consultancy on concrete situations the network was not necessary, and mobility management he considered an issue addressed better through existing national-level deliberative platforms (*14, 8/9).

As they expressed in the SWINGH evaluations, the private network representatives dismissed the view of merely self-interested participation. They had declared their allegiance to the Luteijn approach, understanding that 'a structural breakthrough in policy and organization' would take time to evolve – both for the public and the private sector (Stadsgewest Haaglanden, 2006, 31). They praised the quick wins of the user-oriented approach, and expressed how SWINGH had improved public-private relations. And as SWINGH's first mobility manager had explained, there was certainly repair work to be done in this respect. The unconventional SWINGH approach showed the private sector a government that managed to deliver, and a government that could be worked with. And it did open up avenues for constructive public-private cooperation, in which private sector actors could demonstrate their innovative capacities: 'ICT in Accessibility' was a success story. Open tendering had allowed consortia to innovate, rather than act as mere contractors of predefined services, and governmental actors had managed to provide for a single office window. In the end it could be proven that the market was ready to establish a viable travel information service, a breakthrough generating considerable publicity: Ministers and other governmental representatives giving speeches, presentations on national and international traffic conferences, press announcements, and presentations to foreign delegations.

Still, the exemplary project had had its hiccups. First, communication about the project had involved coordination between different governmental partners and the contractor, with managers, administrators and communication departments seeking to influence the process. This coordination had taken extra time. Second, data acquisition had been

cumbersome, being dependent on several governments for camera installation permits, use of power sources, and disclosure of traffic light data and data on incidents and road constructions. Triplevia had eventually felt compelled to urge the local governments for more timely cooperation. Third, the joint tendering preparations had been suddenly followed by deliberations behind closed doors. And as the ensuing silence about the process had left the applicants in the dark, poor communication about the project had seriously endangered the trust developed in the earlier stages. And whereas governmental parties were enthusiastic about the project's quick pace, some private parties reminded that still the cost meter was running during the year it took (Stadsgewest Haaglanden, 2006, 14).

Not only through the 'Haaglanden Mobiel' service, but also through Rush Hour Avoidance project the private actors had presented themselves as solution providers. Especially the latter showed the merits of the 'mobility market' concept: Self-organization through economic incentives. More generally, PNM's contribution resided in convincing private sector actors to see accessibility as a factor inherent to business, and not just a governmental service to the tax payer. PNM reminded them that they could manage their considerable mobility costs themselves (BEREIK, 2008b, van Egeraat, 2005). And even when the SWINGH evaluations signaled a slow shift from 'asphalt-thinking' to 'Luteijn-thinking', PNM was also said to be too noncommittal, talk insufficiently being followed by adaptations in the business organizations (SWINGH, 2007, 6-9). Similar voices could be heard within PNM itself. Implementation of 'Luteijn-thinking' proved to be more complex than expected, as testified in a reportage of the 'mobility broker': *"Of course not all is running as smoothly as hoped for. This is not a matter of unwillingness on the side of employers. It is more a matter of longer processing times than expected, and additionally, the introduction of new measures is often much more complex than initially expected. Main reason is that mobility management touches upon many facets of operational management, the responsibilities for which are resorting with different departments. For instance, general and technical services tend to be responsible for parking policy, shared cars and bicycle facilities, human resource management department takes care of travel expenses, public transport subscriptions and mobility budgets, and Fleet Management issues lease contracts. And topics like tele-working, e-conferencing or flexible working shifts are often embedded directly in the line organization. Brief, it takes time and attention."* (Mobiliteitsmakelaar, 2008). The 'mobility broker' was installed in November 2007, as independent linking pin between employers, employees and service providers. The experiment was reported to be successful in raising employers' awareness of possibilities for mobility management, actual implementations by 10 'frontrunners', and in having its follow-ups in other regions. And with the national Taskforce Mobility Management setting clear targets, the mobility broker would have an important task in finding customized solutions.

In the evaluations the private sector partners expressed self-criticisms, but they also remained critical on governmental fragmentation and the fear of administrators to concede powers. A battle for competences was exactly what the Luteijn model was meant to avoid, but as a 'table host' observed, this was easier said than done. She reminded that mobility policy was a crucial area for visible deliverance to the public: *"…you do notice, that when engaging in a discretion discussion, that they are anxious to keep traffic and infrastructure in their portfolios, because…in a certain way it provides for status…and well…administrators have certainly not come as far as the*

work floor people may have hoped from time to time…" (*11, 14). To administrators the added value of cooperation was by no means a permanent given, she explained. Instead it had to be reconfirmed repeatedly to keep them committed, and prevent them from relapsing into 'the old way of thinking'. The good thing about BEREIK was that it managed to keep people gathered around the table, despite conflicting interests. Actual acceleration of projects as under SWINGH she found lacking somewhat, but the gains in collaboration remained. The earlier acceleration of projects had in fact become more difficult, she added; after the 'easy picks' the heavier projects had to be confronted (*11, 11).

To move beyond the 'easy picks' was essentially a matter of administrators' commitment, she indicated. A typical complication was that some administrators were more prone to be committed to network-oriented action than others. Whereas the network perspective tended to play into the coordination objectives of Rijkswaterstaat, provincial and metropolitan governments, the added value for municipalities was less obvious, she pointed out. *"When working for a municipality, (…), you're always very much occupied with day-to-day management, and as a traffic expert you're actually concerned with the complete A to Z of mobility policy, happy if you manage to finish your tasks…And looking outside your borders isn't always necessary, as…when looking at the connecting segments, in the Westland region for instance, still the provincial roads are the connecting routes…There is somebody else doing it for you, (…), and after, you can just join the table as a partner…So according to me, the urgency resides much more with the province and metropolitan authorities."* (*11, 3).

Because of their natural focus on the own area, the municipalities had to be convinced of the benefits of coordination. This manifested especially clearly in the Dynamic Traffic Management activities, typically addressing the traffic circulation in the urban areas. As regards slippery road abatement she had seen it becoming harder as well, however: *"So you see the whole process of cooperation pursued, we went quite far with this,…but what you see now, the novelty of it all is wearing off, and the enthusiasm for the agreements starts to fade away…so you have to keep it in swing a little, to keep it operational…Now you do see quite often that the road managers near the coast, they don't have to ride out the salt as often, as [the weather] is a bit milder than for the road managers further in the country, and yes, they start to pose the question, 'it is good to go out with all of us together, but actually I am riding out unnecessarily, and I think it's an environmental waste…or a waste of money'(…)..So now you're going to witness a turning point, because, the real togetherness is eroding a little…so, you see a peak in cooperation, then it stabilizes, but now it tends to diminish a little…and the spirit needs to be renewed to keep it up, to put it that way…"* (*11, 2).

To municipalities, the gain from area-wide coordination was not always self-evident. And with the cooperation moving beyond the easy picks towards further commitments in maintenance and operation, municipalities became more inclined to cling to their autonomy. A traffic management table host noted how these 'sensitive issues' (*15, 5) occurred also in the Dynamic Traffic Management activities, where the tension between network interest and local interests manifested very clearly: Municipalities sought to minimize nuisance from through-going traffic, while maximizing connectivity. The parties concerned acknowledged that this would not add up to the network optimum, yet once general principles were worked out in detail, the local interests tended to resurface. *"You really notice that parties, when it really comes down to it, to their own road*

network, then they really want to be there…(..) But especially those municipalities along those provincial roads that may be deployed on some points, so where it can become more crowded, at times, …well, they may really endorse the basic principles, but as soon as they start to feel it themselves, well…then it turns very tense how they will approach this…" (*15, 6). He described how they went about, first jointly establishing the network principles, which in turn would be gradually specified. A consultancy agency had worked out the principles for separate areas. Despite the seamless steps of specification, oppositions would resurface at some point: *"Well, it is not completely new…it is a logical consequence of…but it is partly new, it's not something they have seen before in this way…"* (*15, 6).

In some cases, municipalities had been sticking to their own interests for years. The province proved reluctant to overrule local interests for the sake of the provincial network interests, however. *"But you see that the province is really taking the position of the municipality into account…and in the talks about this they are saying much like, 'well, we would like it like this, but that municipality wants that, and that municipality wants that'…so, they aren't playing it out very hard, actually…"* (*15, 4). What happened all too often, he opined, was that parties started thinking for others - at the risk of doing so wrongly, or of missing out on ways for resolution. He agreed with the harbor authorities that interests and points of view should not be smothered like this, but better be brought out in the open. Such would prevent half-hearted and suboptimal solutions from coming about. And if no resolution could be arrived at, the differences and tensions should just be presented to the administrators as they were (*15, 5). His 'table' could investigate and register the tensions, but it was not the arena for their resolution, he noticed. *"And well, I do have to say for the working group, because we are occupied with the content of the matter…we can oversee the administrative field only a little, regarding this subject, this element and what is related to it, but, political interests, the whole political game, involves a great lot more than this particular topic, or even transportation, and everything is connected with everything, of course. And well, that is something we don't oversee, and there we depend on the people who are much more acquainted with it, and who can seize the opportunities* there.*"* (*15, 9).

As the traffic management program manager explained, the political dimension was becoming only more prominent - the cooperative projects reached ever more complex proportions. He gave the example of a project featuring information panels from Den Haag inner city to Rotterdam inner city, and everything in between. Recent experiences in similar projects had suggested that the complexity of such technical system integration had been underestimated. *"Well, and then the question arises, do we accept the delay incurred by bringing it under an umbrella contract that hasn't been finalized by far, or, do we continue on our own…Well, at such moments suddenly the own political priorities resurface…then you have an alderman having made promises to the council, saying, 'if that is the situation, I'll take care of my own part'…well, and then the tensions arise…the alderman who has, say, promised it would all be running then-and-then, and has made agreements, … yes, he won't really appreciate it if, due to cooperation, a plan is delayed again for half or three quarters of a year…That type of problems, I think we can deal with those well, together, which means that the common interest is more and more prominent in our minds."* (*16, 9). The regional-scale traffic management system had administrators being held accountable for delays they could not control by themselves. For him as a program manager it meant he had to keep up the pace: *"…the utmost important task is to make sure that* decisions *are being made… The*

land of traffic management consists of generally very committed people with a strongly technical/content-oriented background…be it in the area of traffic studies, or in the area of traffic installation programming…and these people are very much capable of describing what is required…But they don't always agree on it, and are captured by a myriad of new impulses, details, and so on…and well, something does have to be built - a system for the South Wing…" (*16, 1). He held an intermediary position between traffic management professionals and administrators, each with their particular involvement in regional-scale traffic management. The content-oriented professionals, abstaining from the 'political game they could not oversee', as the table host expressed in the above, and administrators, bearing the responsibility for financial risks and possible delays.

A senior traffic management official observed how for a long time, the above two groups had kept in each other in a vicious circle of ad hoc tinkering. The real force of traffic management he considered to reside in supra-local, network level application, however (*31, 8). *"'We put a lot of money in a big pot, and you citizens won't be seeing anything from it in the next four years, and then we'll see',… you won't be attracting any voters with that. So it is logical that the board wants to invest in things on the streets. But on the other hand, also the way in which the civil servants themselves have dealt with traffic management…that has also been a period of, 'let's put things out on the streets, so the administrator will see it, and then we will get new funds to put new things out on the streets, with which…' That is a circle you can't get out of…because, then you will only receive funds for some little things…and well, then you can go out picking the cherries. But a serious vision behind it…a kind of stepwise plan to get there, without it, you were really just fooling yourself."* (*31, 9). The circle they had managed to break with the plan for 'Monitoring Rotterdam', an encompassing road monitoring plan, rolled out in one go. This initiative to invest in structural monitoring, in 2003, had traffic management looked at in a different light[14]. Around that time, he had seen the rise of intergovernmental cooperation, the 'area-oriented road utilization' approach, and a generally increasing attention to network coherence.

Apart from the mobility teams, a great variety of people were 'working with Luteijn'. Several of them indicated to build on precursor or successor initiatives with similar aims. The next section highlights some of these related initiatives.

5.4 Other networked approaches

As the incident management table host indicated, SWINGH had needed to build on success stories 'to attract other things'. Similarly, the former South Holland deputy stressed that the Luteijn report should not be mistaken to have actually initiated the cooperation – it was rather a confirmation of what they had been doing for some time. By then, the province, Rijkswaterstaat and Haaglanden authorities had already forged a tight administrative alliance, determined to escape from the 'administrative spaghetti'. Irritation about inert decision-making had played its part, he indicated (*14, 6/7). It had all started with an angry e-mail from the Haaglanden transport alderman, expressing his discontent about the deputy's media appearances during election campaign. It came on top of earlier clashes between the two young and ambitious administrators, representing

[14] See Chapter 7 on traffic information provision and dynamic traffic management.

not only different constituencies and areas, but also traditionally opposed parties; Liberals and Labor, respectively. Eventually they had settled the troubled relations in a long and good telephone conversation. The two had agreed to 'do it a little offbeat', and cooperate. Rijkswaterstaat joined in soon after, in what was to become a durable coalition (*14, 1/2).

A Rotterdam traffic management official recalled that also NEXUS could build forth on earlier developments. It had been around 2001 that, together with Rijkswaterstaat research department AVV, they had started to develop an integral approach to the Rotterdam regional network. They started with a 'small step', looking for the short term what could be done with the instruments at hand. In the process they found out that programming of measures, decisions on sequence, and planning of equipment investments required a longer term view. *"And a coherent network implies, that in any case you will join around the table with parties in the region, to make agreements about the regional network that displays strong relations…But, just like it doesn't end at the borders for a* municipality*,- driving up the highway doesn't make a difference for the citizen-, the same goes for the* region*…when people leave the Rotterdam region, they enter the Drechtsteden region, or the Haaglanden region, so, also from the* region *perspective it is logical to make the connection with the networks of your neighboring regions. Especially as Rotterdam and Den Haag are becoming a bit of a twin city, the relations between them are very strong, we sought cooperation with the Haaglanden region in particular…"* (*31, 1). Traffic management irrespective of administrative boundaries he indicated to match the experience of drivers. And it was logical to act upon the strong relations in the network, as the twin city idea expressed.

The aforementioned initiative with AVV was part of the latter's ambition to establish an 'architecture for traffic control'. Started up in 1997, it led to the publication of a handbook in 2002. The architecture was to structure the interrelations between traffic management measures and everything surrounding them; 'insight through oversight'. *"It allows to choose, jointly and network-wide, a direction for the long term in which the traffic problems are controlled optimally"* (Rijkswaterstaat, 2005a, 10). The architecture consisted of five sub-architectures, pertaining to hardware/ software and organization, the traffic planning part ('VA') being leading: *"With the VA you indicate what you want to achieve with traffic management in a certain area or region, and what measures you want to use for this. The method of the VA ensures that this process develops in structured fashion. It renders your policy concrete and testable. And, possibly the most important thing: The VA helps you to cooperate with the different parties in order to arrive at* area-oriented road utilization*, which means: Not devising solutions locally, not only for the own network, but making optimal use of the road capacity in the region* as if no administrative boundaries exist*. Here it applies: local where possible, on network level where needed."* (10).

The booklet exposed a stepwise methodic. The first step was essential, gathering the policy objectives of the road managers involved in an 'area-oriented road utilization' (GGB) project. Next, the objectives would be elaborated into a joint vision, a frame of reference containing criteria and threshold values, and prioritizations. Having bundled these elements in a policy document, subsequent diagnosis of the actual situation would allow for identification of bottlenecks and discrepancies. Proceeding stepwise from policy objectives to implementation and operation, the objectives would materialize in implementation of 'rule scenarios', the pre-programmed traffic management responses

to classes of deviant situations. The handbook exposed all consecutive steps in detail, explaining terms, giving specific practical hints, and offering real-life examples. The methodic was not presented as a simple procedure to be followed, however. Instead it was to be understood as a guideline, to be actively applied in the particular context. *"Of course, the implementation of traffic management is not a static project but a dynamic process. Traffic is as variable and unpredictable as the weather, after all. But because VA starts with a joint network vision, you will have a workable framework at your disposal for the coming five to ten years. Within this framework, you can develop, test and apply modifications in structured fashion."* (11). The policy objectives were fundamental to the process, the explanation of step 2 clearly expressed: *"The policy principles form the basis for the entire further process to be followed. Therefore it is crucial for the process as a whole that at this stage all parties are absolutely honest, complete, and clear in formulating their own policy objectives! When parties want to get back to one or more of their initial policy objectives, after they have been laid down, you will have to return to this activity in the process, and go through all steps in between again."* (46).

One of the principal developers of the methodic explained their emphasis on policy objectives: At the time, traffic management practice was very oriented at local bottlenecks, rather than networks. There was a distinct preoccupation with what he called 'the gear', and they had considered it time to replace this means-oriented thinking with a more goal- or 'quality-oriented' approach. And also two developments on the national level had played their part: First, the decentralization of mobility policy in the 1990s, and second, the intensification of traffic management to combat congestion – both road capacity expansion and pricing being problematic policy options (see also Lijmbach et al., 2006). He also recalled the more general societal tendency to put the customer center stage, pointing to a network-approach as well, *'the customer being indifferent about the administrative divisions on the road network he used'* (*17, 1/2).

The booklet had been a bit of a byproduct, he continued. Starting from a synthesis of many research reports, they had considered that, somehow, these findings had to be used, instead of merely documented. *"...we consciously pondered, how to make sure that making this, and embedding it, was going hand in hand...and we didn't write the booklet in one go; first we made a little concept, of really 3...4..5..pages, and we also took it to other projects, regional cooperative arrangements, and said, we have a little idea, a kind of mental framework, could we help you with it...well, we could. So, with all its 9 steps (...), there is a practical example. So actually the booklet is a kind of materialization of a lot of practical experiences..."* (*17, 2). By the time the booklet was released the methodic had already become common practice, he added. Even when Rijkswaterstaat was not too keen on a joint effort with the road managers on the decentralized levels at first, in all its regional departments there had been an 'ambassador for these things'. And users needed only call to get support. Also the consultancy bureaus helped in development; it became a bit 'their thing', too, and they started giving presentations about it. Once the methodic became a standard in traffic management, the last non-adopting consultancy bureaus felt forced to join in as well. Eventually the booklet had all their logos in the colophon.

It had been a process of joining the bandwagon, a bottom-up process. Very much unlike 'Luteijn', he added, which after all had followed from a minister's decree (*17, 5). And 'Luteijn' had ceased to exist, he considered, even when SWINGH had continued for a

while. *"…so you do see, that the commitment…it's not really in the people, you're imposing it…and if doesn't stick with the people…"* (*17, 6). More in general, he saw how in transport, many new fashions got massive following, only soon to be abandoned again. Innovations repeatedly had everybody running along, as they were interesting and offered opportunities, but they changed course all the time. The step from project to process he considered the problem. Also in the beginning of his 'GGB', his directors had focused on having the booklet delivered, while being reluctant to provide funds for continued user support (*17, 3).

The Luteijn approach was very much bottleneck-oriented, he indicated (*17, 6). On the other hand it was much broader in scope than GGB, also taking on board mobility management, for example. 'Luteijn' had also achieved what they had never managed to do with GGB, to get beyond bureaucracy and get a foothold on the administrative level. It would have been nice to have the two approaches integrated, he considered, but they had been very separate trajectories. In a talk with Luteijn himself he had tried it a little, but Luteijn had been very busy, and had focused on his own mission (*17, 7). GGB had not conquered the minds of the administrators; they 'tolerated, rather than stimulated it'. They provided for funds and capacity, but actual management of these initiatives was beyond their concern. *"…so, you have the administrators, the managers, and the public servants…the administrators are not interested, as they have created the big framework, the public servants feel hindered that they can't do this in a structural, good way, and actually now the managers should be explained that it is now their turn to create the conditions to enable them to move on…"* (*17, 14). Together with a partner from a mobility knowledge center he had started to address these political, administrative and organizational issues[15]. Managers, as the crucial middle tier, should somehow be provided with the incentives conducive to embed traffic management in the line organization. The public servants involved with the GGB-trajectories failed to have the measures integrated with the management & maintenance contracts; *'they just did not manage to get the message across'*. He did admit that even when the importance to substantiate costs and benefits was generally acknowledged, much too little was actually done in this direction. *"Of course it is actually quite bizarre, that so much societal money is being spent for something you only* believe *to be worthwhile, without being able to prove it…"* (*17, 14/15). Despite the difficulty to arrive at more structural and firmly embedded 'network management', it had become standard traffic management practice. The methodic yielded regional analyses that in their turn could serve as input for other network-oriented mobility policy initiatives: The 'rule scenarios' guided the National Data Warehouse[16] in their selection of roads to be monitored, for instance. And stretching the usual 5-10 years time horizon, the analyses could also inform the multimodal regional 'network analyses' (Lijmbach et al., 2006, 18).

The network analyses had been introduced by the 2004 mobility policy paper, following from its motto 'central when necessary, decentralized where possible' (Min. V & W, 2005, 10). The new national policy embraced the networks, for both administrative and traffic-technical reasons. First, the vast majority of trips was indicated to take place on the short or middle long distance. Second, regions were known to differ greatly in spatio-economic conditions (20/21). And setting national targets for accessibility and

[15] Van Meggelen et al. (2007), see also Voerman & van Luipen (2004).
[16] See Ch.7 on traffic information.

reliable travel times and paying specific attention to network robustness[17], the Luteijn approach was posed as a benchmark: *"This commission concludes that better problem analysis (network analysis) and better cooperation (public transport, bicycle, walking, mobility management) are the keys to success. Also the relation to spatial planning is crucial. A great number of areas has already started with this approach: Different road managers utilize their common road capacity as if no administrative boundaries exist. First experiences show that gains can be made relatively easily. The State wants to extend this approach and expects the governmental bodies involved to analyze the complete urban network, together with national government*." (21). 'First experiences' referred to were the 'simple' adjustment of traffic lights, and the 'ICT in Accessibility' project (39). More than quick wins and innovative projects, the minister aimed for integral analysis however, also requiring the decentralized authorities to specify how their measures would contribute to national policy goals.

On October 16th 2006 the minister of Transport addressed parliament under the heading 'from network analysis to network approach'. She observed that despite enthusiasm and visible commitment, the network analyses had not always been worked out as elaborate. *"But this [endorsement] is not always materializing in the concrete elaborations of the network analyses. Lack of time and the complexity of the subject are the most important reasons. What is striking, is that analysis of door-to-door accessibility is often aimed at accessibility by car. Especially public transport, the relation with the secondary road network, mobility management and the bicycle as important link in before and after-transport need to receive more attention. Freight is even close to absent in the network analyses."* (Peijs, 2006g, 2). The minister continued with an outline for further development of the networked approach: *"In the end balances must be struck more and more across administrative boundaries. I envision the perspective of region arrangements, coupled with substantive problems and solutions. I use the term 'arrangements' as it concerns administrative, organizational and financial elements. I foresee that this can lead to a tailored approach per region, considering the diversity of problems and solutions. On the basis of the network analyses thus far, I don't have the impression that the current financial-juridical instrumentation wouldn't, in a general sense, be suitable to bring about such arrangements."* (10). The minister continued to sketch a growth trajectory, with the network analyses eventually serving as input for the MIT infrastructure financing schemes.

A year later, in November 2007, the advisory council for transport and water affairs unfolded an ambitious view on 'network management': 'From road management to network management; advice on organizing road management differently'. Unlike the minister's integrated and multimodal 'network approach', the report focused on road management: Road maintenance, capacity planning, and traffic management. The council diagnosed that the Dutch road network, and especially the main road network, was becoming overloaded to an increasingly critical degree. Travel time losses had risen 3 times as much as traffic volumes, and were expected only to continue their disproportional growth (Raad V&W, 2007, 3). On the short term, the solution strategy would have to consist of selective capacity expansion on the one hand, and intensified, 'pro-active', traffic management on the other. Both would be targeted at a main road network, consisting of the highways and some essential segments of the secondary roads. Even when consisting of only 7,5% of the total network, it accounted for 60% of

[17] (137/138). See for comparison a similar emphasis on network vulnerability in the Luteijn analysis in 5.1.

vehicle kilometers and 90% of its bottlenecks (11). The existing decentralized institutional constellation would not do, the council stressed: *"This inherently decentralized approach is at odds with being able to steer a network effectively. In order to steer forcefully on the coherence of the network, the Council advises to define one single main network (...), and to have this network steered in coherence by a National Road Authority fulfilling the role of a network director"* (11).

The Council had examined three models for network steering: 'Cooperation', 'coordination', and 'integration'. They acknowledged the increased cooperation between road managers, but considered it insufficient. *"The increasing cooperation between road managers on the different administrative levels in the Netherlands is to be valued in itself. However, this cooperation is ad hoc and noncommittal, and therewith insufficiently effective to realize improved traffic flow. Integration on a network level is required. Only through a joint effort on all administrative levels the traffic problems can be tackled for real."* (12). Decentralized-level governments were to devolve discretions and responsibilities to Regional Road Authorities, *"...a logical next step to the network analyses for the eleven urban regions implemented earlier by these regions, and to the already existing cooperative arrangements like BBKAN, DVM Alkmaar and SWINGH."* (12). The council followed up on the 'Nouwen council' on road pricing, and indicated to roughly coincide with the latter's analysis – especially the attempt to arrive at a more forceful arrangement to manage the network (65-67). In the 'integrated' model, road pricing was to become a corner stone, yielding a self-financing system at a distance from government that directly linked investments to returns. They envisioned a long road towards this model, sketching a stepwise migration path for this 'transition'.

On September 5th 2008 the Transport minister responded to the council's recommendations. He agreed with the council's problem analysis, including the sense of urgency that immediate and concrete action was necessary. *"A lot has to be done, but we don't start from zero. The first steps towards a transformation to joint network management have already been started, and have yielded concrete results."* (Eurlings, 2008b, 2). After naming three examples of boundary-crossing cooperation, the minister indicated how his policy ambitions undeniably 'touched' at network management. He also mentioned the 'Luteijn' recommendations, *'partly as a result of which the network approach and GGB had been developed'* (4). The minister concluded that 'before taking the road of large-scale organizational solutions to the problem sketched', he considered it *'more sensible and necessary to establish network management as a joint value among all road managers'* (5).

Two months before, on July 9th 2008, the Verkeersonderneming ('Traffic Enterprise') had started off, one of the minister's three shining examples (Verkeersonderneming, 2010). It was a cooperation agreement signed by the minister, the director of the Rotterdam Port Authority, the transport alderman of Rotterdam and the city region representative. A larger group of stakeholders such as shipping and freight organisations, adjacent municipalities, chamber of commerce, province and employers in the harbor area, and also the police joined in. The Verkeersonderneming was meant to give a significant boost to management of the harbor area's accessibility problems. The area relied heavily on the A15 highway, an overloaded corridor. And with a large scale harbor expansion scheme taking off and the A15 due for reconstruction, the parties foresaw even greater challenges for the near future. They aimed for a 20% reduction of peak hour traffic demand, and optimization of capacity supply.

As its managing director explained, the Verkeersonderneming was a short term oriented enterprise, not occupied with infrastructure expansion schemes. The program consisted of a wide variety of traffic management and mobility management measures: For the first time, the two were joined in one hand, he noted with contentment (*18, 4). For traffic management they had close cooperation with the South Wing program, they took on adaptation of road marking and innovative ramp metering, and intended to make maximum use of in-car systems. For mobility management they had taken on Rush Hour Avoidance. He was especially proud of arranging hotel capacity near the massive construction activities in the new harbor areas, an anticipatory measure to dampen the attendant additional commutes. Furthermore, they stimulated public transport by water, and some of the employers took own initiatives to keep their personnel out of peak hour – including attempts towards flexible working hours. With mobility management and traffic management 'in one hand', they also experimented with mixtures between the two: Multimodal traffic scenarios, for instance, and flexible use of bus lanes. As they explained on the 2009 national dynamic traffic management congress, the program had been tailored to the specifics of the area: *"Because of the special structure of the harbor area, the kind of activities in the (…) Harbor Industrial Complex, the type of employees, the solutions will be a mix of public transport, company transportation, park & ride, e-bikes, adaptation of working shifts and driving schedules, etcetera."* (Scheerder & Schrijnen, 2009, 4).

The collaborating parties had had to allow him to steer this on behalf of the four partners. Of course such devolution of powers hurt, he indicated. On the other hand, the whole enterprise had started from the calls to move beyond the many non-committal collaborations. The Nouwen council and later the council for Transport and Water affairs, both had indicated it was time to take the next step, and 'really grub at these administrative boundaries' (*18, 3). The Verkeersonderneming had been the first pilot in this direction. Right at the start the lawyers had lined up to formalize the agreements, but he hadn't wanted any of it – first it was a matter of just setting things in motion, and see what they would run into. It had been essential to gather a band of enterprising people, seeking to score, rather than merely avoid trouble. Of course, questions were raised about the arrangement's effectiveness, the cooperation being hardly legally consolidated. *"…as, there are more of those cooperation bands, there is BEREIK, NEXUS, and SWINGH…and that is all fine, and there are really things happening there, it has its yield, but the real breakthroughs, we haven't seen those yet. And I have a few reasons, why it will succeed this time around…"* (*18, 6). First, the real commitment of the partners, up till the highest echelons. Second, he pointed out some major reorganizations in key organizations: The Port authority adopting an entrepreneur-oriented perspective, the ministry of Transport aspiring to reliable partnership, and Rijkswaterstaat reinventing itself as cooperation-minded 'public-oriented network manager' (see WOW, 2009). To underline his points, he indicated how Rijkswaterstaat and the Dutch railways were jointly developing an ad-hoc intercity train station in response to major highway maintenance: Those were '*the really new cooperative ventures that would have been inconceivable five years earlier…the real innovations taking place at this very moment'* (*18, 6).

A key ambition consisted in establishing accessibility as a common interest, to be taken into account permanently by all harbor area actors. Businesses were still remote from the 24-hour economy, he indicated, notwithstanding several significant steps in the right direction. Shifting freight traffic out of peak hours would be an important development:

"…why do we have that much freight in the evening peak? Is that really a conscious choice? Or is it more a matter of, 'well, I just want to be home by eight o'clock, tonight, to see the children', well, of course I surely don't begrudge him, but if everybody wishes to bring the children to school at eight and be back for dinner at six, it all comes to an end…after all, our road network is just incommensurate to the task. In the weekend, and especially in the evenings and at night, you can hear a pin drop at the A15, it's really not crowded at all, it is crowded between four and six, better said, between two and eight, but not in the weekend…and there you have my problem…" (*18, 6). He noted considerable shifts in employers' attitudes to mobility management, venturing initiatives out of themselves. On the other hand the cooperation inevitably involved painful concessions as well. In similar cases such had become accepted as a perfectly normal way to deal with scarcity, he explained with a smile: "*…like in air transport, nobody doubts the use of slot systems at Schiphol airport,* nobody *doubts this…*nobody *is angry when having to buy a ticket for a nice exhibition in the museum. Recently I was at Villa Borghese in Rome, you make a phone call, and next day you can come between eleven and two…isn't that just fine? We all accept that…at the doctor's as well, he doesn't do visiting hours anymore…or maybe for some remnant bit…No, you make an appointment…and* that *is why the man can process a* lot*. And there you have the cogwheels gripping on to each other, and if you take part in it, you get a very efficient system. Well, on the road network…true, mobility is a right, but we are running against the limits of that right, and we want to…regulate that a bit. Can't we make agreements about use of the A15? And don't start reasoning from enforcement, no, it's about* compliance.*."* (*18, 8).

While the Verkeersonderneming addressed the harbor area's traffic metabolism, a similar initiative had already started for the city of Rotterdam. By the end of 2006, all its traffic-related organizations had jointly discussed a basic problem: How to tackle sudden traffic problems? An example they had encountered recently was the breakdown of a traffic light installation on a pivotal intersection. It had been followed by a whole sequence of phone calls between the traffic department, the police, Rijkswaterstaat, public works, and the borough authorities. Safety fences had been placed by the one, only to be removed again by the other - as there was no sign of public works in execution. Many organizations being involved with traffic flow sideways, this problem had proved to be nobody's *particular* concern. It was too operational for the traffic management office, nor did the police consider it part of their core tasks. Still people did expect these problems to be tackled, the alderman had pointed out. And this was how the task of 'traffic direction' was put on the agenda (*19, 1). The head of the traffic management office had worked out a proposal, consulting the whole circle of involved parties.

The idea was that some 'spider in the web' was needed, the so-called 'traffic marine' told. Even when endorsing the basic idea, both police and public works had clearly expressed not to accept any 'traffic director' to tell them what to do, however. It had taken him some 'massaging' reformulations to appease the parties, stressing that their mandates wouldn't be intruded upon: *"…if I see, from my role as traffic director, what is required, I have to be able to build on the mandates of the operational parties, who have been knowing what to do for a 100 years…and then I should be able to act, and say to public works, 'this is the situation now, you know what you have to do…'"* (*19, 2). The city administrators sought to avoid a swamp of juridification, and decided to do it the forceful 'Rotterdam way'. Following the example of the 'city marine', a function

established to tackle public safety problems not hindered by 'red tape', they installed the 'traffic marine'. Residing immediately under the mayor, he thus could step into any decision situation without questions asked about mandates, and lay his problem on the table. He knew this 'shadow of the mayor' to require caution – overassertive behavior on his part would only resuscitate the mandates discussion (*19, 2).

The traffic marine started in October 2007. He was keen to stress that for 80%, the existing organizations were just doing a good job, essential work 'behind the scenes' not always being noticed by administrators and the public (*19, 12). He positioned himself as a 'linking pin', a 'lubricant' or a 'crowbar' (BEREIK, 2008c, 18) to reach for the remaining 20%. Especially shop keepers had often voiced their frustrations about government's apparent inability to coordinate, and minimize the accessibility problems arising from public works or sudden congestion. Still coordination was by no means lacking, the mariner found. The problem was rather that the respective coordination arrangements in place added up insufficiently for the particular problems he was charged with. The commission for road constructions did its planning, the inner city bureau listed the construction sites, and another commission coordinated the permits for organization of events. He understood well the position of the road construction commission, not very convinced of the need for more coordination: They had pointed out that building sites tended to be only 'a few blocks away', not affecting the main routes directly. As the mariner explained, things were not that simple, however: "*...of course the queue arising from that truck drilling piles over there will turn up on the main road network within three minutes"* (*19, 4). And although the coordination commissions did send out their planning charts, they were mistaking this for coordination, he pointed out. Felt pen-drawn charts for internal use only would no longer do. He therefore took the initiative to develop a GIS system, reconciling comprehensiveness with user convenience through zooming and selection functions. Towards the public he took similar initiatives for effective and relevant communication of the information available.

Attunement, communication and forceful action were the key tasks the mariner identified for his position. He laid down an agenda for his appointment period, set to expire just after the next elections. Apart from his ambitions in communication, he also wanted the different organizations to agree on some basic 'rules of the road', so as to attune their operations in recurring situations such as maintenance works. Furthermore, he wanted to improve his view on problem sites: Instead of going there by car, or preferably by helicopter, he could also 'hook up' to the Monitoring Rotterdam initiative and the cameras in use by his city surveillance colleagues (*19, 7/8, see also Ch.7). A detailed and real-time view of events would support immediate action. This also depended on the availability of 'hands on the street' however, and as the police had withdrawn from these tasks, he needed traffic controllers. They could be recruited from the city surveillance office, and in case of imminent problems they would *'put on their traffic control outfit, and take care of traffic until it calmed down again…'* (*19, 9). In the end, the various initiatives were to culminate in a traffic marine control room. Also in this case, he pointed out, it wouldn't make much sense to have another structure erected: There already existed the Rijkswaterstaat traffic control center, camera surveillance, the reporting station of the police, the football stadium's command center, the monitoring system of the tramway and metro company and the monitoring of the Rotterdam traffic management office. His control room could very well be limited to a virtual entity, linked with the existing systems.

In January 2009 a progress report described how a traffic marine 'network organization' had developed, giving some concrete examples of its successful interventions. Some minor hiccups had been the delayed availability of software to connect to the monitoring Rotterdam system. The main insufficiency identified, however, resided in the still rather 'reactive' approach of the parties involved. *"The questions and incentives of the traffic mariner don't automatically lead to improve Rotterdam traffic action within the standing organizations. Therefore in 2009 the step will have to be made towards a further bundling of forces to further increase official performance on the one hand, and on the other hand, lay down more firmly the results out on the streets. Around the traffic marine as a crystallization point, operational traffic management has now to be established as a governmental task. Traffic action should not remain limited to incidental and constantly repeated interventions of a single traffic mariner."* (Gemeente Rotterdam, 2009a,1). The assessment coincided with the marine's earlier complaint about 'deliberating too often with the same people about the same topics' (*19, 11). This is why he had sought to embed operational traffic management in the modus operandi of organizations, and have the 'marine way' materialize in information systems and the 'rules of the road' charter.

Sustained fulfilling of the traffic marine function was crucial, the Rotterdam traffic alderman summarized stakeholder evaluations in September 2009. The standing organizations proved to endorse the approach, and urged to maintain him in an independent, critical position. Incidentally they reported difficulties to keep the mariner's pace; a reminder for both the offices and the mariner himself. Some parties praised the mariner's strategic achievements, such as the 'rules of the road', but were disturbed by his operational interventions. For others, it was exactly the other way around. Finally, the alderman also noted the difficulty to have the expectations of omnipresence met by the mariner alone. He drew the parallel with firefighting, adequate prevention and preparation tending to be less visible than the incidental breakouts of fire (Gemeente Rotterdam, 2009b).

Relatively invisible was also the work of the 'Green Wave team', dedicated to functional maintenance of traffic light installations (Groene Golf team, 2010). As one of its senior members explained, traffic lights regulate intersections on the basis of more or less flexible programs, optimizing traffic flow according to pre-set priorities. As traffic flows change over time, due to rising travel demand or changing spatial structure, for instance, the programs would gradually run out of sync[18]. Reprogramming being a job for specialists, it tended to be neglected by road managers, however. Often the time and the funds were lacking, and in the case of small municipalities, sheer lack of know-how came on top of that. However understandable the causes, he could not help deploring the widespread negligence. Recalling some outrageous examples he sighed: *"...there was one road manager saying, 'I have one that hasn't been looked after for 20 years'...20 years, I'm telling you...I think it was in 1986 they had planted it on a crossing...* never *looked after since...so you have this thing running for* twenty *years...and well, the things you hit upon...that's really lamentable...detectors no longer functioning...timings not even coming close..."* (*20, 12). Sometimes officials told him that the municipality hadn't received any complaints, but that could hardly reassure him.

[18] Without maintenance, performance on average diminishes roughly 3% per year, the Green Wave team's website states.

The team had become operational by February 2007, as a result of a ministerial innovation program for congestion abatement [19]. They had been funded to give free advice to road managers throughout the country, so as to give maximum diffusion to their surprisingly easy way to reap huge benefits. One of their showcases had recurring highway congestion vanish by simply adjusting a traffic light further down the ramp: Not surprisingly, the team was celebrated at the congestion abatement 'quick win' contest. Still he was amazed how, already ten years earlier, a few MPs had apparently just ignored the memo he had drawn up for them. Doing the math on the amount of time unnecessarily lost at traffic lights, it proved to exceed the time losses of highway congestion by far; the massive investments into the latter thus missed out on far more cost-effective measures on the secondary roads. Somehow the politicians and administrators couldn't be interested. *"But well, it isn't that surprising…the congestion queues are trumpeted abroad through the radio every half an hour…and the waiting times for the traffic lights, you never hear about those"* (*20, 4). More generally he saw how traffic light programming was all too often left to public servants, despite the tradeoffs and essentially political prioritizations implied. Programming often lacking any basis in policy guidelines, he accorded both policymakers and specialists a responsibility to mend the disconnect. A crucial challenge they faced was to ensure sustained functional maintenance, to avoid winding up in the same situation again (*20, 7). Apart from organizing specific professional training, they actively sought to put functional maintenance on the agenda. As their director indicated in a news letter: *"..once road managers have organized things properly, the team may even no longer be needed."* (Groene Golf team, 2009, 2).

After the timeline of events, innovation outcomes are assessed in section 5.5.

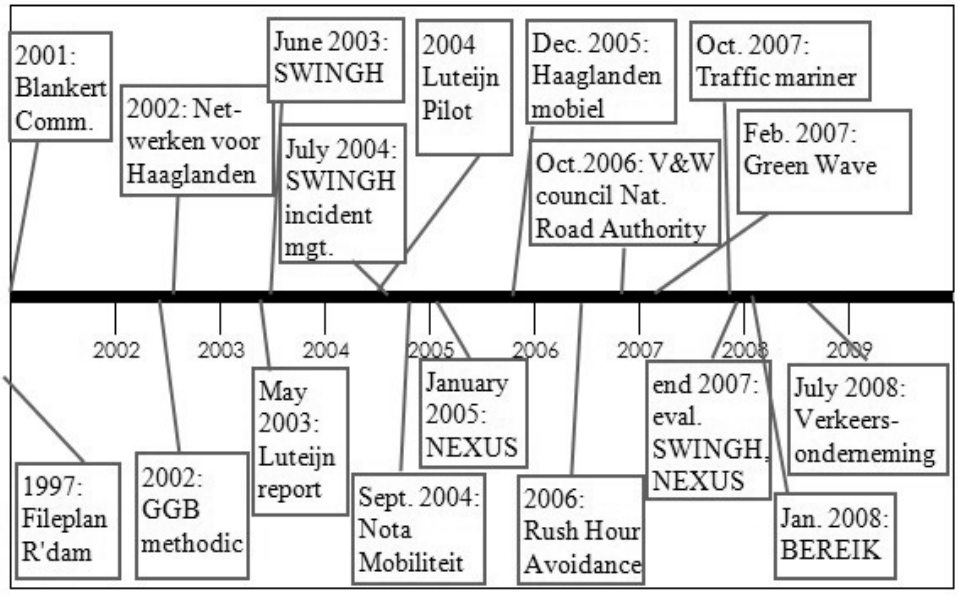


Figure 5.6 Timeline 'Luteijn'

[19] For an overview of Fileproof initiatives see http://www.fileproof.nl/congres/?cat=3

5.5 Innovation outcomes

5.5.0 An initial ordering of footage

Having described the innovation's circulations through the experiences of various initiators and translators, a rather chaotic picture arises. The first step to gain understanding of this innovation journey is to step back, and take stock of some basic characteristics. Ordering this relatively raw material through initial assessments of outcomes and development patterns helps establish striking events, salient issues and rudimentary patterns. These can be used as leads for subsequent translation-dynamic analysis **(5.6)**. The following three questions help to develop a basic overview of the innovation journey as a whole: *Was the innovation attempt successful, as perceived by initiators and stakeholders* **(5.5.1)***? What was achieved in terms of system innovation* **(5.5.2)***? What basic innovation patterns can be distinguished* **(5.5.3)***?*

5.5.1 Innovation success

One question relevant to any innovation process is what its yields were, and whether it met expectations. Yet considering the aim to approach innovation as two-way traffic, it is important to consider that 'success' and 'failure' are in the eye of the beholder, and that evaluation of success is bound to be ambiguous and contested. Hence the following question: *Was the innovation attempt successful, as perceived by initiators and stakeholders?*

The Luteijn commission's innovation attempt was the third in line to address the persisting problems with the A4 highway. Its newness consisted in its divergence from the earlier corridor-oriented analyses. Drawing a circle around the Greater Haaglanden area, they redefined the A4 problems as regional network malfunctioning - involving both main and secondary road network, and both public and private actors. The commission's recommendations introduced both a new perspective and a governance model for appropriate action. Knowing their recommendations' success to depend on the targeted actors' willingness to put them into practice, the initiators foresaw the need for rapid 'returns-on-investment'. A first observation on innovation success is that the **envisioned quick wins** were **achieved** indeed. Soon the SWINGH initiative generated quick wins and innovative solutions: Traffic light programming, incident management and coordinated slippery road abatement convinced many network partners that boundary-transgressing action was worthwhile.

The commission had intended the quick wins to generate the trust needed to take up the more demanding network challenges. Indeed, the quick wins convinced administrators, public servants and private sector actors of the usefulness of networked action. The accounts of the SWINGH protagonists confirmed how the visible successes fueled further actions, encouraging the stakeholders to mount the 'Luteijn ladder'. The 'ICT in accessibility' and 'Rush Hour Avoidance' projects were markedly innovative ventures, the latter being especially daring. They materialized how the private sector could really contribute to accessibility solutions. Furthermore, the administrators found their coordinated infrastructural bids rewarded for their consistency. As the former deputy indicated, their content-driven rather than discretion-driven design allowed the bids to be succesful. A second observation on innovation success is this **successful demonstration** of the **growth model**.

As several protagonists noted with contentment, SWINGH was intensively followed by representatives from other regions. Beside the Rotterdam region and its NEXUS initiative also other regions followed the Haaglanden 'frontrunners'. Furthermore, the 2005 national mobility framework elevated the network perspective to a benchmark for its decentralized policy, requesting urban regions to follow suit and base their policies on network analyses. Its emphasis on network vulnerability and appropriately networked action featured similarly prominently in the National Road Authority proposal and the Traffic Enterprise arrangement. A third observation on innovation success is the particularly **wide diffusion** of the innovation attempt.

As the SWINGH mobility manager indicated, the 'Luteijn ladder' led towards the a unified Mobility authority, yet only implicitly so. With respect to this end goal, innovation success was limited: SWINGH did prove the viability of the growth model and the mobility managers could note a generally increasing ability to 'switch hats' between network perspective and the home organization's perspective. However, SWINGH, NEXUS and BEREIK experiences also brought out the difficulty to mount the ladder to its highest step. Instead of steadily increasing willingness to concede discretions to the benefit of the network, several accounts also brought out relapses into 'old ways of thinking': Generally agreed upon traffic scenarios had trade-offs resurface once elaborated, and the merits of coordinated salt sprinkling never became self-evident; more generally it proved difficult to move beyond the 'easy picks'. In the face of partners' various reasons to cling to their autonomy, networked action proved unstable and 'fragile', as several protagonists indicated. A fourth observation on innovation success are the recurring **relapses**.

The SWINGH and NEXUS evaluations displayed broad agreement both on 'Luteijn' success and the occurrence of relapses. Beyond this general agreement a striking miscellany of assessments can be discerned, however: NGOs and the 'private network' urged for a stronger user-orientation, yet administrators had their reservations against this; some administrators advocated greater private sector involvement, others hadn't been convinced of its merits; some parties considered the merger with the Rotterdam region a logical next step, others pointed out the network relations with the northern axis, towards Schiphol airport. The NEXUS evaluations strikingly signaled a need to specify goals, and communication of those: This illustrates the more general observation that the network partners evaluated the initiatives by a variety of standards, and judged them both for what they achieved and what they didn't. A fifth observation on innovation success is this **ambiguity**.

Looking back the South Holland deputy displayed enthusiasm about SWINGH and the 'Luteijn approach', but also indicated it hadn't been enough. In order to resolve the inadequate 'administrative spaghetti' he considered institutional restructuring indispensible - yet national government failed to pass appropriate legislation. Similarly, the evaluations had brought out calls for more forceful network action to meet the only increasing congestion pressure. In 2007 the Transport ministry's advisory council was even more outspoken, stressing that network vulnerability asked for centralized steering. Noncommittal cooperation had failed to keep up with the magnitude of the problems. The 'Traffic Enterprise' director argued similarly, but warned against juridical formalization. Just like the traffic mariner, his arrangement aimed to move beyond noncommittal cooperation, based on shared sense of urgency and direction yet accepting that 'cooperation would hurt at times'. The BEREIK 'boxing' manifestation sought to

bring home similarly that partners should be prepared to deliver and take punches. Considering the many calls for fortification, a sixth observation on innovation success is that **more results** were **deemed necessary**.

5.5.2 System innovation achievements

One question is the innovation journey's significance in terms of various actors' ambitions, yet another is its significance in terms of *system* innovation – the typically organization-transcending changes that alter the relations between actors, and mitigate dominant cultures, structures and practices. Instead of moving the camera between various initiators and translators, this rather involves the researcher's helicopter view on the changes in the network as a whole: *What was achieved in terms of system innovation?*

Considering the signaled ambiguity of innovation success, assessment in terms of system innovation achievement cannot be straightforward either. Indeed, the attempted innovation's transformative potential seems limited compared to what it promised to deliver at the start: The very mission of the 'Luteijn' commission, the development of a 'mobility market', revealed the Transport's minister's ambitions for a radically different approach. The combination of pricing and capacity expansion created enthusiasm especially amongst private sector actors, but this enthusiasm waned soon once the new administration cancelled the envisioned toll arrangements. In that light the commission's less spectacular 'call for cooperation' fell short of high expectations. On the other hand, the commission did break with the past in redefining the problem to be dealt with: The often lamented capacity shortage was not the heart of the matter, they indicated, pointing out that mobility problems better be approached as matter of network functioning; as systemic problems requiring an integral approach to play into the characteristics of the network. The commission putting system failure on the agenda, a first observation on system innovation is this **problem redefinition**.

Adjustment of traffic lights and coordinated salting may seem marginal achievements in the light of persistent mobility problems, but such assessment would miss the point. Other than marginal 'system improvements' SWINGH's earliest boundary-crossing activities formed part of an encompassing strategy towards systemic mobility governance. The aforementioned activities being targeted to reduce network vulnerability, the marginal adjustments could yield disproportional gains. More than regular problem-solving activities, these systemic measures displayed how the complexity of the regional network could be played into. A typical example of this leverage was the adjustment of the traffic light down the A13 ramp, achieving massive gains on the adjacent highway - tangible gains becoming within reach once networked interdependencies prevail over administrative boundaries. A second obervation on system innovation achievements is this **shift to** a **systemic**, leverage-seeking **approach**.

The Luteijn commission knew that their pilot could build on earlier cooperative initiatives in the region. More specifically, various accounts brought out how SWINGH could profit particularly well from the developing network-oriented approach to traffic management; 'GGB'. SWINGH making the shift to a systemic approach through its 'management of flows', its first mobility manager admitted with slight bravery 'not to have had a clue' about these flows, however - the concept just helped to pry open congealed administrative structures. On the other hand the traffic professionals had more than a clue about the management of flows, but for them the politico-administrative game was hard to oversee. Considering the flows 'a little detached from administrative

reality', the NEXUS mobility manager therefore considered that Luteijn's network philosophy also implied changes in the relations between traffic professionals and their administrators. Instead of being worlds apart, they had to become more closely intertwined. Several protagonists indicated the logic of flows to have become better connected with administrative reality. They also acknowledged that there was still a world to gain: The 'GGB' trailblazer considered it was especially up to the managers. A third observation on system innovation achievements is the **tightening connection** between **traffic professionals** and **administrators**.

'Luteijn' was much broader in scope than his area-oriented traffic management, the 'GGB' protagonist indicated. Traffic light optimization, incident management and slippery road abatement had been essential steps on Luteijn's ladder, but so were the Rush Hour Avoidance project and the mobility broker's activities in mobility management. The ladder targeted the 'flows' through an integrated package of measures: The overflowing network was 'drained' through traffic management, whereas mobility management addressed the flowing tap of travel demand. The later National Road Authority proposal espoused similar integrative ambitions, and the Traffic Enterprise director was especially content to have traffic management and mobility management joined 'in one hand'. He exposed vividly how it helped to have the cogwheels of the harbour area system grip on to each other. A fourth observation on system innovation achievements is this **policy integration**.

Addressing the flowing traffic tap critically depended on the cooperation of the private sector. The Traffic Enterprise director lamented the narrow mindsets that had traffic unnecessarily concentrate in peak hours, yet he noticed the rise of various initiatives in mobility management as well as an increased sense of urgency. Five years earlier the SWINGH mobility manager had encountered considerably less sense of problem ownership amongst employers, however. SWINGH pioneered with mobility management: Creating trust and restoring relations through quick wins and innovative projects, the mobility team and the private network managed to make headway, convincing employers of their share in the 'flows'. Rush Hour Avoidance and the 'mobility broker' were offbeat initiatives that materialized this emerging sense of problem ownership. The initiatives were continued under NEXUS, BEREIK, and the Traffic Enterprise, but especially the national-level Taskforce Mobility Management gave a significant boost. A fifth observation on system innovation achievements is this **boost** to **private sector problem ownership**.

5.5.3 Innovation patterns

Moving the camera along a variety of actors yields a multitude of views on what is difficult to decipher as an ordered sequence of events. Setting up a timeline is one way to order the footage, another is to observe whether the capricious innovation journey displays apparent turning points, repetitions-of-moves or accelerations: *What basic innovation patterns can be distinguished?*

A pattern anticipated upon was one of gradually improving relations between network partners. As the SWINGH mobility manager told, they had had to tread very carefully in their first half year. Public- private relations had turned sour, and both administrators and public servants had yet to be pursuaded into endorsing the new organization. The various accounts and evaluation reports coincide in the observation that, over time, the people came to know each other better, knew to find each other, and became accustomed to 'switching hats', i.e. to alternating representation of the own

organization's and network interests. In this respect Luteijns growth model proved to work; a first basic pattern is this **formation of trust**.

As indicated under innovation success, the innovation attempt managed to diffuse. The deliberate divergences from the 'noncommittal' cooperation (the National Road Authority proposal, the Traffic Enterprise) only confirm how Luteijn became a benchmark for successors. A second basic pattern is this emergence of a Luteijn **brand** in mobility governance. This brand formation was even more pronounced for the area-oriented methodic for traffic management; 'GGB' developed into an undisputed standard.

The above two 'brands' did not only coexist, they were related too. For several project leaders and 'table hosts', 'GGB' was common practice even before the Luteijn recommendations. Their earlier acquaintance and experience with networked action helped SWINGH getting started through success-stories. Part of the successful mounting of Luteijns 'ladder' can thus be attributed to this preceding innovation trajectory. Inversely, Rush Hour Avoidance and the mobility broker were SWINGH initiatives taken up by other organizations. As the BEREIK mobility manager indicated, the arranged innovation table was to be a *dynamic* table – innovations leaving the table once matured and/or taken care of by other organizations. BEREIK, the Traffic Enterprise and the traffic mariner were network organizations consciously operating within an ecology of organizations with many overlaps, actively seeking to generate synergy. A fourth basic pattern is this **synergetic coexistence of similar innovation attempts**, each aiming for network-oriented action in its particular way.

SWINGH 'kept things light'; it was to avoid the trap of congealing into yet another body that would only exacerbate the widely lamented administrative crowdedness. By contrast, the National Road Authority proposal rather advocated a heavier, fortified arrangement. Yet the majority of network arrangements were designed to become obsolete over time; in the end their network-outlook was to become internalized into the modus operandi of the standing organizations, and live forth through network-aware individuals used to 'switching hats'. It is remarkable how, instead of seeking consolidation and expansion, many protagonists saw the innovative structures as **temporary catalysts**.

Finally, assessment of innovation success already indicated the recurring relapses. On the other hand the growth model did prove successful. This yields a mixed picture of both mounting and descending movement on Luteijn's ladder. A sixth basic pattern is this alternation of **growth** and **decline**.

5.6 The Luteijn translation sequence

5.6.0 Developing translation-dynamic insight

Having assessed innovation outcomes, it becomes easier to distinguish rudimentary storylines within the innovation journey. Yet as theorized in chapter 2, a key to understanding the course of innovation evolution is to consider the particular ways in which an innovation attempt is translated. Circulating through a polycentric society, an innovation transforms, and engages translators in different ways. Theoretically, certain *types* of translations can be expected to occur: Starting from a basic distinction between 'affirmative' and 'negating' translations and further differentiating within these

categories, the discovery of translation-dynamic *patterns* can be enhanced. Distinguishing between 'non-translation', 'interference', 'embracement', 'modification', 'alien modification' and 'self-translation', translations tracing was sensitized to several foreshadowed problems and issues[20]. Another point of attention was whether and how actors managed to 'synchronize' their translations. This initial categorization helps to carve out case-specific translation patterns: Construction of those involves first a closer look on the occurrences of interferences and non-translations, shedding light on the counter-forces encountered by initiators **(4.5.1)**. Next, the embracements, (alien) modifications and self-translations elicit rather how the innovation attempt was met affirmatively, and did manage to spread **(4.5.2)**. Having highlighted these dimensions separately, case-specific translation-dynamics can be established **(4.5.3)**. These 'configurations' form the input for comparative analysis.

5.6.1 Innovation ignored or resisted: 'Non-translation' and 'interference'

The idea behind these categories comes primarily from Luhmann: An innovation attempt may be very promising and meaningful to its initiator, but in a differentiated society translators are likely to receive it as irrelevant or even as disturbing. In the first case translations are marked as 'non-translation', in the second case as 'interference'. The latter category is especially salient as it highlights the counter-forces the initiators ran up against.

The assessments of innovation success and system innovation achievements bringing out considerable feats, one would think that the innovation attempt met with affirmative translation only. On the other hand, the signaled relapses, the growth & decline pattern and the calls for fortification indicated clearly that mounting Luteijn's ladder wasn't always as attractive. A closer look on non-translation and interference can clarify why:

The Luteijn recommendations presented a compelling problem redefinition and an elaborate systemic approach for appropriate action, but eventual materialization was in the hands of translators. As the mobility manager knew from the outset, SWINGH had little time to demonstrate its added value; In the first half year 'they would enter a meeting not knowing whether they would still have a cooperation agreement at the end'; it was a matter of 'keeping up the pace without stumbling'. The quick wins allowed them to overcome initial **skepticisms** towards what seemed a meager substitute for the expected 'mobility market'. The Luteijn trailblazers managed to overcome **initial non-translation**.

Even when succeeding to overcome initial non-translation, the accounts of key translators also display many occurrences of decreasing interest later on. When elections 'broke out' and administrators left their positions, SWINGH proved to be fragile. Without the tight and trusting relations between key translators the accelerating translation process stagnated, and evaporation set in. Several translators indicated how SWINGH stuck together through key individuals and their relations. Non-translation set in again due to **personal changes**.

As the incident management coordinator told about his experiences as 'table host', it had always been essential to keep all network partners 'on board', and allow them to report successes for the home organization every once in a while. This wasn't always possible, however. For the smaller municipalities, networked action wasn't as vital as it was to the

[20] See sections 2.5 and 3.2 for more extensive description of these sensitizing categories.

cities of Den Haag and Rotterdam, and they had a naturally more limited outlook than metropolitan or provincial authorities. The relapse in salt sprinkling cooperation was a telling example of stagnating translation; due to differences in local conditions parties started to doubt the benefits of Luteijn coordination. More generally it proved difficult to continue translation beyond the easy picks; **translators** were **discouraged** by **decreasing benefits**. The 'GGB' developer and the Rotterdam traffic management professional noted a similar difficulty to arrive at sustained network-oriented traffic management, for lack of tangible contributions to administrators' policy objectives.

The non-translations explain the occurrence of relapses in between otherwise affirmative translations. Still they account for those only partly: Moving beyond the easy picks was not only difficult because of hiccups in network formation and nebulous gains, interferences were involved as well:

'To the road user, administrative boundaries are irrelevant', the mantra of the network-oriented initiatives went, but to administrators they were. As a table host explained, especially mobility policy was a coveted asset in administrators' portfolios; a key to tangible deliverance to the public. Hence the difficulty to agree on boundary-transgressing traffic scenarios: Even when subscribing to the general principles, road managers often shied away once confronted with potentially adverse ramifications for their areas. The manager of the regional Dynamic Traffic Management program indicated similarly how their ambitious and complex program put administrators under pressure; they had to reconcile loyalty to the program with accountability to their own constituencies. The innovation attempt **interfered** with the **autonomy** and discretions of its intended translators: The SWINGH mobility manager knew they should avoid any impression of a quest for power. Instead of a monster taking over[21], a new administrative structure acquiring mandates and snatching projects, the network organization should move *between* organizations. The later traffic mariner and Traffic Enterprise arrangements reveal awareness about this interference from their very inception, steering clear from paralyzing mandates discussions. Not surprisingly, the 2007 plea for the National Road Authority received little applause, the Minister seeing little reason for fundamental changes in the existing institutional architecture.

'Keeping things light' helped to reduce interference with network partners' autonomy. Seeking carefully for common gains, allowing partners the informal space to 'grope' a little, and build trust – it was not that they really had a say, a table host explained, but they did get things done every once in a while. Ironically, the very effort to avoid interference with autonomy also ran into another kind of interference: The earlier 'mobility market' mission had borne the promise of forceful action against the looming congestion deadlock, and would rise above the administrative swamp. The 2007 National Road Authority plea reinvigorated the solution strategy of decisiveness and centralization, backed by an alarming further increase in congestion levels. In this light 'Luteijn' appeared as rearranging the furniture while the Titanic was sinking - forgetting about the lifeboats in the form of infrastructure provision. The recurring calls for fortification can be better understood through Luteijn's **interference** with widespread **yearning for decisiveness**.

[21] Just before the municipal elections, the NRC newspaper featured an alarming article about the 'morbid growth' of cooperative arrangements and their erosion of municipal discretions and legitimacy (NRC, 2010b).

As several protagonists indicated, one of Luteijn's main successes was the participants' generally increased agility in 'switching hats'. This wasn't as easy as the term suggests, however: A later mobility manager paid specific attention to the HRM aspects of combining networked action with tasks for the home organization. These tasks should be aligned, enabling mobility team members to report concrete results 'at home'. Administrative boundaries did not only matter to administrators, but were also most relevant to public servants, maneuvering between networked action and the order of the home organization. 'Luteijn' action was often hampered by and **interfered with** the **reward structures** of the **home organizations**. A mobility manager considered it a key challenge to deal with organizational cultures not conducive to 'escalate' issues to higher echelons. His SWINGH colleague had noted a similar tendency among the 'traffic light men' to smoothen out the tensions and tradeoffs in network optimization, rather than eliciting them to their administrators.

Many private sector partners endorsed 'Luteijn' for its off-beat problem-solving. It met their wish to get rid of the deplored 'administrative spaghetti', 'red tape' and indecisiveness. SWINGH had 'government' finally show its extroverted, unified face, with the 'ICT in accessibility' tender as a shining example. Yet even when part of the relapses can be explained by the 'introverted sluggishness' of governmental organizations, networked action also displayed **interferences** with **business administrations**: The incident management procedure proved difficult to adapt to for the salvaging companies, not used to this 'concerted' entrepreneurship. The report of the mobility broker was an especially telling example of this interference: The attempted integrated management of companies' mobility expenses displayed serious mismatches with their internal organizations. Governed by different business units, the relevant financial flows proved hard to bundle.

Overseeing the above non-translations and interferences, a common denominator is the interference of networked action with the operations of the partners' home organizations. The accounts of the mobility managers, the traffic mariner and the Traffic Enterprise director instructively show the efforts to avoid these interferences. Yet they also show a more combative attitude, and a striking awareness that this interference-avoidance alone would not suffice: In this regard the SWINGH mobility manager explained the trick to play into administrators' feelings of shame, the BEREIK 'boxing' manifestation expressed explicitly that interference was 'part of the game', and also the Traffic Enterprise director expressed how the time had come to confront the collective problems – and each other. This play with interference leads to the observation of apparent **productive use** of **interference** – a phenomenon not anticipated in the translations typology.

5.6.2 Innovation adopted or adapted: Embracement, (alien) modification and self-translation

These categories stem primarily from earlier studies into the translation of innovations. They highlight that even when an innovation is not ignored or resisted but engaged with more affirmatively, this generally occurs not as 'adoption', but rather as adaptation. In the first unlikely but possible case, translations are marked as 'embracement', in the latter it is marked as 'modification'. If adaptation diverges markedly from the innovation intended by initiators, it is marked as 'alien' modification. Finally, adaptations by the initiators themselves are set apart as 'self-translations'.

Innovation success and system innovation achievements suggest that affirmative translations prevailed. The previous subsection specified several interferences underlying the relapses and calls for fortification, however. Somehow, the translation sequence must have contained considerable affirmative translations to outweigh these interferences. The 'productive use of interference' may account for a part of this counterbalancing, persuading translators to accept a degree of interference. A closer look on embracement, modification and self-translation offers further explanation:

The Luteijn commission knew innovation success to depend on the translations by others. It is striking to see that their recommendations actually anticipated upon the translation sequence to follow. Instead of arguing for drastic measures and establishment of radically new structures that were likely to evoke considerable interference, they aimed to start a translation sequence that would achieve their intended systemic impacts in a gradual way. The growth model was essentially a translation model: The networked approach would have to be meaningful to its constituent actors in order to become reality. SWINGH was a first seed to plant, and to grow through sustained translation. As indicated in the previous subsection, SWINGH overcame initial reluctance amongst the targeted translators. One factor may have been that it was accompanied by a mantra that proved irresistible: The idea that administrative boundaries did not matter to the road-user fitted well with the user-oriented public management holding sway at the time. The turn to network-oriented action being nicely carried by this more encompassing fashion in public management, at least the commission's innovative **concept** met with **widespread embracement**.

The SWINGH mobility manager knew that embracement of the general idea would not suffice, however. However compelling the logic of the 'flows' and the assertion that 'administrative boundaries were irrelevant', translators would have to find that networked action had something to offer. The quick wins brought home the message that it did: Beyond widespread embracement of the general concept, also the **quick wins** gained embracement.

Yet apart from the embracement of the general line of thinking and the endorsement of its smart problem-solving, the network turn case is striking for its variety of modifications: Distinguishing six clusters of networked activities, the innovation initiators actually anticipated upon such variety. The various networked activities were to be taken up by clusters of translators, as joint translation processes. The modifications show how translators typically appropriated 'Luteijn' with a twist, using it in different ways to further their particular goals: To administrators it was an opportunity to demonstrate responsiveness to citizens and **tangible deliverance** of **mobility solutions**. Moreover, the networked approach also proved very effective in developing **coherent** and convincing **infrastructure bids** – a major payoff for synchronized mobility policy.

For administrators and mobility managers the bottleneck solutions were especially valuable as stepping stones for more demanding cooperation. As the SWINGH mobility manager indicated, the 'flows' were particularly useful **ploys or levers to establish joint problem ownership**. More important than the solutions to concrete bottlenecks, the quick wins created trusting relations between translators. To traffic management professionals the management of 'flows' was more than a vehicle for ccoperation, though. To them it had already become an essential shift of perspective, and an empowering one at that: It allowed them create funds for 'serious traffic management', beyond ad-hoc tinkering with local bottlenecks. To them Luteijn's governance

philosophy was primarily a golden **opportunity** to demonstrate their contribution to policy goals, and **advance the position of their profession**.

To the congestion-plagued private sector, 'Luteijn' merited support for its unification of fragmented government. Moreover, they could also seize the opportunities to show their **capability to provide innovative solutions** (this could come in most useful when it would come down to the major projects of road pricing). Furthermore, the take-off of mobility management can be understood through not only through their acknowledgement of problem ownership, but also their growing awareness of the scope for **savings on** their **mobility expenses**.

The miscellany of modifications testifies what can be summarized as high transferability. The innovation initiators had anticipated this, and wider diffusion they had envisioned as well: Applications in other regions brought forward **various region-specific network approaches**, the **national mobility policy** set 'Luteijn' as a **benchmark** for the required regional network analyses, and the National Road Authority proposal and the Traffic Enterprise were **successors** explicitly **aimed to strengthen** the **original idea**.

The commission had expected that adoption would imply adaptation; translations were to depend on the particularities of the network to be governed. Allowing translators considerable scope to tailor it to their ambitions, almost any networked action would be good action: **'Alien' modifications** were **unlikely to occur**. The **National Road Authority proposal** can be considered an exception, however: Even when similarly responding to network vulnerability, its recipe for appropriate action headed towards a formalized and centralized structure – and this Luteijn had sought to avoid.

Luteijn's growth model allowed for a great diversity of modifications. It also deliberately aimed for *joint* translation, for sustained efforts to attune the not always compatible ambitions for networked action. The strategic discussion on continuation of SWINGH and BEREIK shows particularly well how translators attached different purposes to further network arrangements, diverging in their ideas about the appropriate functional and geographical scope. This discussion on feasible modification was typical for the **synchronized translation** the commission had envisoned. (This is why the centralizing proposals, lacking this synchronization, can be considered 'alien' modifications).

As regards self-translations, it can be said that these did not occur: The initiating commission launched its attempt, but did not take part in the ensuing translation game. As innovation trailblazers specifically drafted for the job, the mobility managers can be counted among the innovation initiators, however. Their strategic modifications display several deliberate attempts to refine the Luteijn philosophy, and guide its translation sequence: First, the introduction of the 'tables' somewhat de-emphasized the importance of the analytical concept of 'flows'. The process focus served to make 'Luteijn' **more meaningful** to the **administrative** rather than traffic-technical **reality** of key translators. Second, the **differentiation** into 'area' tables and 'innovation' tables accounted for the lesson to 'mind the scale', and third, the boxing manifestation was a self-translation to move 'Luteijn' practice **beyond** non-committal, **shallow** and mere interference-avoidance. Fourth, reflecting on the network organizations' operation amidst others, the mobility managers came to understand the arrangements as **temporary catalysts**: Eventually, once internalized in the partners' daily operations, the networked modus operandi could go on without them.

5.6.3 Conclusions on the translation sequence

Having highlighted the ways in which the innovation attempt was ignored, resisted **(5.6.1)**, adopted or adapted **(5.6.2)**, innovation outcomes can be appreciated as results of a chequered translation sequence. Considering the apparent occurrences of translation types and further interpreting the fit between these theoretical constructs and the process described, translation-dynamic patterns can be identified. Overseeing the translation sequence as a whole, the case displays the following striking translation dynamics:

First of all it is striking how the innovation attempt was **widely embraced**. The network concept easily touched ground through its mantra that 'administrative boundaries were irrelevant to the road user'. The attempt was also nicely carried by a more encompassing user-oriented fashion in public management.

Widespread embracement of the commission's idea by itself cannot account for the innovation success and system innovation achievements, however: The interferences with the modus operandi of the targeted translators reasserted the importance of administrative boundaries in various ways. The idea of networked action was well easier to advocate from a distance than to materialize in the practices of its intended adopters. A second conclusion on the translation sequence are these **recurring interferences and non-translations**.

Interferences were overcome, but also came back or were followed by new ones. Several actors expressed that apparently, things first had to fall back in the old bad state, before parties would regain interest. The 'relapses' and growth & decline pattern signaled earlier can be understood to have resulted from the combination of recurring interferences and high transferability. A third conclusion on the translation sequence is this **oscillation between** enthusiastic appropriation of and disturbance experienced from networked action, between **interference** and **modification**.

The above oscillation emerged from the non-translations, interferences and modifications of a manifold of translators. The 'flows' and the 'tables' ensured that these modifications were always joint translations; the innovation attempt can therefore be understood as a synchronization attempt. A fourth typifying translation dynamic is this strongly **synchronized translation** process.

The mobility managers were the appointed innovation trailblazers to enhance this synchronization. This amounted to many 'lubricating' activities, but to mild irritation as well. Particularly striking were the attempts to persuade translators into 'entering the ring'; a more confronting approach would help to address the more ambitious and potentially interferential network challenges as well. A fifth conclusion on the translation is this **productive use of interference**, as attempts to guide synchronization beyond the easy picks.

Both mobility managers and several other translators considered the network organizations as temporary catalysts; ideally, networked thinking would be internalized by the translators and their organizations. Moreover, they knew their synchronization attempts to take place amidst other and similar initiatives, within an ecology of network organizations: BEREIK, the Traffic Enterprise and the traffic mariner formed part of each other's environments, and both SWINGH and NEXUS had been able to build on earlier networked initiatives such as 'GGB' and the 1998 'Fileplan'. A sixth conclusion on the translation sequence is that it **could lean on other parallel translation sequences**.

The conclusions on the translation sequence are nicely captured by Sloterdijk's introductory 'foam' metaphor. The oscillations resulted from translators' changing appreciations of either being enclosed or of having more permeable cell walls, with 'Luteijn' injected as a catalyst to soften those. Overlooking the whole sequence, the picture arises of constantly changing cell walls, forming more or less stable bubbles.

Chapter 6 Rolling back Traffic control through Shared Space

"According to some physicists, there is not enough mass in the universe to balance the accounts that cosmologists make of it. They are looking everywhere for the 'missing mass' that could add up to the nice expected total. It is the same with sociologists. They are constantly looking, somewhat desperately, for social links sturdy enough to tie all of us together or for moral laws that would be inflexible enough to make us behave properly. When adding up social ties, all does not balance. Soft humans and weak moralities are all that sociologists can get. The society they try to recompose with bodies and norms constantly crumbles. Something is missing, something that should be strongly social and highly moral. Where can they find it? Everywhere, but they too often refuse to see it in spite of much new work in the sociology of artifacts".

Bruno Latour – Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts (1992, 227)

6.0 Introduction

Around 2005 'Shared Space' came up as an innovative concept, acquiring both fame and notoriety for its anarchist approach to traffic. Shared Space only became an emblem over time, however. This case study describes its evolution, starting from a concrete innovation attempt: The town center reconstruction in Haren, a village in the north of the Netherlands. The case study proceeds in six steps: First a brief description of what the initiating protagonists sought to achieve **(6.1)**. Next, the experiences of the initiators of the Haren municipality **(6.2)**, and those of Haren stakeholders confronted with the attempt **(6.3)**. Fourth, the experiences of protagonists developing Shared Space, and the reactions they encountered **(6.4)**. Fifth, innovation evolution will be assessed for innovation success, system innovation achievements and basic patterns **(6.5)**. The evolution of the innovation attempt is analyzed in the final section, highlighting its different translations **(6.6)**.

6.1 The Haren town center reconstruction

One of the later Shared Space showcases is the reconstructed Haren town center. Haren is a small town near the city of Groningen, in the north of the Netherlands. Around 1990 the municipal authorities had established an encompassing plan for the renewal of its built-up area. In 1997 they had joined the national 'Sustainable Safety' approach, an approach involving systematic and clear distinctions between road categories and their appropriate use. The municipality integrated this approach with its road maintenance program. In 1999 they prepared plans for the town center, including reconstruction of the Rijksstraatweg, the main road through Haren. Within the 'Sustainable Safety' program the road section had been indicated as a 'dwelling space access road'. This opened up traffic calming options, enhancing the dwelling function. Figure 6.1 shows the Rijksstraatweg layout before reconstruction.

Figure 6.1 Rijksstraatweg Haren center, before reconstruction. (Grontmij)

The Rijksstraatweg cross-cuts Haren. Because of its prominent presence its reconstruction entailed town center renewal, and considering its particular importance to Haren citizens the municipality decided to initiate an 'innovative participatory process' (Gemeente Haren, 1999). The procedure would allow citizens to participate from the very beginning. The first step was to draft citizens for a sounding board group, making an inventory of problems and ideas. Subsequently a project group of municipality officials, stakeholder groups and citizens would work out a plan eventually to be passed on for formal decision. A reporter from the local newspaper would keep the wider public informed about the proceedings. About three years later the reconstruction had been implemented. As can be seen in figure 6.2, the separate bicycle lanes had been removed, creating a unitary road surface that road users needed to share. This aspect made the reconstruction into a showcase for what later became known as 'Shared Space'.

Figure 6.2 Rijksstraatweg Haren center, after reconstruction. (Grontmij)

The following section offers a description of the process that led to this new lay-out. It starts from the experiences of the Haren municipality innovation initiators. Section 6.3 features accounts of other actors involved with Shared Space Haren, and section 6.4 describes the development of the Shared Space approach.

6.2 Renewing the town center

By the time they had reached the phase of taking on the town center Rijksstraatweg section, they had wanted to take a 'fundamental' approach to the matter: What to make out of it? As the head of Public Works explained afterwards, they had just started with an add in the local newspaper. As about 60 people turned up for the problem inventory of the sounding board group, they had enough to work with. The process continued with a project group to devise solutions. The project group consisted of a mixture of

individuals drafted from the sounding board group, stakeholder group representatives and municipality officials. The approach had for a large part been his responsibility – with the necessary political backing, he added.

The public officials in the project group were to facilitate, rather than lead the process, and provide information on participant's requests. And out of a long list of problems, the project group had come to a surprising solution: *"Difficulty to cross the road, speeding, too small curbs…people considered it ugly, the Rijksstraatweg…Well, and then there was a range of minor problems…the curb for this and this shop being not in order…But those were the three main reasons: Speeding, too small curbs..crossing was awkward, because of the differences in levels…it was impossible to cross with a rollator, that would require a six-fold on and off …So the working group that came out of it, they thought up by themselves, so to say, 'why don't we get rid of those bicycle lanes'? Well, nobody with the municipality, you could say, could have thought that up…or have come up with the proposal. Not the politicians, but neither my department …I'd never have concocted that myself. I wouldn't have dared, to put it that way…"* (*21, 1).

After this problem inventory, in November 1999, the project group came together in seven meetings until May 2000. The official for traffic affairs had become enthusiastic right from the start. Beside the necessary road maintenance program, 'Sustainable Safety' had stipulated a 30 km/h speed limit for the larger part of the built-up area, including the Rijksstraatweg town center section. And as there was also the reconstruction program to increase the livelihood of the worn out town center, the moment had come to make it complete. In the preceding phase they had started with re-pavement already. His late colleague, the project leader at the time, had envisioned how the re-pavement scheme could actually be continued on certain sections. On top of that, he himself had envisioned an integral refurbishing for the Rijksstraatweg: Taking out the asphalt altogether, and red clinkers, front-to-front: Quite a natural approach for him considering his professional upbringing in Emmen - the cradle of the 'home zone' concept[1]. Above all wisdom on road lineage and traffic lights, to him it was all about the combination of spatial design and traffic. *"Look, the Shared Space idea isn't new to me…it has been an idea for some time already that these dwelling spaces…you have to make them livable…and have the people engage with each other"* (*22, 1).

They had figured that the 8000 to 9000 vehicles per day needn't pose a serious impediment: After all, they had to get the speed out of traffic anyway. Eventually the idea of mixing traffic had come out of the project group deliberations spontaneously, when discussing the options: Of course the separate bicycle lanes could be maintained, but it would confer constraints on road design. Once the idea of mixing traffic started to emerge it had struck some participants as a revolutionary thought, he remembered. 'Have you gone mad, that's impossible', he recalled a member of the elderly council saying. After a few meetings the project group participants started to endorse the traffic mixing more and more, however. He described how every meeting, they would revisit the pros and cons, and provided with new information the people could make better assessments and choices. It took time, as the project group consisted largely of citizen laymen – not always aware of their lack of traffic technical expertise (*22, 2). On the other hand, he had also explained them that it was not a matter of traffic technical

[1] (*22, 8). The 'home zone' is an urban design principle developed in the late 1960s/ early 1970s. Its dead-end streets facilitated the use of minor neighborhood roads as dwelling spaces – with the appropriate low speeds.

expertise only. Despite enthusiasm for the spatial design, some still had doubts whether traffic intensities permitted removal of the separate bicycle lanes. On their request for authoritative judgment and guidelines he had said: *"…well, I'll give them a call, I'll just ask them…But I know the answer already: They will say, 'this is not according to the book, in accordance with the guidelines…up till 5000 vehicles per day, and if not…'…that will be the outcome. They also said, 'as a road manager it is your responsibility, of course, but we won't advise you to do it'. Well, that's clear, then."* (*22, 4). As regards the guidelines he was a bit self-willed, he admitted with a smile. They had been quite brave, he thought, not in the last place the alderman who had supported the plan all along.

The project group members evaluated the design process by the end of 2000. As the participatory process had been new to Haren practices, they had no experience to build on - all the more reason to have the members lay down their experiences for future applications. A critical comment pertained to the provision of information: *"At the start of the Project Group activities no relevant information was available to project group members, concerning, for instance, traffic intensity, traffic casualties, frequency of buses, et cetera. Also after urges of members. Only after mounting pressure from the citizenry, data came up. Thereupon great confusion arose about whose data were valid. If the Project Group had the required data at their disposal timely, the decision-making process would have taken place more quickly. Furthermore, it would have improved its credibility towards its environment."* (Projectgroep RKK, 2000a, 3). Also interim reporting could have been catered for better, they indicated, whereas outside exposure could have been diminished somewhat - so as not to disturb 'hatching'. All in all they noted the group to have worked in a good atmosphere and with mutual trust, however. Apart from their critical notes, they 'wanted to leave no doubts that they firmly supported the choices they had made', and 'despite initial unfamiliarity with the difficult matter, they had generally had high-level discussions' (5). Standing firmly behind the plan, they regretted not to have played a part at its official public presentation.

On April 27th 2000 the project group had its last meeting. Before the session the members were given notice of the municipality administrators' decision to pass on integrally the plan for official decision-making. Other incoming mail featured another critical letter from the 'working group Safe Traffic Haren' and the bicyclist's association. Also at the presentation for the municipality council traffic commission there had been some questions about the plans to mix traffic. And to the surprise of one of the members, the meeting featured an agenda point to discuss an alternative - a matter of 'advances in insight', the chairman explained. The account of the meeting read: *"After extensive discussion it is decided to maintain the present proposal of the Project group (complete 'mixture' of traffic on the Rijksstraatweg). The alternative variation, i.e. no 'mixture' (almost the existing situation) will be used as a frame for reflection."* (Projectgroep RKK 2000b, 4/5).

The plan was fed back to the sounding board group on May 8th 2000. After a presentation by the municipal traffic official, the provincial coordinator for the 'Sustainable Safety' program explained the 'traffic philosophy' adopted by the project group. He supported his vivid exposition by a slideshow. As summarized by the official account: *"By the hand of 'images' Mister Monderman explains the traffic philosophy. Aspects like accessibility, safety, and environment are the central aspects. He makes a clear distinction between traffic behavior and social behavior. Traffic behavior often*

goes at the expense of social behavior. How do we engage with each other? Up till now traffic measures are often based on 'flows'. Monderman, however, argues for a design starting from 'places'. Mr. (..) asks whether mr. Monderman has taken traffic intensity sufficiently into account. Mister Monderman answers that numbers in themselves are not meaningful to him. The Haren town center is dwelling space, and that is what the design ('place') should be based on." (Projectgroep RKK, 2000c, 2). Monderman had become involved with the project group process after a talk with the Haren traffic official at the provincial traffic commission. Already in the 1970s, Monderman had been involved in the design and implementation of seemingly similar schemes in Friesland, an adjacent province. Monderman was enthusiastic about the daring proposal that seemed to emerge: After all, the Rijksstraatweg had a considerable traffic intensity of 8000 to 9000 vehicles per day. He became an advisor of the Haren municipality. The fifth meeting of the project group involved a tour along villages where he had developed similar schemes of 'mixing traffic', and his guidance did not fail to leave an impression: *"The reactions bring out clearly that the members of the project group experienced the excursion as very useful and instructive. Some even report 'their eyes to have opened'. A few fervent opponents of 'mixture' of traffic modes prove to have radically changed their opinions, for instance. Especially the traffic situation in Bolsward turns out to have made an impression"* (Projectgroep RKK, 2000d, 3). At the end of the meeting some members suggested that Monderman do his presentations at the meeting for the sounding board group and the official hearing as well.

Beside the skepticisms voiced during the meeting with the sounding board group, also among the wider public there was a growing disagreement with the plans to 'mix traffic'. Disapproval focused on the removal of the separate bicycle lanes. Stakeholder groups expressed their deep concerns about traffic safety in letters to the administrators and council members, and started a petition against the 'irresponsible' plan. The municipality split decision-making on the reconstruction plans, and forestalled the Rijksstraatweg part. Before continuing with the envisioned trajectory they inserted an extra informative public hearing, at the end of September 2000. To the head of Public Works the evening started off unfortunate: The hired mediator could not make it due to a broken down car. Suddenly he had to chair the meeting himself, confronted by a crowd of 200 to 300 people almost unanimously opposed to the plan: *"Well, I felt pretty ill at ease that evening, you may say…It wasn't an outright fight, they're Haren people, after all, they remain nice…or nice, in any case there is no calling names….But any argument, whether put forward by a civil servant, myself, or the alderman, was met by howls of derision, as a way of speaking of course…"* (*21, 4). Afterwards he thought they had just been 'organizing their own resistance'. Just as the project group members had indicated afterwards, it might have been better to have them present the plans themselves. In hindsight, he would 'seriously consider the option' (*21, 3-4).

The regional newspaper reviewed the evening like a theater play: *"From the very first minute it was as clear as a pikestaff: The information hearing in Haren about the derided traffic plan for the Rijksstraatweg (3000 signatures against) would unfold opposite to what the municipality had imagined. Now that the prologue was missing, a theater play followed with the public claiming the main part, blowing away the director in the very first act"* (Nieuwsblad van het Noorden, 2000). The article continued to sketch how the public refused to submit to the proposed division in groups, and burst out in a litany of complaint instead. Then Monderman 'got hold of the microphone', the 'actor intended to give the play its surprising plot', but called to the stage earlier than

scripted. He managed to defuse the heated discussion on solutions, and return to problem inventory. His introduction of traffic casualty statistics proved unsuccessful, however, the audience responding quickly with other, less worrisome numbers. *"But with some pains the actor regained the favors of the audience. He told about the uselessness of one-way traffic and the precariousness of safety islands. 'But for the elderly, with glaucoma and being bad walkers, those things are a relief', the woman said who had died over the plans a few times already. 'Oh yes, I would certainly build them near elderly homes', Monderman answered. 'But sir, Haren is one gigantic elderly home!'"* The latter quotation made it to the heading of the article, which finished with Monderman actually gaining applause for his concluding personal story. Once, having been completely at a loss to find a traffic solution for a village, and after many painstaking hours without any solution, he arrived at the square-like lay-out. *"Without bicycle lanes, and with cautiously mixing traffic. Even when he didn't actually mention the latter, everybody understood and didn't protest."*.

Monderman had been incredibly important in convincing the people, the former alderman said. Without him, they would have ended up with a conventional picture with a carriageway, possibly an extra zebra crossing, and maybe even an extra traffic light installation. He had been of tremendous importance in the beginning; on the other hand, his charismatic performance hadn't always been as effective. *"When suddenly this great resistance emerged, however, then he turned a little into a voice crying in the wilderness. And he was, well, this is what you often encounter with visionary thinkers, he was just that convinced of being in the right…at one point, and I've had a talk about it with him, he found it awfully difficult to take that little step to the political compromise…"* (*23, 6). The resistance, they hadn't really seen it coming, he admitted. They had mistakenly believed that the newspaper reports would keep the public in tune with the process group proceedings. Instead, a lot of resistance came up when releasing the final picture for formal decision-making. Several stakeholder groups presenting themselves as 'vulnerable road users' objected to the mixing of traffic: The elderly, the bicyclists and parents seeking to protect their children. Their petitions gathering an impressive adherence, support in the municipality council began to crumble (*23, 1-2).

It hadn't really been an issue of political convictions, the former alderman recalled; both socialists and liberals favored the plans, for example. Only the environmentalists, under the sway of the bicyclist association, were squarely opposed. He was still convinced about the plan himself, though, stressing how government just couldn't guarantee absolute safeguards against accidents. On the other hand he had understood well that, in the face of considerable concerns voiced by the constituency, council members could hardly be expected to simply stick to their initial commitments (*23, 3). Following the unsuccessful public presentation and the petitions there was little point in continuing with the proposal; first they needed to mend it. The Haren municipality invited its citizens to go on a bus tour, in order to see and experience that schemes similar to the one proposed could actually work. After a number of difficulties to cater for the required buses and quibbles about appropriate dates the tour finally took place by the end of October 2000. The local newspaper noted how fervent opponents did not change their convictions, but that some others did consider the examples appealing. *"Now it is up to politics. The mayor and aldermen in the first place. It is to be hoped that they won't turn the pancake three times again, before taking a position. Now it comes down to straightening up. A final judgment has remained forthcoming for all too long. And for*

the opponents there will be another occasion to explain once again that the bicycle and the car are sworn enemies" (Harener Weekblad, 2000).

The new occasion for discussion came on February 19th 2001. This official public hearing would prepare a plan to be discussed in the municipality council traffic commission, in which Haren citizens could exert their right to comment. The findings of the public hearing would also be 'taken into consideration' for the plan to be discussed there, two months later. The alderman started the session announcing that the plan had already been amended. In order to meet the objections of many vulnerable road users they had diverged from the original plan of an undivided road space, and devised the solution of a 'noncompulsory bicycle lane'. This would offer a refuge for the bicyclists, away from mixing with car traffic on the main carriageway. The meeting proceeded with still many critical questions about responsibilities, liability, enforcement and safety, but also about noise and slipperiness of the proposed clinkers, the proposition to bring the zebra crossings back in, possible obstruction for the bus lines, environmental aspects of stop-and-go traffic, illicit parking, diverting traffic and the viability of the trees to be planted. The elderly associations voiced contentment about their views being taken into account, but did voice the expectation that some of the elderly would start to avoid the town center. 'Safe Traffic Haren' expressed their dissatisfaction about the municipality's failure to meet their requests to come up with evidence, and identified the plan as unlawful. They showed the alderman the red card (Gemeente Haren, 2001).

The mixed bicycle/pedestrian path, contracted into the ugly 'voetspad'[2] term, had been a necessary political compromise, the former alderman indicated. They had also diverged from the earlier plan consisting of clinker pavement only; on a few stretches they had decided for asphalt, to reduce noise. And finally, he had also given in to the urges to have zebra crossings after all. As the traffic official explained, this also entailed a compromise with their wish to get rid of those traffic signs. Zebra crossings are required to be accompanied with a sign announcing 'approaching zebra crossing'. The police indicated that without the sign, it would no longer be their business. Eventually they had left out the signs, however. Similarly, it had been quite a challenge to demarcate the 'voetspad', and delineate what would and wouldn't be allowed. In contrast with Monderman's mantra of 'no more traffic signs', the official had considered that enforcement was necessary to some degree. He indicated himself to be somewhat less idealistic about the human inclination towards social behavior (*22, 6/7).

The former alderman admitted he had actually forgotten about the zebra crossing compromise. As people were effectively crossing the street everywhere, it didn't matter that much, however. The noncompulsory bicycle lane had been a necessary concession. On May 21st 2001 the municipality council decided for the adapted plan on the condition it would be evaluated after a year. Rijksstraatweg reconstruction was completed by the summer of 2002. After implementation of a roundabout at the end of the Shared Space zone and a connection point further down the Rijksstraatweg by the end of 2003, the time had come to celebrate deliverance (Gemeente Haren, 2004a).

The evaluations, conducted by an independent agency, started with a public hearing in January 2004. In July the municipality published a first version of conclusions, to enable stakeholders to voice their reactions. On September 7th the municipality administrators drew their conclusions: *"The poll brings out that our citizens consider the town center*

[2] A Dutch contraction between 'fiets' (bicycle) and 'voet' (foot).

much more attractive than before the reconstruction. Whereas before reconstruction the Rijksstraatweg was experienced as a cleavage in the center, it has now acquired more the function of a dwelling space. Also the character of traffic has changed, it turns out to have calmed and mutually anticipating. Traffic behavior has become more social too; pedestrians nearly always being granted priority at zebra crossings. The car driver proves to allot the bicyclist the space on the carriageway. The greater majority of the population considers the Rijksstraatweg has been removed as a barrier, and that it belongs to the center in its entirety (Gemeente Haren, 2004a). Even when the earlier safety concerns were not confirmed by traffic accident statistics, the 'subjective safety' polls did reveal that many citizens still felt uneasy with the combination of bicyclists and pedestrians on the noncompulsory bicycle lanes. This yielded the choice between a return to the separate bicycle lanes, 'practically undoing the results of the reconstruction', or relegating the bicyclists to the carriageway. The municipality council opted for the latter way to clarify the position of bicyclists, keeping them away from the footpath. Subsequently a publicity campaign was started to communicate clearly that bicyclists would be obliged to take the runway, instead of the sides of the road.

The withdrawal of the noncompulsory bicycle lane effectively restored the arrangements as proposed by the project group. The former alderman explained that they had meant it as a safety zone for the vulnerable bicyclists. However, it turned out that practically everybody went for the noncompulsory bicycle path: Surprisingly docile they followed the 'noncompulsory bicycle path' sign, even the groups of scholars. It didn't work out in two respects: First, the intense bicycle traffic started to interfere with pedestrians, and second, the bicyclists on the carriageway were too sparse to prevent car dominance on the carriageway. With whole platoons of bicyclists on the road, no car driver would even consider to blast through, but the isolated bicyclist risked to become pushed away. For these reasons they eventually returned to the original plan. *"And the extraordinary thing is that there had been a lot of opposition the year before, but at the evaluation we didn't hear much of that anymore…so when the bench proposed to bring back the bicyclists on the carriageway, everybody was convinced…and I think, you see that more often in processes, I think that has a lot to do with the fact that in advance it is devilishly difficult to figure the consequences of it all…And after people had a year of experience, 'hey, actually it isn't that bad..'"* (*23, 2).

By the time that the noncompulsory bicycle paths had been withdrawn, Haren had already become a Shared Space showcase[3]. Hans Monderman had joined the Keuning Institute, a institute on spatial design and rural planning. And together with the province of Fryslân – his earlier working territory - and several Northwestern European municipalities he had managed to pull off a European 'Shared Space' project. As a successful Shared Space example 'doing away with traffic signs', Haren received one camera team after the other from all over the world[4]. In April 2004 Haren hosted an international starting conference for the partners of the European Interreg IIIb program. As a local newspaper announced under 'Haren boasts traffic design', *"In Haren the visitors don't only hear and discuss about Shared Space, but they can also see how the concept can turn out in practice. After all, the Rijksstraatweg had been laid down according to the philosophy of Monderman already in 2002, two years before the start of the European project"* (Haren- de krant, 2006). Haren participated through two other

[3] See http://www.youtube.com/watch?v=plgcFjCJJPA for a brief presentation by Hans Monderman.
[4] See further section 6.4 for further Shared Space developments.

projects in its municipality, though. Both involved reconstruction of the main roads, in the small villages of Noordlaren en Onnen respectively.

In a sense the projects were similar to the Rijksstraatweg reconstruction; the villages were confronted with the cleavage by the main road (displayed in figure 6.3). In Noordlaren the challenge was to apply Shared Space and protect the safety for the children attending the local school, situated along the main road. The Shared Space approach suggested removal of the separate bicycle lanes, and providing for a spatial context communicating clearly its dwelling function, and the presence of school children. As the former alderman recalled, such self-explaining context had been difficult to bring about in Noordlaren. So ideally the road and the school yard would be merged into one space clearly not dedicated to traffic flow only. Some form of fence proved indispensable, however, considering the school direction's responsibility for the children. All in all it had been a Murphy's Law trajectory, he did remember (*23, 6).

The former head of Public Works concluded similarly. Living there himself, he had said to his fellow citizens: *"Well, in the village, along that school, I drive 70 km/h…even if only 50 is allowed and 30 is desirable. But, if I know there are children playing around there, I won't. And in the evening, when the school is closed, I go…"* (*21, 3). Not that it had really persuaded the residents, but it had been his way to stir up reflection on the speed limits. The project had been quite a task for his own organization. They had had to integrate their contributions, be attentive to the feelings of the residents. The latter had been somewhat suspicious towards the municipality, and perhaps they were right, he added. And as it was an official Shared Space project, Hans Monderman had been the leading expert, discussing the design with his colleagues from the expert committee. Naturally he had taken the Noordlaren citizens on his bus tour, and had done a splendid job there. However, it proved hard to come to an agreement between the Shared Space experts and the Haren official, and eventually a design emerged that had the residents up against the wall. By the time it came to actual implementation the residents had more than enough of the experts. It had all become that complicated that time was running out. A bureau would draw the design sketches, but again everything went wrong that could go wrong: Trees indicated wrongly on the map, a scheme well over budget, and only during the working group session it turned out the plan hadn't actually been finalized yet (*21, 7/8). In the end the process had also been nice to do, though. Parents and teachers had become involved, and the school director had given essential support. The children of the school had done a whole project on refurbishing the school yard, led by an artist to guide their creative process. Figure 6.4 displays the eventual layout.

The encompassing reconstruction of the main road was completed by April 2008. Meanwhile, the Haren municipality had taken Shared Space as a guideline for its transport policy. New residential areas would be designed conform Shared Space principles, and prioritization and implementation of road schemes would be based not only on road construction and traffic technical considerations, but emphatically concern the surrounding public space as well (Grontmij 2008, 10).

Figure 6.3 Shared Space Noordlaren, before reconstruction (Grontmij).

Figure 6.4 Shared Space Noordlaren, after reconstruction (Grontmij).

On December 4th 2007 the Haren administrative bench addressed the municipality council on the recent evaluations of the 'Sustainable Safety' program. They started by noting significant decline in traffic accidents, especially in the 30 km/h areas – by far the larger part of Haren, in line with the Sustainable Safety objective to create large 'dwelling spaces'. With respect to speed limit compliance in the 30-zones Haren also did well: an average 37 km/h, with 85% of drivers staying below the 45 km/h. National monitoring had brought out that only 14% kept to the 30 km/h limit. They gave special mention to the Rijksstraatweg: *"The Rijksstraatweg is a good example of a relatively crowded road where the 30 km/h has been applied successfully. Intensity does not automatically determine a road's function. It is about adapted traffic behavior. Adapted traffic behavior consists of several aspects, of which speed limit adaptation is one. Other aspects are: Alertness, acknowledging the position of bicyclists, taking traffic coming from the right into account, granting priority and eye contact. This and earlier evaluations show that these aspects are met: People take each other more into account"* (Gemeente Haren, 2007, 3). The bench proposed to maintain the existing road categorizations, seeing no compelling reasons to mitigate speed limits. Moreover, they argued for further completion: *"Interviews brought out that people may 'forget' about the 30 km/h regime, as the signs are only in place at the edges of the areas. A repetition of signs has been asked for. On a few occasions this has actually been effectuated by means of a '30' marking on the road surface. Road design should be such that the desired behavior (amongst which, speed) can be read from the road. The call for more traffic signs and markings effectively means that design should be attuned further with the dwelling function"* (4).

The Haren official had seen them being reintroduced, here and there, the traffic signs. Citizens, notably the organizations for the elderly, had called for 'bicycle path' and 'foot path' signs, for instance. The police lacking legal grounds to take action, bicyclists couldn't practically be prevented from disturbing pedestrians on the curb. Citizens complaining about failing enforcement turned to the municipality council, stepping up the pressure to put back the signs as a matter of responsiveness. That 'circle' they had to mind a little bit, he considered. If necessary, it had to be done, but still they had this Shared Space guideline in the policy program (*24, 7-9).

Having moved to Haren only after the Rijksstraatweg reconstruction, he had been project leader for several spatial developments. They all had had this Shared Space dimension: *"Any plan, as soon as it is about more than 10 houses, has components of public space, infrastructure, and the concomitant question how to shape it…and it used to be plainly 'a road is a road, and a grass-plot is a grass-plot', but now one approaches those things differently of course…now you ask first, how to design this together with the residents…what is the function of this road, what is the function of public space…and then pretty soon you're coming to consider Shared Space ideas…at least, that is how it works for me"* (*24, 1). Still he also acknowledged the temptation to fall back on automatisms and classical design principles: Also the developers had their calculus and buildable-space ratios. Laying down Shared Space in new guidelines, indicators and percentages he did not consider of much help, however. Both Haren experiences and the European project had revealed that Shared Space hardly allowed for elaboration into recipes. "*…that's the special thing with Shared Space, for every particular project you have to consider how do you want to design it, what do residents want"*…(*24, 4).

The neighboring city of Groningen had also approached them, inquiring about application of Shared Space within their municipality. One of the possible sites would be a crossing on the very Rijksstraatweg, connecting Haren and Groningen. They had surely been willing to pass on their experiences, he said, reminding them of a multitude of practicalities they had encountered earlier. The plans shouldn't be pursued from the idea to 'have Shared Space', however; the design should emerge out of a Shared Space *process* (*24, 11-12).

He had also stressed it in his contribution to the Shared Space booklet that gathered the experiences with the approach: Shared Space being all about policy integration, it was *"…all too often associated with traffic signs (or their removal), and less with the underlying concepts. Shared Space tends to be allocated to Traffic management departments. Although this is not necessarily a mistake, there is a danger that this can isolate the process from the wider responsibilities of local government."* (Shared Space, 2008a, 17-20). He suggested to develop Shared Space further as a 'broad political philosophy', an 'underlying policy principle' to be embedded throughout the municipal organization. This could be done in the policy areas of social services, health, economic development, public safety, social well-being and equal opportunities. In Haren they had applied Shared Space in their elaboration of the Social Support Act, for example, as a principle through which to promote social cohesion.

Embedment of Shared Space he considered both essential and hard. He understood very well the difficulties of citizens to share space without the signs and the zebras they had grown accustomed to. Such change would take a long period of time to come about, and required sustained efforts from the municipality to communicate and explain Shared Space philosophy. Quite a challenge, he admitted, considering how communication tended to be forgotten amidst the immediate demands and hectic of ongoing operations. It was 'fragile', and unless it would be embedded and become part of the organizational culture, it might even evaporate again someday. As only an idea, it was a bit of a strange phenomenon. It was in the heads of some people, amongst whom he counted himself, but sometimes he wondered what would eventually remain -beyond that nice pavement they had (*24, 9/10).

6.3 Moving around in Haren

On October 22nd 2008 the Haren municipality presented a preliminary policy document on Shared Space in Haren. The report had been written by an independent bureau. Under the heading 'Evaluation and integration' it bundled the bureau's new and earlier traffic monitoring and polls, background data, and stakeholder opinions. It also made inventory of Shared Space applications in the municipality, and how it had become embedded. The report also featured an internal evaluation by the municipality as conducted within the framework of the European Shared Space project, and their vision for future integration of Shared Space into policy. The Noordlaren en Onnen sites were implemented too recently to allow for meaningful traffic safety data, but Rijksstraatweg accident and casualty rates displayed a declining trend (Grontmij, 2008, 24). For future Shared Space sites both objective traffic monitoring and the opinions and experiences of residents should be investigated. Still, evaluation in terms of traffic monitoring alone would not do justice to Shared Space, understood as a way of thinking and acting about public space design (28).

The internal evaluation noted similarly that Shared Space could easily become misunderstood, both by residents and the municipal organization itself. Moreover, the term continued to evoke mixed emotions: *"Rijksstraatweg reconstruction involved emotional discussions with residents about proposed changes, fear for unsafe situations has led to opposition especially from many senior citizens of Haren. And even though there is general satisfaction with the current lay-out of the Rijksstraatweg and the fact that barely any deterioration in safety occurred (to the contrary, the number of accidents declined), the name Shared Space still evokes reactions. In conversations with residents of new neighborhoods we now encounter the same emotions. Implementation of Shared Space in new neighborhoods is therefore not easy. Over the recent years the term Shared Space has acquired an emotionally charged character. Citizens have started to come under the impression that Shared Space is a governmental hobby horse. It would be wise to reflect on the question whether we would wish to employ the label Shared Space in the future, and whether it would be more effective to detach ourselves from it and come to agreement with each other about a set of conditions, processes and design commitments that together secure a desirable living and dwelling space."* (48)

Two months after the report's publication, on January 20th 2009, the Haren municipality organized a hearing to inquire about citizens experiences with Shared Space. Under the heading 'Equality or the law of the jungle?' it was reported in a local newspaper how, despite the improvement in objective safety, anxious feelings remained. Other than the suggested dilemma, the account showed a wide diversity of practical issues and concerns brought forward by the citizens: Calls for more extensive monitoring, restriction of delivery to shops, announcement of the Shared Space zone to incoming traffic, more road signs and personnel for enforcement, consideration of the orientation problems of the visually challenged, better communication, juridical clarification, reconsideration of the roundabouts at the edges of the Shared Space zone, and measures to make the clinkers less slippery. The representative of the elderly associations came with a list of points established by their focus group. *"The elderly associations have an urgent request to politics: Provide for periods of (car) traffic calming on Friday evenings and Saturdays, and keep regular surveillance on violation of the parking regulations. Can't the town guards be involved with this? Shared Space relies on shared*

space and shared responsibility, but an important precondition is that traffic rules agreed upon are being upheld. Ensure that the elderly dare to visit the town center. It is an augmenting group of residents!" (Haren – de Krant, 2009).

Three months later, on March 17th 2009, citizens' reactions were discussed in the traffic commission of the municipality council. Several parties declared their allegiance to the idea of establishing a list of traffic bottlenecks, and the alderman promised to provide for such list. The two roundabouts at the edges of the Shared Space zone would be listed at the top. Next, the chairman addressed the lack of enforcement that was also pinpointed by several parties: Parked cars and lorries cluttered the center, and made it more difficult for bicyclists to move around. He noted that for lack of a municipal police department, they had to rely on the regional police. Enforcement of parking regulations they did not count among their core tasks, however; a shortcoming, he considered. *"There is a notable augmentation of parking pressure on the Rijksstraatweg, which doesn't belong there - to everybody's disapproval. Otherwise, this isn't that bad from the Shared Space point of view, as the more cars (disorderly) parked there, the more carefully everybody will drive. But it is not allowed, and shouldn't happen. Those who do will be given notice that parking is not allowed, and can expect to be fined, but this risk is currently not that great and relatively many people living in Haren take the gamble to park more or less shortly and go shopping"* (Gemeente Haren, 2009, 9). The municipality therefore decided to have two of its town guards trained to become special enforcement officials, entitled to issue parking tickets.

The meeting continued with the difficult issue of how to proceed with Shared Space. Several parties wanted to keep the bench to its statement that Haren refrain from a 'missionary role' as regards Shared Space. Furthermore, several parties pinpointed that Shared Space did require 'the space to be actually shared'. And considering that this requirement was hard to meet in the rural areas of Onnen and Noordlaren and even on the Rijksstraatweg in the off-peak hours, they stressed that Shared Space only be applied where sensible and useful. The alderman agreed (Gemeente Haren, 2009, 11).

Eventually they had given up the struggle, the representative from the bicyclists association declared in an interview in February 2008. They had started their opposition against the Shared Space plans around 2000. The whole idea had been inconsequential, he argued. Reading from the 'Sustainable Safety' plan, he commented: *"'The Rijksstraatweg fulfills an important function for the opening up for the Haren and Glimmen centers, including the surrounding rural areas. The reconstruction plan has stipulated earlier it fulfills a traffic function.' Well…that's clear…the name says it all in fact, Rijksstraatweg. 'Except for the central part' Well…[laughs]…that's just impossible, of course…You've got this through going road, and then you say, well, it has a traffic function, except for…you can't do that, of course."* (*25, 3). Incredulous about the plans for the traffic artery, they had contacted the national traffic safety institutes. SWOV and CROW confirmed their concerns about withdrawal of separate bicycle lanes. The first, the Foundation for Scientific Traffic Safety Research, stressed the importance of clear demarcations between 'traffic' and 'dwelling' functions. They added that Haren seemed to be relatively short of roads with disclosure functions, the Rijksstraatweg being the exemplary case. Turning it into a dwelling space access road would require additional measures. Removal of separate bicycle lanes they advised against for several reasons: Mixing of traffic would occur under 'relatively high' traffic intensities, and the presence of buses would require a well broader road profile. Apart

from that there would occur an inconsistency with the other sections of the Rijksstraatweg, where the separate bicycle lanes would be maintained. The foundation also pointed out that recently zebra crossings were allowed in 30 km/h zones as well. And considering the heavy bus and car traffic, combined with the presence of many elderly and visually challenged, they would advise against removal of 'crossing facilities' (SWOV, 2000).

The bicyclists teamed up with the elderly associations and 'Safe Traffic Haren', who had similar objections: In their appeal against mixing of traffic they referred to the advice of the safety institutions, 'and in case these would not be followed, the municipality would be held responsible' (Verkeersveilig Haren, 2000).

His experiences with activism had taught him to be somewhat mistrusting, he explained. And also in this case they had had to consult the institutes to find out that zebra crossings were possible after all. Then the traffic counts had been wrong, and also the sketches of Shared Space sites he hadn't trusted for their representation of traffic behavior (*25, 3). And that was the essential point, he argued: *"Look, if everybody would just behave, and there wouldn't be any criminals, and no crime, and no nuisance…well, we all know that it is different in practice. And then I think, Sustainable Safety, and especially Shared Space, then it is said, 'people should engage with each other, make eye contact…with car drivers…, the car is here as a guest', this is all going too far for me. After all, making eye contact with a car driver, that isn't always that easy, sometimes they have these reflecting windshields, and sometimes you just haven't got the time to have a look at the car driver…I find it hard to believe it".* (*25, 2). Himself, he had become used to observe cars, rather than car drivers – for it was essential to react quickly. The alert bicyclist would manage, he considered, but for the elderly and young children, mixing would be a bad idea. There was no enforcement there, nor had the municipality adapted the design in accordance with a 30 km/h area. In the end they had just pitchforked a former 50 km/h road into a 30 km/h road (*25, 4).

More in general he saw the Dutch bicycle culture to be a bit on the decline: Fancy new projects attracting attention, yet existing bicycle infrastructure suffering from negligence all too often. To him the separate bicycle lanes were a historical achievement (*25, 5). Instead, Shared Space had it that bicycle traffic was to act as a brake on car traffic: *"…they really have that on black and white…and I think it is just a wrong premise, to say, bicycle traffic has to put a brake on car traffic, I think the idea is in the wrong…(…)…it is an unjust line of reasoning.."* (*25, 11). The bicycle was not be used as a means to an end like that. Without any Shared Space arrangement in place, one would just be ill-advised to purposively block a car! He had grown tired of resisting the plans, however, and accepted the new lay-out. It had improved the look of the town center, he agreed. And over time he had become accustomed to it, and just hoped that everybody would adapt. He still saw regularly how parked lorries and oncoming traffic had bicyclists trapped, and how they slipped between these little fences to seek refuge on the foot path[5].

The 2009 public hearing featured several speakers voicing their concerns about the 'vulnerable road users'. Compared to the earlier turbulent hearings, the elderly associations were still active in arguing for their cause, while the bicyclist association

[5] (*25, 6). See also http://www.youtube.com/watch?v=mkSBWP2CfLg for an inspection of traffic behavior in the Haren town center by 'Fietsberaad', a bicyclists' association.

had stepped back. Also present was a representative from Royal Dutch Visio, Center of Expertise for blind and partially sighted people, a revalidation institution. He explained the audience that for his clientele, Shared Space felt 'possibly unsafe', due to lack of the required eye contact. Unlike the fierce reactions against Shared Space of colleagues abroad, he did not want to reject the concept, however: *"As far as safety is concerned, things appear not that bad: Driving speed in the village centre is quite low, and the blind fellow citizen is taken into account. More challenging is finding your way without orientation points like curbs."* (Haren – de Krant, 2009).

As he explained in an interview a year earlier, his institution assists visually impaired people to cope with their limitations. One important element in this was to get a picture of their environment as clear as possible. Of course, the Shared Space requirement on eye contact his clients could not meet – they had to rely on being seen by others. But the really blind, he pinpointed, they were unlikely just to turn up in a Shared Space area anyway. They depend on a number of fixed routes, and have a hard time when they visit *any* environment for the first time. *"See…a large part of our target group is seriously impaired, but can't be recognized because they don't use white canes. They suffer from a wide range of visual handicaps, one can think of loss of visual acuity, loss of visual field, a lot of problems that differ from person to person, and these people are not recognizable as visually impaired…whilst they are."* (*26, 3). This was an essential problem, he concluded. Moreover, Haren happened to be a municipality with relatively many visually impaired, since they Visio has six offices in Haren.

Also for his clientele Shared Space entailed the removal of established certainties. Levelling out carriageways and sidewalks removed curbs as barriers, but also prevented blind people from using them as tacitle guidelines for their sensory canes. Another point were the clinkers, used to create a unitary road surface. The contrast between the red clinkers and the black asphalt on the carriageway, the *brightness* contrast, was relatively low. And taking into account the color-blindness of guide dogs and their concomitant reliance on brightness contrasts, something had to be done – be it with enhanced brightness contrasts or through additional training for the guide dogs. Furthermore, the Shared Space inclination towards square-like lay-outs posed navigation problems as well. Instead of safety, the real problem with Shared Space he considered to be navigation and orientation (*26, 3-4).

As regards safety, he could recall well how patient organizations had expressed their outrage and disapproval, 'without any closer examination of the concept first'. Similarly, he had seen the difficulty of town center renewal under the pressure of different interest groups holding on to their attainments and certainties. At Visio, situated along the Rijksstraatweg as well, there had also been loud calls to repair immediately the traffic lights right in front. Also in that case, people had been a bit rash in their judgments: The traffic lights displaying green almost permanently, they weren't attracting much attention from drivers. Alternatively, there were many options to enhance the visibility of the people crossing the zebra - a marginal narrowing of the road, for example. The premature judgments of alleged safety hazards and the recourse on the standard repertoire of traffic management equipment, this reasoning from 'entrenched positions' he disapproved of. Instead, he plead for a prudent approach. First 'see what it is', identify opportunities and threats, and assess potential gains. After all, nobody could claim absolute truths in these matters; not the people mistrusting Shared Space, nor could Hans Monderman prove his concept to be safe (*26, 12).

Thinking it over, he did consider Shared Space a promising concept. *"Reducing Shared Space to the traffic part, or the public space part, as that is what we are talking about now, then it amounts to refraining from apportioning all streams their own piece of public space, but rather, to have all people move along amongst each other…that has large advantages…that* may *have large advantages…I think that it is true indeed that by creating a kind of chaos you can make it safer as a whole…or safer…that people take each other more into account, and therefore have to be more conscious about how to behave in traffic, and to grant whom, where, when and which space…"* (*26, 2). The open approach to design of public space opened up new possibilities, he sketched: An orientation line could be an ornament, and the gutter for the rain could potentially be used as a guiding line – provided the cane wouldn't get stuck, or it would have bicyclists fall over it (*26, 13). Whatever the specific lay-out or application however, it would be essential to communicate clearly the underlying ideas, appropriate behavior should be clear to users, and they should have had a say in its design in the first place. In these respects he wasn't very satisfied with the way Shared Space had been introduced in Haren. He had observed quite some inconsequential designs, failing to display clearly how users should behave. The little fences in the town center were a case in point: *"You can consider them pretty…but they have been placed there to prevent parking…whereas those fences, they are actually anti-Shared Space, for blind and visually impaired people they are very awkward, they are objects they have to circumvent…if you're blind and you tip it with your cane, …The fence is mute, you see, people will park their bikes against it, they will use it for who knows what…(…)..'You park here, you get fined, and we keep a tight look on it',- that will make people learn. But for lack of manpower they put fences there…while it is counterproductive…as a bicyclist it robs you of a chance to escape…With two passing buses, there you are with your bicycle, hitting upon a little fence…that's risky. So that's how even such a little fence can turn out risky…Well, there are a couple of these situations…"* (*26, 6-7). Many choices for lay-outs in Haren were perfectly defensible, he said, yet the explanation of the associated new rules of conduct he had often found lacking (*26, 5). More generally he expressed his discontentment with the Haren municipality's organization of public participation; they better read that Shared Space booklet about it after all (*26, 9/10).

It had only been once Haren had started to manifest itself as a 'Shared Space municipality' that he and his VISIO colleagues had started to explore the concept. They had soon found out that there was much more to the concept than road design: Design of public space, citizen participation – the whole process of involving stakeholders he considered a very important element. Haren would have done well to include them as well, but they hadn't. Also Hans Monderman and his people clearly had initially overlooked the visually impaired (*26, 1-2). He had had a good conversation about it with him and the people from the Keuning Institute, who acknowledged this was a serious problem to take into account. He understood their eagerness to 'turn a threat into an opportunity', yet warned that the precise balance between those two had yet had to become clear. There were certainly opportunities, he indicated: Specific training for both the impaired people themselves and their guide dogs, in the first place. He also envisioned how over time solutions would become available through the increasingly

accurate navigation systems. This could enhance navigation on the streets and the detection of oncoming traffic, as well as the visibility to others[6].

A year later VISIO started up a research project on the navigation of the visually impaired in Shared Space areas, together with the Shared Space Foundation and the University of Groningen. As the psychologist explained her dissertation research, the project was to yield points of attention both for policymakers, spatial designers, and the 'mobility instructors'. The research involved an inventory of potentially problematic Shared Space sites and aspects, as well as interviews with visually impaired people living near Shared Space areas. The third phase would involve a field study, involving navigation assignments for people new to a certain Shared Space area. The people would be asked about the problems they encountered and the safety they experienced (Verkeerskunde, 2010, 7).

6.4 The advent of Shared Space

The Haren policymakers and officials had a hard time presenting the project group plans at the public hearing. The regional newspaper's dramatic description of events highlighted how in the end, Hans Monderman managed to get at least some of the message across. Several actors confirmed his vital role in the Haren reconstruction process, recalling his charismatic performance. With his light-hearted yet compelling slideshows he showed the loss of common sense and human standards reflected by current road design practices. The bus tours showed the hesitant public how an alternative approach was indeed possible, the proof of the pudding being his famous jaywalking act. Beyond demonstrating the scope for social traffic behavior, he also invited anxious visitors to *experience* Shared Space.

In 2003, at the time they were preparing the submission of the European Shared Space program proposal, Hans Monderman and his British colleague Ben Hamilton-Baillie[7] coined the name 'Shared Space'. Together with amongst others the Keuning Instituut and the province of Friesland they had formulated a program to test the approach in several European countries, i.e. in different institutional and cultural contexts. Lead partner was the province of Friesland, where many Shared Space predecessors had been implemented and the approach had become embedded in provincial policy. The program consisted of three pilots in the Netherlands (Haren sites, Friesland and Emmen), Ipswich/Suffolk County Council (UK), Oostende (Belgium), Bohmte (Germany) and Ejby (Denmark). Once the funds were granted the North Sea Interreg IIIb program could take a start in 2004, with 2008 as its expiry date. The concept was laid down in a booklet published in June 2005: "Shared Space: Room for everyone". The booklet presented 'a new vision for public spaces', exposed in clear language and richly illustrated with reference images.

The booklet explained how the division of public space had made it less of a shared space: *"The advent of the car meant that traffic-led thinking acquired a dominant influence on the design and use of public spaces. Public space tended to become space solely for movement and traffic. In large parts of the public domain other purposes have been subordinated to the traffic function and the space is designed from the wish to limit*

[6] Such electronic support of the physical guiding lines is hardly a distant future vision anymore. Through electronic beacons and application of information 'tags', extra location and travel information can be provided to enhance navigation for the visually impaired (Verkeerskunde, 2009c).

[7] See http://www.hamilton-baillie.co.uk/ for this Shared Space protagonist in the UK.

the dangers of motorized traffic. We are no longer sharing the space - we have split it up. Space has become a system of rules, prohibitions and orders and human beings are required to adapt to the system rather than the other way around. Social norms and values become subsidiary to traffic rules and man, as the user of the space, is reduced to a traffic participant. Shared Space succeeds by reversing these roles." (Shared Space, 2005, 12/13). In the Shared Space approach public spaces were taken as the 'heart of society', as a 'window on and mirror of society' (9); as a locus of social interaction they should be designed essentially differently from highways. Shared Space was not about rejecting traffic and its system of rules, but rather about distinguishing between traffic space and social space: Unlike highways, public spaces don't require regulated and predictable behavior (14).

Shared Space was a way to counter the dominance of the traffic function over the public domain. One reason was the detrimental impact on spatial quality and the loss of identity, caused by the proliferation of homogenizing traffic signs (see figure 6.5). Another, related reason resided in the erosion of people's involvement with public space (Shared Space, 2005, 23), the abundance of signs, regulations and obstacles discouraging people from social behavior. This implied missing out on people's self-regulating abilities, and the potential for self-organization: *"When different types of road users need to share a space and when the right of way is not regulated explicitly, they need to negotiate the right of way and they need to make eye contact"* (41). Finally, Shared Space also stressed how in its turn erosion of self-organizing capacity would be dangerous. Reliance on traffic ordering could feed false feelings of safety: *"Separating traffic flows often increases the feeling of safety, but in practice it appears to be counterproductive – the number of accidents with injuries increases. Separating traffic flows blinkers people and causes an increase in speed. Because everyone has their own lane, people take less account of other road users."* (45). The latter was captured in the slogan 'better chaotic than pseudo-safe'.

The social sharing of space was indicated to require several changes in the road design process. First of all, the dominance of the traffic sector would have to be rolled back, and design should be returned to politics (Shared Space, 2005, 28). Politicians should formulate a vision on public space as a starting point for a design process. Such design process would typically involve several disciplines to match the many purposes and dimensions of public space. And moreover, it would rely on the problem-solving ability of citizens, companies and social groups (29).

Monderman was the main protagonist making Shared Space into an emblem. Not only Haren but also the earlier showcases in Drachten[8] and Oosterwolde attracted reporters and delegations from all over the world[9]. As described in a report by the New York Times about Mondermans 'simple, if counterintuitive philosophy': *"But in spite of the apparently anarchical layout, the traffic, a steady stream of trucks, cars, buses, motorcycles, bicycles and pedestrians, moved along fluidly and easily, as if directed by an invisible conductor. When Mr. Monderman, a traffic engineer and the intersection's proud designer, deliberately failed to check for oncoming traffic before crossing the street, the drivers slowed down for him. No one honked or shouted rude words out of the*

[8] See the Shared Space institute website for video footage on these sites, commented by Hans Monderman. http://www.sharedspace.eu/nl/component/seyret/?catid=0

[9] The Shared Space team had the national and international exposure listed and put together in a short compilation: http://www.youtube.com/watch?v=ThaQjDLLJWA

window." (New York Times, 2005). Similarly, Der Spiegel reported how the European Shared Space project was attracting followers for its anarchist approach to traffic and its understanding of 'unsafe safety' (Der Spiegel, 2006). As a key developer of Shared Space Monderman received an honorary doctorate in Santiago de Chile, a nomination for the World Technology Award for the Environment in San Francisco 2005, and the Dutch ministry of Home Affairs lauded him as 'Innovator of the Year'. When he died in the beginning of 2008 an obituary noted how he, like the proverbial prophet, hadn't received much praise in his home land, however (Friesch Dagblad, 2008).

As an independent researcher, 'Baluw' sought to exert his influence on a variety of mobility-related topics. He described himself as an outsider. On his website he kept track of mobility issues mainly in his hometown Amsterdam, but also national and international issues (www.baluw.nl). He declared himself an admirer of Hans Monderman and his traffic philosophy - even when self-organizing traffic wasn't that new a concept. *"You can call it a conservative vision, as it rejects almost all (traffic) measures, and thus returns to the bare street we used to have until the seventies: sidewalks and a carriageway".* He entertained contacts with like-minded researchers[10] and activists primarily by e-mail and telephone, while seeking to convince local politicians and website visitors of his critical views. He was especially concerned about the tendency to separate traffic and the widespread reliance on traffic lights. The traffic lights, he considered, were based on a basic misconception about the self-organizing capacity of traffic participants. Moreover, they hampered traffic flow - with the concomitant adverse effects on air quality[11]-, they frustrated drivers, incited speeding prompted by the green signals, and created dangerous 'blind corner' situations as bicyclists gathered before the red lights. Analyzing casualty data and research reports he found confirmation that in fact, 'traffic lights make victims'. From the side of various authorities he received evasive answers however, if at all. As he reacted on his website: *"The point is, that the alderman and his officials are in the position to know traffic lights are deadly, and refuse to admit it. My advice: It is best to reconsider it now. It has been a widespread fallacy".*[12]

Figure 6.5 'Dominant traffic function' (Shared Space, 2005, 36)

Figure 6.6 'Traffic lights make victims' (baluw.nl).

[10] See Cassini (2006), and http://www.safespeed.org.uk/ against speed controls.
[11] See also Ch.4
[12] http://baluw.nl/index.php?id=143#c567

In June 2006 a journal for traffic professionals brought Hans Monderman's Innovator of the Year award under the attention of its readers. The winner was quoted to say that even when the adherence abroad was a bit greater, he didn't feel misunderstood in his home country. *"On the other hand, to his opinion the Dutch 'Sustainable Safety' principle is reasonably in harmony with 'Shared Space', that propagates that public space be restored to human standards, not stuffed with white lines, traffic signs and lights, but accommodating good old eye contact and common decency"* (Verkeerskunde, 2006). The responses of the SWOV safety research institute and the CROW knowledge center[13] were given under the heading 'Concerned': *"'Shared Space is only eligible for 30 km-areas', SWOV and CROW posit. There it is in harmony with Sustainable Safety. On disclosure and arterial roads 'Shared Space' can really clash with safety principles. 'There is the fundamental difference that Sustainable Safety adapts the environment to the capacities and limitations of people. Shared Space, on the other hand, presupposes in a way that people will adapt to the environment, provided it is designed in a certain way', SWOV says."* (Verkeerskunde, 2006). Except for the 30 km/h areas, CROW also saw some scope for Shared Space application outside built-up areas, though. SWOV considered it too soon to give a final judgment; 'Only after thorough evaluation of safety effects the method can be properly assessed.'

Shared Space and Sustainable Safety really had a lot in common, a former colleague of Monderman explained. In the 1980s they had been colleagues in adjacent provinces, and at the time Sustainable Safety was being developed as a more fundamental approach to traffic safety. In its initial theoretical shape the approach posited the human standard against the traditional approach that focused on traffic-technical measures. The physical environment, the vehicles and education, they were all secondary to the central point; the functionality of people. Once the vision had eventually been elaborated into the Sustainable Safety program for municipalities however, many considered the dwelling areas/traffic areas distinction had been pushed too far. Both Hans Monderman, he himself and others had been dissatisfied about it (*27, 1). Especially with regard to the dwelling spaces he agreed with Mondermans objections against the overly traffic-technical design approach, focused on uniformity and predictability. He explained it was all about people's capacity to cope with traffic complexity. The degree of complexity depended largely on speed, speed differences, traffic intensity, and in relation to those, the complexity of the physical environment. Further considering that people cope with this complexity primarily by storing experience and forming expectations, design should ensure a certain conformity with expectations: *"So, the more complex the situations get, you have to ensure the expectations can be better met. And there you dearly need uniformity, and therefore, a certain traffic technical solution. So, the more traffic, the higher its speed, the more important it gets to have a certain degree of uniformity. But inversely, the slower the traffic, the less interesting it is to focus on uniformity. In other words: In dwelling areas uniformity is nonsensical."* (*27, 2).

Dwelling areas could very well be designed as attractive spaces for people and as places with an identity – there was absolutely nothing against that. In fact, he had seen a more general shift away from traffic-oriented design. Not only in the highly overregulated UK, where Shared Space was received as a radical alternative, but in many other countries he noted a growing inclination to design for places, rather than traffic flows. In Germany and France, such design was not that exceptional – even when generally

[13] See 6.2. and 6.3 for the ways in which concerned Haren citizens introduced them as authoritative experts.

motivated by spatial-aesthetic grounds. "*So…it had been around already, it just wasn't called Shared Space. That development was gestating on many fronts…and Hans Monderman as an excellent performer has played into it in a very vivid and fascinating way…but again, that doesn't necessarily mean it is correct…"* (*27, 10). He also pointed out how since the early 1990s, guidelines on traffic rules and signs had adopted the principle that desired traffic behavior preferably be enforced through road design rather than traffic rules. The legislators themselves as well had started to cut away at the 'forest' of traffic signs, and shift responsibility to road users. Also in that sense Shared Space wasn't as new an approach as it appeared; it only applied the new principles more consequent and extensive than was usual (*27, 11/12).

Shared Space was a design philosophy, he stressed - not a traffic safety philosophy. He noted that many of the Shared Space schemes had in fact started from the desire to revitalize public space. There was nothing wrong with that, he emphasized, but he did object to the safety reasons added on to those projects (*27, 6). Moreover, the approach had become donned in a political guise, and accompanied with a wrong storyline. *"The problem is that Hans has started to lay emphasis on communication between people. That would solve everything then, it shouldn't be minded by government, people were to do it by themselves. That is a neoliberal conception of how we should engage with each other…and it may very well hold, but only as far as people are actually able to do it. As long as you're dealing with fairly homogenous groups of people. From the moment you're not dealing with homogenous groups, with respect to abilities and to motives – as that plays its part as well -, then it could turn out otherwise. In dwelling areas you will encounter the full spectrum, as regards abilities – from young children to the highly aged. Are they able to communicate with everybody? Does the addressee open up the possibility to do so? Are the power relations such that communication takes place fairly?"* (*27, 3). Continuing on the disturbing function of reflecting windshields, he dwelled on the more general condition of the powerful position of car drivers. Not for nothing the liability for accidents was placed upon car drivers, he indicated.

The abilities to cope with complex traffic situations largely relying on experience and expectations, especially the elderly could be expected to have difficulties with the Shared Space approach to safety (*27, 2, see also Verkeerskunde, 2009a). The 'safety through chaos', he considered it a way to evade choices. The Haren Rijksstraatweg he considered a case in point: *"I mean…what is it then exactly, that area? Is the Rijksstraatweg a shopping street? Or is it a traffic area? What did you choose for? Well…you didn't choose at all."* (*27, 5). This half-heartedness applied less to the Drachten Lawei square, he indicated. There the road *was* self-explaining. This underlined his general point that the flaw resided more in the accompanying storyline than in the Shared Space projects by themselves. As he had written in a congress paper, the idea fitted well with the Zeitgeist of emphasizing citizen's own responsibilities. In practice, Shared Space mixing of traffic wasn't always applied as radically however – and fortunately so (Methorst (2007, 3, 16)).

While traffic safety quarters were skeptical and awaited evidence on the safety-through-chaos idea, Shared Space proved less controversial as an approach to public space design. As described in a Shared Space portfolio from a leading urban design bureau in the Netherlands, they always tackled spatial issues involving several disciplines:

Landscape architects, urban designers and traffic engineers. This multidisciplinary approach allowed them to capitalize optimally on the opportunities afforded by an area. It enabled to strike an optimal balance for the question present for any public space: *'Is it to be a dwelling space, a traffic space, or a mixture of those'?* (Royal Haskoning, 2008, 2). The portfolio featured a collection of sites throughout the Netherlands, accompanied with short texts about the design challenge, visuals of the old situation, design sketches, and the new situation. (Figure 6.7 displays one of those sketches).

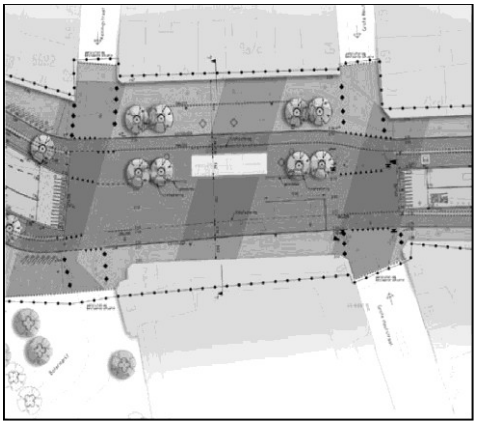


Figure 6.7

Shared Space scheme. (Royal Haskoning, 2008)

'Shared Space is touching ground', one of their designers had written in a traffic professionals' journal (Koolen & Andriesse, 2008). In another article she noted several studies to have brought out that subjective unsafety and the evoked carefulness of road users generally improved safety. Moreover, the application of a unitary surface with less signs, lineage and height differences made for a 'communal, more mild and quiet appearance'; an appearance that would be appreciated more (Koolen, 2008, 30). Shared Space amounted to holist design, every site requiring a tailored integration of the particular traffic intensities, landmarks and facilities, and function. Collaborative design by traffic specialists and public space designers could be difficult at first, but could be furthered through a distanced stance towards conventional guidelines. The integrated design was strongly related to the main principle of Shared Space: Integrated use of public space. In the process both disciplines would be confronted with diverging goals - but after all, users should be understood to attach different purposes to public space as well (Koolen, 2008, 33).

Apart from its traffic and urban design aspects, also the non-spatial dimension of Shared Space attracted attention. Around 2006 Hans Monderman was approached by a highly ranked official from Microsoft, for example, who had followed the experiments with unregulated communications with interest. Similarly, Monderman received the 'Innovator of the Year' award for what was recognized as an innovation in public management. The prize was sponsored by the Home Office's commission on 'innovation of public management'. In a commissioned paper Shared Space was taken up as a promising steering model. Unlike regulatory modes of societal organization Shared Space was understood to be footed on spontaneous compliance, with noncompliance as the exception rather than the rule. *"Shared Space deliberately creates situations of controlled unsafety, trusting in the resilience of traffic participants. Steering aims to enable people to be resilient. (...) Shared Space tries to steer from the principle that people share public space, from the idea that as soon as it becomes*

practically possible, people will behave as co-owners with co-responsibility. From that point they will really 'share' space, rather than merely 'use' it. Steering at present, the argument goes, takes away co-ownership, both as it is felt and practically. People don't consider themselves owners and design prevents them from interaction. This is how users start to maximize their own interests in a way that detracts from the interests of others and the collective, no longer recognized as such. (…) In an interactive design process the lay-out of public space is arranged such that the actors involved are enabled to act upon their co-ownership and responsibilities. In practice this means that many of the 'traffic-regulating' obstacles and traffic lights are removed and wide open spaces with an attractive and 'pretty' appearance remain." (Van der Steen & van Twist, 2008, 41/42).

In February 2008 the project manager for the European Shared Space project reflected on Shared Space past and future development. His beloved colleague Hans Monderman had passed away the month before. And as the EU project would be rounded off by June that year, there was more than one reason to devise ways to consolidate, and continue with, Shared Space. 'The momentum was there', he indicated, feeling they were entering a new phase in which they had to institutionalize what had been developed. They did no longer have a standard bearer like Hans Monderman, but there was enough to build on (*28, 6).

His province of Friesland having endorsed Shared Space from early on, they had been lead partner for the European project. For the period after they had set out a trajectory of three years, in order to 'put it out on the market, so to say'. It was a bit beyond the proper tasks of the province, he indicated, but they had a very enthusiastic deputy to act as an ambassador. They sought to establish contacts with other provinces and national institutes, and they supported the initiative for a Shared Space knowledge center. As Shared Space formed part of provincial policy they supported the municipalities with Shared Space projects; after all, Shared Space primarily involved roads governed by municipalities. They had a coordinator and consultant dedicated to the task, and also sought to establish inter-municipal networks to further collaboration and knowledge exchange. Furthermore they had already established contacts with polytechnic academies to have traffic engineering and architectural students conduct research projects. They aspired to establishing a special Shared Space chair (*28, 1).

He noted how skepticisms remained, especially from the side of established traffic knowledge centers like SWOV and CROW. And also academics challenged them to come up with evidence, a requirement that remained hard to meet. Evaluation was not only a matter of traffic accident statistics, he explained: The Shared Space schemes generally concerned sites where little accidents occurred anyway, for instance, and registration tended to be unreliable. Behavior and experience should be investigated as well, he found, but he signaled that the appropriate methodologies hadn't been sufficiently developed yet. Skepticisms therefore remained; also on the side of administrators, reluctant to embark on an undertaking with little guarantees for success. He acknowledged Shared Space to be a bit vague: In the end it came down to the choice to endorse the idea or not, and to the question of courage (*28, 3).

The courage and commitment of administrators was the essential starting point for a Shared Space process, he stressed. Administrators should develop a clear vision, and give it sustained support. The vision should clearly indicate the outlines and side constraints, without imposing an end vision – such would be at odds with a Shared

Space way to conduct the process. And exactly the tension between open, free design and given constraints he found fascinating. It had learned him to look beyond his own discipline and take a broad outlook, and develop a sensitivity to the many opportunities afforded by a space (*28, 4). In order to have this variety of perspectives come out, a different, more open process was required. It was to be entered in a more uncertain mode, rather than systematically rounding off project phases. In that respect the European project had contained an internal inconsistency from the outset, he indicated frankly. In the end they had put together a number of projects with similar problems or challenges, but with visioning and decision-making in different phases. *"So as regards the leaders of the [overall] project, the projects are there for mutual learning, but well, you do have this particular project with its own life…so what you saw there was that next to that project orientation, -you've got to tell the board 'we're starting then-and-then, that is what it's going to be like',-…you found yourself in the odd situation that you have to make clear what it will look like in the end, while simultaneously you're actually still in the middle of the process…(..)…and well, there you see that a lot of compromises have to be made, as the environment responds differently, which in itself is really fascinating…"* (*28, 5).

Even when acknowledging how some compromises had been unavoidable and others had actually brought an improvement to the eventual layout, some designs wouldn't really live up to the Shared Space standard. He recalled well how especially the expert team had considered some schemes 'not really the way it should, to express myself a bit mildly'. In a few cases they had managed to adjust things a little. He recalled how in one case they had talked about possible add-ons in later phases, so as to make it a little more 'Shared Space – like' (*28, 5). They had pondered over the idea of a Shared Space 'trademark', but hadn't really made it into an issue. The concept had been registered, he thought, but he didn't know much of the details: In the end it was more about giving the good example, rather than forbidding people to use the Shared Space label (*28, 8/9).

The European project partners gathered their reflections in a new Shared Space booklet that was released in February 2008. 'From project to process' started with the observation that the approach had 'found wide acclaim all over the world', but also noted many headlines to have focused on the 'surface features' of the Shared Space philosophy. The experiences with the various Shared Space projects and the 'implementation of the Shared Space vision' had led the partners to recognize the design *process* as equally important, however (Shared Space, 2008b, 5). Reflection on the participatory processes had yielded several lessons: The importance of strong administrative commitment and vision was actually confirmed. The new insights were that this was also vital to ensure sustained cross-sector collaboration, and to foster an organization-internal visioning process from the very outset. Especially the officials and specialists had signaled Shared Space to require an altogether new way of working, finding it far from easy to adopt: *"It is very difficult for us to let go of familiar practices and adopt a new attitude. To avoid accidents from happening we draw up endless streams of reports, protocols and procedures. These are the administrative equivalents of traffic lights and the familiar plethora of mandatory and prohibitory traffic signs… and they have a similar effect: We stop thinking. The primary change that the Shared Space concept requires is that people learn to think for themselves again and take responsibility."* (12/13).

Administrative commitment and vision should create the conditions to have officials 'think for themselves and take responsibility'. The same applied to participation of citizens: Assessing participation levels, many members of the partnering organizations came to realize that participation in their municipality had been more limited than they had thought it to be. And as many officials had wanted more far-going participation but lacked the mandate (Shared Space, 2008b, 21), administrators were recommended to lay down clearly the desired level of participation. This would be a matter of political choice, but *"On the basis of our experience with Shared Space processes so far, we can tentatively conclude that the maximum level of participation that can be achieved in a Shared Space process is 'advising' or, perhaps, 'co-determining'."* This maximum level was related to a dilemma encountered by many Shared Space partners; the difficulty of maneuvering between 'dilution' and 'manipulation', or between innovation and participation (27).

On June 10th 2009 the Shared Space Institute opened in Drachten, Friesland. The institute was to function as a focal point to develop a new knowledge domain around Shared Space, broadening the initial focus on traffic and public space. As stated on the website, *"the way we design and use public space, provides insights into our view on society."* [14] Research would be targeted at the public realm, both in the physical and the mental senses. In all cases it would maintain a strong connection with practice, starting from questions raised by practitioners, and conducted in close cooperation with them[15]. Consultancy and network building activities were the other pillars in the stated mission to strive for knowledge creation, transfer and application. The broad profile of the institute is displayed in figure 6.8.

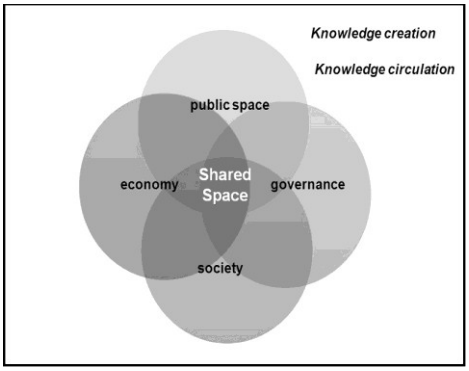


Figure 6.8
Shared Space profile.
(www.sharedspace.eu/)

Shortly after the opening of the institute, one of its associated consultants told about his activities. After Hans Monderman had moved to the Keuning institute, he had continued his work for the province of Friesland. Together with two colleagues he was on the move almost the entire week, offering advice to municipalities, provinces, citizens and various organizations about what use Shared Space could be them. Requests were coming from increasingly different quarters: Usually traffic, but also the building inspectorate, spatial planning, rural planners – even the health care sector and elderly associations starting coming with requests to have Shared Space 'brought in' somehow. They were keen on taking a position between the principal and the bureaus responsible

[14] http://www.sharedspace.eu/en/activities/research
[15] In the summer of 2009 the Northern Polytechnic of Leeuwarden launched an encompassing research program 'Respect instead of rules', http://www.sharedspace.eu/en/about-us/news?start=32

for implementation: In this way they could secure the coveted independent position, whilst incubating the bureaus in the process. The independent position was very important, he explained, preventing any suspicions amongst citizens about his being 'one of the municipality', or alternatively, 'one from the bureau'. He wanted to stay involved throughout the processes from the very beginning to the end, or until the start of implementation. The initial phase always received their special attention; he sought to ascertain the municipality was really willing to go that way. Politics, but also the people from maintenance and from spatial planning, they all had to be 'taken along' throughout the process – not to mention the citizens: *"And what we often do with this 'starticipation'*[16]*, is delve deep into the problems, establish the objectives, like, what is it that we all want, - we're not talking solutions yet, as it will only get us fighting -, and then we start sketching from the side of the citizens, with a working group, a sounding board group, a project group, or a group of municipality officials together with citizens, and we take things through with them…often it is about taking out some cultural-historical things first, like, let's have a look on some old postcards, or let's pay the elderly home a visit to ask how it used to be…And then slowly we start building things up…"* (*29, 1). This is how they would start sketching, refine those, involve the people responsible for implementation, and also undertake activities in communication and education.

All things being nice, he didn't want to get around the political reality that raised the questions about costs, about safety, and about the evidence for this approach to actually work. The need for an evidence basis had been an important reason to establish the research institute, and to involve researchers with the projects to raise questions for further development. They continuously encountered the questions for further explanation of that 'nice idea of participation', and for backgrounds, underpinning and evidence (see for example Verkeerskunde, 2009b). Just the other week people from the police had shown themselves quite sympathetic to the idea -but they as well had suggested to publish more about it, and to have the message settle broadly (*29, 2). Beside the slowly emerging endorsement of the police, he saw professional training to be 'lagging miles behind practice'. This is why they had sought collaboration with the polytechnic academies. Together with the CROW traffic experts they would start organizing Shared Space courses throughout the country (CROW, 2009). The CROW guidelines, they were a kind of bible to the traffic and construction engineers, he indicated. Their engagement with CROW had started three years ago, when they started a joint project on the design of rural roads. That had gotten the process started: Commenting on the guidelines the latter had defended that these had never been intended to be followed literally; tailor-made solutions were required. Still the problem remained, he indicated, that the guidelines often served to legitimize design by the book. On the other hand he also saw CROW acknowledge themselves that they had to change their approach. *"…and now they say themselves, 'we can't sustain this anymore…there is a development going on, people [claim to-B.P.] know all about traffic, or they don't, but everybody knows it all about everything…and we have to take this direction as well'."* (*29, 6).

After more passionate expositions about his experiences with Shared Space processes and his attempts to get the message across, he came back to his earlier remark that they

[16] The Dutch neologism is 'beginspraak', referring to citizen participation in a particularly early stage.

couldn't possibly do it all alone. People had to tell each other about it, and education and research were vital. It would be long road to go, but a nice one at that (*29, 13).

After the following timeline of events, an assessment of innovation outcomes follows in section 6.5.

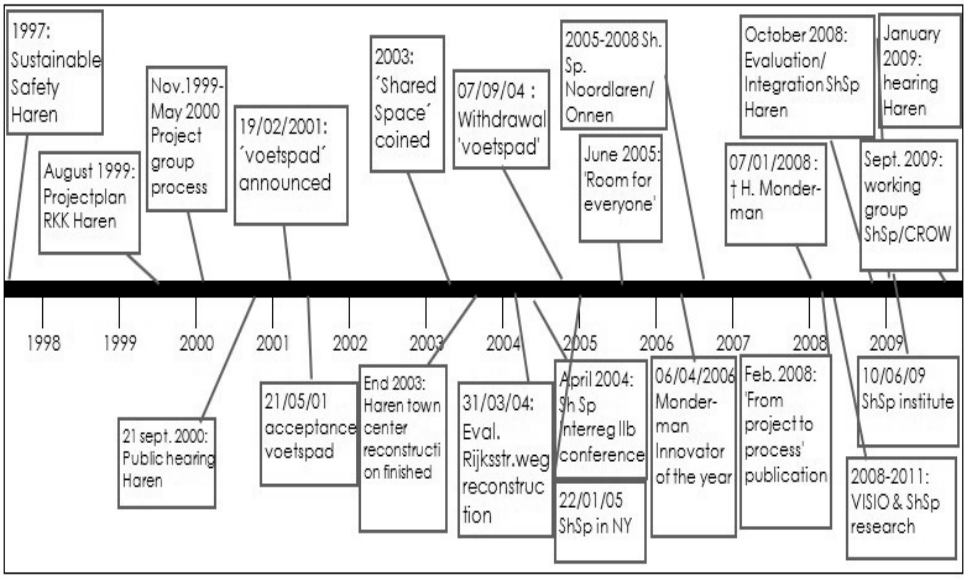


Figure 6.9 Timeline Shared Space

6.5 Innovation outcomes

6.5.0 An initial ordering of footage

Having described the innovation's circulations through the experiences of various initiators and translators, a rather chaotic picture arises. The first step to gain understanding of this innovation journey is to step back, and take stock of some basic characteristics. Ordering this relatively raw material through initial assessments of outcomes and development patterns helps establish striking events, salient issues and rudimentary patterns. These can be used as leads for subsequent translation-dynamic analysis **(6.6)**. The following three questions help to develop a basic overview of the innovation journey as a whole: *Was the innovation attempt successful, as perceived by initiators and stakeholders* **(6.5.1)***? What was achieved in terms of system innovation* **(6.5.2)***? What basic innovation patterns can be distinguished* **(6.5.3)***?*

6.5.1 Innovation success

One question relevant to any innovation process is what its yields were, and whether it met expectations. Yet considering the aim to approach innovation as two-way traffic, it is important to consider that 'success' and 'failure' are in the eye of the beholder, and that evaluation of success is bound to be ambiguous and contested. Hence the following question:

Was the innovation attempt successful, as perceived by initiators and stakeholders?

When considering the success of Shared Space, the first thing that is striking about the case is the ambiguity involved: *'It's a chaos around here!'*, people complained about the Haren town center sometimes. *'Well, then you understand exactly what it was intended to be'*, the former alderman had often replied enthusiastically, *'you may not agree with me about it, but at least you saw its purpose…'* (*21, 2/3). The alderman's anecdote captures the ambiguity of Shared Space success elegantly, the 'chaos' remaining contested from the moment it welled up in the project group. Despite general endorsement of the town center revitalization and reassuring accident statistics, concerns about road users' safety remained. The bicyclist's organization representative felt Shared Space used bicyclists rather than serve or protect them. Similarly, the elderly organizations in Haren opposed the plans for the dangers and anxiety conferred on their constituency. Later on they indicated that some even avoided the space they did no longer dare to share. A first observation on innovation success is this **controversy**.

Even the critics agreed the town center had become more pretty, though. Not for nothing Shared Space gained adherence as a way to create attractive dwelling spaces. The Haren municipality protagonists did achieve the rejuvenated town center they had strived for. Moreover, the international recognition for the innovative design yielded them the funds for new schemes in their municipality, and afforded them a profile of an innovative municipality. A second observation on innovation success is this **successfully implemented upgrading**.

The municipality's internal evaluations suggested restrained usage of the term Shared Space however, as the term evoked negative associations. Impressions had arisen of Shared Space as a governmental 'hobby horse'. Municipality officials and citizens agreed that the intended 'innovative participatory process' had left much wanting. Even when the design had really emerged from civic problem inventory and consecutive deliberations of the project group, - the municipality officials 'wouldn't have dared' to come up with the plan -, the eventual presentation to the wider public had been a cold shower. With hindsight, it would have been better to have the plan presented by the members of the project group, several protagonists indicated. The initiators had hoped the newspaper reports on the project group's proceedings would take along the wider public, but found this belief defied; the plans were hardly acknowledged as plans developed by citizens themselves. A third observation on innovation success is this **cumbersome process**.

At the Haren public hearings the initiators harvested unexpectedly firm opposition, with Hans Monderman stepping in to 'sell' the plan. Several Haren municipality officials recalled his crucial role in bringing home the plans to mix traffic. His visionary leadership helped people to make the step to Shared Space order. On the other hand, as transpired through the European project as well, Monderman wasn't much inclined towards compromises (In Haren these occurred through the noncompulsory bicycle lanes, the reappearances of zebra crossings and traffic signs, and through the tightened enforcement of parking regulations). A fourth observation on innovation success is that it involved several **compromises**.

These compromises may detract from the innovative lay-out and betray Shared Space design principles, but on the other hand they signal citizen involvement in the shaping and operation of shared space. As testified by the many suggestions at the public hearing in 2009, the 'innovative participatory process' became ongoing, extending beyond the reconstruction project. In this respect, the ensuing compromises and mitigations add to

the success of the innovation attempt. A fifth observation on innovation success is that the innovative project became prolonged as an **ongoing process of renegotiation**.

Particularly striking about the case is the wide spread of initially marginal innovation, however: Haren town center reconstruction was followed by other Shared Space applications in the municipality. Moreover, the European project and the international exposure of the Shared Space showcase inspired a great manifold of actors towards Shared Space ambitions. A sixth observation on innovation success is this **diffusion**.

6.5.2 System innovation achievements

One question is the innovation journey's significance in terms of various actors' ambitions, yet another is its significance in terms of *system* innovation – the typically organization-transcending changes that alter the relations between actors, and mitigate dominant cultures, structures and practices. Instead of moving the camera between various initiators and translators, this rather involves the researcher's helicopter view on the changes in the network as a whole:

What was achieved in terms of system innovation?

Sometimes he wondered what would eventually remain of the endeavor, more than that nice pavement, a Haren public servant expressed in 2009. Zebra crossings and traffic signs reappearing under pressures from the public, it seemed as if Shared Space had only removed weeds, without eradicating the overcrowding traffic signs altogether. The lasting impact of Shared Space he saw to depend on future administrations, management and citizens. In 2009 several members of the municipal traffic commission argued for cautious, restrained further application of Shared Space. They pointed out how not only in Noordlaren, but even in the Haren town center at off-peak hours, traffic conditions worked against a proper functioning Shared Space: 'Space had to be actually shared' for the concept to work: This understanding indicates in a nutshell how the innovation attempt became a common reference, yet without becoming fully institutionalized. A first observation on system innovation achievements is this halfway embedment, **between fashion and institutionalization**.

Haren became a Shared Space showcase, enabling Hans Monderman and his partners to weld several earlier applications together into a Shared Space emblem. The European project led to international exposure, the formation of an international Share Space network and knowledge exchange. Supported by a network of equally committed people Hans Monderman became a rewarded standard bearer of what became acknowledged as a fundamentally different approach. The approach was laid down in, amongst others, the 2005 and 2008 booklets. A second observation on system innovation achievements is this establishment of a **brand**, and the **articulation of an alternative vision** on dealing with traffic.

The establishment of the Shared Space institute marked a consolidation of the Shared Space 'brand'. It formed a basis for further institutionalization, both through consultancy, collaboration and as a platform for research. The institute was intended to establish Shared Space as a serious alternative: By then the Shared Space partners had already started to shed the iconoclastic 'removal of traffic lights' slogan, shifting focus towards the broader issue of freeing design processes from 'mental traffic lights'. This shift also involved critical scrutiny of the concept's merits and limitations, responsive to the enduring calls for scientific underpinning: A pacification with the traffic

management and enforcement ‘establishment’. A third observation on system innovation achievements is this **consolidating ‘mainstreaming’**.

During the Haren design process, concerned citizens confronted the initiators with their negligence of road design guidelines. Given the traffic intensities, the envisioned mixing of traffic and creation of dwelling space would be ill-advised: Invoking the authoritative judgment of leading traffic safety institutions, the citizens could convincingly argue the proposed ‘mixing of traffic’ to be inconsequential, and negligent of received wisdom. Almost ten years later, the Shared Space institute served as a platform from which to engage with these received insights: The research collaboration with VISIO taking up the under-explored consequences for visually impaired road users, new enforcement practices being deliberated about with the police, polytechnic and other knowledge institutes inserting Shared Space into the curricula of new generations of traffic and design professionals. Finally, the joint working group with CROW indicated the start of a deliberative process of joint reflection upon the authoritative status of road design guidelines. Future initiatives similar to the innovation attempt in Haren may thus be more in accordance with, or even be underpinned by, new general guidelines. A fourth observation on system innovation achievements is this **broad reconsideration of guidelines**.

6.5.3 Innovation patterns

Moving the camera along a variety of actors yields a multitude of views on what is difficult to decipher as an ordered sequence of events. Setting up a timeline is one way to order the footage, another is to observe whether the capricious innovation journey displays apparent turning points, repetitions-of-moves or accelerations: *What basic innovation patterns can be distinguished?*

Throughout its evolution Shared Space acquired both fame and notoriety. The ‘brand’ attracted worldwide attention to its counterintuitive and controversial idea of ‘safety through chaos’. The iconoclasm against traffic lights and signs was highlighted in the media, and Hans Monderman acquired wide recognition for his outspoken, no-nonsense approach. As noted earlier, the success of the Haren innovation attempt was controversial. Once Shared Space became actively branded as an approach to ‘roll back the dominant traffic function’ however, the concept acquired an ideological dimension: On the one hand the emphasis on empowerment and the trust in road users’ self-organizing capabilities, on the other hand the accusations of neoliberal indifference about the fate of vulnerable road users. A first striking innovation pattern is this **politicization**.

The reactions to and appropriations of Shared Space covered a wide range. Even apart from the aforementioned ideological dimension, it is also remarkable how Shared Space was endorsed for various reasons: As a design principle to arrive at attractive public space, as restoration of the human standard and common sense, as general self-organisation principle, or as a traffic solution. A second observation on basic patterns are these **diverse appreciations**.

The Haren innovation attempt did not start off as a Shared Space site, but *became* one. Serving as a showcase for the European project and the 2006 publication, it played a part in brand formation. Before that, Monderman’s early schemes in Friesland had served as examples in the Haren visioning process. A third basic pattern, therefore, is this relatively slow **brand formation**.

Not only the Haren reconstruction but also Shared Space application at large involved many compromises. As the traffic safety researcher pointed out, the showcased Shared Space designs tended to be far less radical than suggested by the accompanying storyline. The initiating protagonists described these concessions as consequences of conducting Shared Space processes: In the course of the European project the partners experienced that Shared Space was hard to fit in with a project-based modus operandi. It couldn't and shouldn't be imposed, it became only more clear to them, instead requiring a whole change *process*. They also came to identify an innovation paradox: Maximized participation could 'dilute' transformative initiatives, yet principled imposition of 'safety through chaos' would betray the commitments to self-organization and empowerment. A fourth basic pattern is this **struggle with 'dilution'**.

Acknowledging the above innovation paradox, the Shared Space protagonists took a turn 'from project to process'. In this 2008 publication they noted the worldwide 'rumour around the brand' to have focused on Shared Space's 'surface' dimension only. Instead, they sought to move beyond the understanding of Shared Space as mere 'removal of traffic signs', stressing the importance of an equally shared design *process*. Only a process-based approach would enable professionals, citizens and administrators to shake off conservative routines - the mental counterparts of the stifling traffic management arrangements resisted. Similarly, Haren sought to proceed with Shared Space as a broad social philosophy, rather than as a traffic solution. Next to 'dilution', the process turn also signals a fifth pattern of **broadening**.

6.6 The Shared Space translation sequence

6.6.0 Developing translation-dynamic insight

Having assessed innovation outcomes, it becomes easier to distinguish rudimentary storylines within the innovation journey. Yet as theorized in chapter 2, a key to understanding the course of innovation evolution is to consider the particular ways in which an innovation attempt is translated. Circulating through a polycentric society, an innovation transforms, and engages translators in different ways. Theoretically, certain *types* of translations can be expected to occur: Starting from a basic distinction between 'affirmative' and 'negating' translations and further differentiating within these categories, the discovery of translation-dynamic *patterns* can be enhanced. Distinguishing between 'non-translation', 'interference', 'embracement', 'modification', 'alien modification' and 'self-translation', translations tracing was sensitized to several foreshadowed problems and issues. Another point of attention was whether and how actors managed to 'synchronize' their translations. This initial categorization helps to carve out case-specific translation patterns: Construction of those involves first a closer look on the occurrences of interferences and non-translations, shedding light on the counter-forces encountered by initiators **(6.6.1)**. Next, the embracements, (alien) modifications and self-translations elicit rather how the innovation attempt was met affirmatively, and did manage to spread **(6.6.2)**. Having highlighted these dimensions separately, case-specific translation-dynamics can be established **(6.6.3)**. These 'configurations' form the input for comparative analysis.

6.6.1 Innovation ignored or resisted: 'Non-translation' and 'interference'

The idea behind these categories comes primarily from Luhmann: An innovation attempt may be very promising and meaningful to its initiator, but in a differentiated society translators are likely to receive it as irrelevant or even as disturbing. In the first case translations are marked as 'non-translation', in the second case as 'interference'. The latter category is especially salient as it highlights the counter-forces the initiators ran up against.

Shared Space only became a brand over time; the early schemes were rather **inconspicuous** spatial measures, not immediately recognizable as innovations. Hardly acknowledged as such, the innovation attempt **started marginal**. And even if Shared Space wasn't as revolutionary as often presented, Hans Monderman cleverly made it into an appealing innovation: Provided with an innovative storyline, the design approach gained the relevance initially lacking.

As observed under 'halfway embedment', non-translation also recurred later on, however. Also the Shared Space protagonists themselves noted that it was all too easy to fall back onto the old routines. Even once the approach started to receive much embracement abroad, reactions in the Netherlands remained much less enthusiastic. Typical for the enduring non-translation was the reaction by the traffic safety institutes: Indicating how Shared Space could be feasibly applied on certain categories of roads - as just another way to design 'dwelling spaces'. This reinstatement of received insights revealing little interest in the radically alternative approach implied, it relegated Shared Space to marginality. The innovation initiators had to cope with **recurring marginalization**.

Beyond non-translation, Shared Space evoked significant interferences, however - innovation success was not controversial for nothing. During the Haren town center reconstruction process the interferences surfaced especially strongly: The municipal officials and the project group members had been very enthusiastic about the plan that emerged, but the fierce opposition took them by surprise. Elderly associations, parents of young children and other citizens asserted interference with the **safety of vulnerable road users**.

The bicyclist association representative was especially clear about his objections against 'mixing traffic': It removed the separate bicycle lanes they had been struggling to conquer, their protective space against automobile domination. The plans thus interfered with the **bicyclist's organization's** very **identity** as emancipatory movement. Instead, Shared Space 'used bicyclists to put a brake on car traffic'. By contrast, as one of the Haren municipality protagonists opined, the bicycle lanes do not only secure space for bicyclists, but also confine them – only consolidating the car dominance they were supposed to reduce.

The police experienced interference with enforcement practices. Without traffic signs the police could only *advise* people to keep to the 30 km/h zone, lacking the authority to actually enforce – could they issue fines, or couldn't they? Similarly, the undermining of enforcement had administrators shy away from Shared Space – in case of accidents they might be held accountable. This **interference with enforcement practices** had citizens approach municipality council members, who in turn considered re-introduction of traffic control measures – a 'circle' they had to mind, a Haren official expressed.

Joining forces in their opposition to the plans, the 'vulnerable road users' invoked traffic safety expertise to back their cause. In the light of traffic safety guidelines the

innovation attempt appeared not only as a dangerous negligence of the vulnerable citizen, but also as an inconsistent design. *"Is it a dwelling space, or a traffic space?! How can you introduce a dwelling space within a through going main road?!"*, both the bicyclists' representative and the traffic safety researcher expressed their discontentment. Throughout Shared Space evolution these accusations of inconsistent design kept recurring; it went against received beliefs and established guidelines. Especially the friction with the road categorization system indicates its interference with a deeply entrenched traffic safety code - developed by traffic experts and legal actors, influenced by societal groups like the bicyclists association and car drivers organizations, enforced by the police and acted upon by citizens. Distinguishing dwelling space from traffic space with typically binary logic, Hans Monderman used to emphasize how codification had overtaken common sense and decency. So if the Haren reconstruction breached the code rather 'accidentally', Shared Space was actively branded as principled resistance: 'Never treat traffic participants like idiots'. These provocative statements interfering with the 'Sustainable Safety' principle to start from people's limited abilities to cope with traffic complexity, traffic experts kept prompting Shared Space proponents to substantiate their 'safety through chaos'. Beyond the interference with the vulnerable road users themselves, the **interference** with the **traffic safety code** was especially deep-rooted.

In the light of the above interferences, it is easier to understand the compromises made. They were politically necessary, the former alderman recapitulated the political dynamics at the time. This reveals an interference relatively independent from the particular spatial design: In spite of their intended participatory process, Haren protagonists could not ward off the impression of Shared Space as a governmental 'hobby horse'. As expressed in their evaluations, overly powerful Shared Space branding would risk further **interference** with **citizens' expectations about participation**.

It is interesting to see how Shared Space's international exposure stemmed largely from the very interference with the traffic safety code. Monderman was on the relatively safe side of the interference, representing common sense and decency against what could easily be framed as a faceless but omnipresent system. Monderman's charisma resided partly in his particular use of interference, playing all the registers. The in-your-face slideshows, confronting the public with traffic management's hyperrational 'colonization of the lifeworld'[17] and the loss of the human standard; the bus tours, indicating how things could be done differently; finally, his famous jaywalking act, inviting the audience to experience the slightly discomforting 'safety through chaos'. This **productive use of interference** helped to carve out Shared Space identity, establish the brand and secure a stage from which to operate[18].

[17] The 'colonization of the lifeworld', a term coined by philosopher Jürgen Habermas, refers to the way 'instrumental' rationality has come to dominate 'communicative rationality', the first creeping into societal realms where the latter is more appropriate. Shared Space reliance on eye contact and self-organisation is a typically Habermasian emancipation strategy, 'rolling back' this colonization.

[18] The activism of Baluw offers an instructive contrast. He modulated interference even more, confronting administrators head-on with the safety hazards of traffic lights. His confronting 'evidence-based activism' proved an uphill struggle against the traffic safety code however. As an 'outsider' he lacked the repertoire and the position to draft and enroll supporters.

6.6.2 Innovation adopted or adapted: Embracement, (alien) modification and self-translation

These categories stem primarily from earlier studies into the translation of innovations. They highlight that even when an innovation is not ignored or resisted but engaged with more affirmatively, this generally occurs not as 'adoption', but rather as adaptation. In the first unlikely but possible case, translations are marked as 'embracement', in the latter it is marked as 'modification'. If adaptation diverges markedly from the innovation intended by initiators, it is marked as 'alien' modification. Finally, adaptations by the initiators themselves are set apart as 'self-translations'.

Considering the deep-rooted interference with the traffic code, promoting Shared Space can be understood to be an uphill struggle. In this light 'Baluw''s attempts to have administrators pull out traffic lights assume Don Quichote proportions. Considering the reappearing zebra crossings and traffic signs, the innovation feat in Haren could eventually evaporate as well. As indicated with the introductory Latour quotation, this street 'furniture' accounts for a considerable part of the ties that keep traffic order together – all too strong ties, as the Shared Space protagonists hold. Indeed the subsequent shapes of the Rijksstraatweg road design are revealing: Compromises materialized in zebras and traffic signs, responsiveness to noise effects speaks from the asphalted part of the carriageway, and the subtle introduction of parking restrictions shows through the fences. The balance between negating and affirmative translations could be read off from the street.

The materializations are only moments in ongoing transformation between ideas, actions and objects however. Purely materialist assessment would overlook the constant renegotiation of Haren traffic order. The temporary 'noncompulsory bicycle lane' arrangement was invisible afterwards, for example, but it crucially enabled translators to experience and learn about Shared Space - about the importance of bicycle/car ratios, the impacts of changing traffic intensities, and more generally how mixing traffic worked out in practice. Telling is the expression that Shared Space be materialized only in places 'where space is actually shared'. Indicating how it sedimented as a common reference in Haren, the expression indicates **embracement of the general idea** that traffic management and spatial design imply choices about the sharing of space.

Yet this 'general embracement' does not so much denote widespread diffusion, but rather a range of modifications: The international media hype around the Space Space 'brand' and its charismatic standard bearer focused on the anarchist radicalism of the approach. The iconoclasm of the 'rolling back traffic management' message, the appeal to common sense and decency and the image of a determined lone innovator contributed to Shared Space's modification into an **iconoclastic symbol**. This facilitated rapid spread, yet typically the less spectacular elements of the innovation went lost in this modifying translation.

The **European project** allowed for planned diffusion. The different contexts yielded different modifications of the common concept, however: Depending on local spatial and administrative contexts, schemes developed with more and less pronounced innovative elements. In fact the innovation partners anticipated upon this **international variety** of elaborations, seeking to benefit from these differences as an opportunity for learning.

Shared Space also became acknowledged as an innovative and promising approach to interdisciplinary urban design. The Royal Haskoning bureau portfolio advertised the Shared Space approach for its integral approach and enhancement of spatial quality. Also other bureaus took up the concept, not so much for its radicalist message but rather as a **formula** for **attractive spatial design**. By contrast, other translators were less interested in what Shared Space could mean for traffic and public space, but rather valued it is a refreshing paradigm for social policies. Monderman was approached by Microsoft for his **innovative steering philosophy**, and similarly, the Internal Affairs commission rewarded him for his innovative approach to public management. These translators modified the innovation attempt for applications in non-spatial domains.

The 'safety through chaos' storyline met with wide appreciation, but few translators took it as a guideline for fundamental reorganization of traffic. An exception was 'Baluw', integrating Shared Space into his activist work. He modified it by singling out the argumentation for **self-organizing traffic** and applying it in the urban context of Amsterdam. His added message that 'traffic lights make victims' indicates how his modification implied a rather extreme position on self-organizing traffic – with less attention to Shared Space as public space design, or as a model for deliberative design processes. The latter aspect the VISIO spokesman considered Shared Space's particular strength: He considered it especially promising as an **open design process**, stimulating people to take each other more into account and to devise multifunctional designs. Whether deregulated traffic would interfere with his visually challenged clientele he considered another question.

The above modifications displaying various forms of 'adoption with a twist', together they allowed the protagonists to move beyond initial non-translation. The initiators followed this process of diversification closely: The experiences with the European project alone had learnt them that not all modifications would be as 'Shared Space-like' as desired. At times the shallow, 'diluted' schemes had the expert team frown. *"Shared Space requiring space to be actually shared"* posing a relatively modest modification, in 2009 a representative of the Haren elderly stretched the concept much further, stressing the looming enforcement deficit: "*Shared Space relies on shared space and shared responsibility, but an important precondition is that traffic rules agreed upon are being upheld."* Had he still been there to hear about this, this call for regulated space may have appeared 'alien' to Hans Monderman. Similarly, the Shared Space protagonists had their doubts about apparently **one-dimensional appropriations** that reduced the concept to a **simple traffic solution**, a **marketable 'formula'** for **public space design**, a **superficial expression of iconoclasm** or as a **fashionable façade** for business as usual. The various alien modifications they couldn't suppress however; they could only 'give the good example', as the leader of the European project indicated calmly.

The 2008 booklet 'from project to process' exemplifies how the protagonists responded to diversifying modification through self-translation. Reflection on the respective translations of the European Shared Space project led them to a **crucial self translation: the 'process turn'**, as the title of the booklet expressed. This involved a move from implementing projects to management of processes: Having encountered the tension between Shared Space design on the one hand, and the commitment to participatory processes on the other, the 'process turn' was a self-translation that clearly bent towards the latter: The Shared Space Haren policy document signaled how Shared Space could easily become misunderstood as a 'traffic management principle'. The Haren official

therefore held to his interested colleagues that they better not think of 'having a Shared Space crossing', and secure a properly participative Shared Space process first.

The process turn marked a break with the iconoclastic cultivation of interference. Instead, the compromises and **remedial measures** can be understood as facing, coping with, and alleviating deep-rooted interference. The protagonists increasingly acknowledged that the intended system innovation would be a matter of slow but broad change. The establishment of the Shared Space institute materialized this self-translation towards deliberation and knowledge co-production. The ambition to provide underpinning of Shared Space principles is indicative of an interference-avoiding strategy, no longer resisting but co-developing the traffic code. The establishment of the institute marks the initiators' move towards a broad **synchronization strategy**: Apart from giving guidance to various local translation projects, it acted as a deliberative platform. The synchronization strategy involved a range of joint explorations, education programmes, networking activities and awareness campaigns, targeting different interferences - the working group with CROW addressed traffic safety and design guidelines, the workshops with the police involved enforcement practices, and the research project with VISIO explored the space sharing abilities of the visually impaired.

6.6.3 Conclusions on the translation sequence

Having highlighted the ways in which the innovation attempt was ignored, resisted **(6.6.1)**, adopted or adapted **(6.6.2)**, innovation outcomes can be appreciated as results of a chequered translation sequence. Considering the apparent occurrences of translation types and further interpreting the fit between these theoretical constructs and the process described, translation-dynamic patterns can be identified. Overseeing the translation sequence as a whole, the case displays the following striking translation dynamics:

First of all, it is remarkable how a collection of hardly conspicuous road reconstructions could acquire international fame as sites of societal experimentation. The self-translated Shared Space brand connects these dots: Hans Monderman and his fellow protagonists welded the reconstructions together into something greater, the Shared Space brand. The various applications actually adding up, **replication** of the concept proved **synergetic**.

Second, Shared Space evolution was marked by controversy and politicization. The lasting controversy around the Haren Rijksstraatweg reconstruction made for a turbulent process in which the innovation initiators had to compromise. They had to deal with resistance and skepticisms from different groups of translators, some of whom saw their attainments and certainties threatened. The protagonists' uphill struggle can be explained through the particularly **deep interference** with the traffic safety code.

Remarkably, deep-rooted interference did not prevent Shared Space from becoming a successful brand; to the contrary. This counterintuitive conclusion can be accounted for by the **productive use of interference**, for which Hans Monderman had developed an elaborate repertoire.

As the consultant from the Shared Space Institute noted, they were receiving inquiries and requests from increasingly diverse quarters, all interested to see how Shared Space could be useful to them. A fourth striking translation dynamic resides in the Shared Space concept's transformations into a broad variety of shapes, its **diverse**

modifications. The innovation attempt proving so unexpectedly malleable, it is an example of what is been theorized as a 'boundary object'[19].

Until now Shared Space's core identity is generally retained within diverse modification. A typical expression is that it 'be applied only where space is actually shared'. This expression indicating on the one hand that space is renegotiated, it also reminds that renegotiation may yield fairly conventional designs as well. A recurring theme throughout the translation sequence is the struggle to keep the concept malleable and open to negotiation, while keeping alive its transformative spirit. A fifth translation dynamic is this **dilution dilemma**.

Sixth, it is striking to see how the initial iconoclasm was withdrawn, to make way for a self-translated process turn. Acknowledging the need to face deep-rooted interference and having come to understand this as a broad and long-term change process, the protagonists assumed a **synchronization strategy**. Consolidating the brand, the Shared Space institute offered a platform from which to address interferences through joint translation.

[19] See Star & Griesemer (1989) in sections 2.5 and 3.2.

Chapter 7 Welding a travel information chain for 'informed choice'

"Areas of this map were now becoming familiar. So was the territory they represented. Had they become familiar to other travelers? Were other travelers obliged to travel through the same country? There was no indication that they should. They left me no signposts. Perhaps it was not impossible that other travelers had different maps of this territory, simpler and more straightforward maps. Perhaps the country only existed *in its maps, in which case, a traveler created a territory as he walked through it. If he should stand still, so would the landscape."*

Peter Greenaway - A walk through H; The Reincarnation of an Ornithologist (1978)

7.0 Introduction

The ICT-boom of the 1990s opened up many avenues for innovation. In 1996 the Dutch Ministry of Transport launched a policy paper to improve traffic information provision. This case study describes this policy initiative's evolution, proceeding in five steps: First a brief description of what the initiating protagonists sought to achieve **(7.1)**. Next, the experiences of the initiators **(7.2)** and those of other involved actors are described **(7.3)**. Fourth, innovation evolution is assessed for innovation success, system innovation achievements and basic development patterns **(7.4)**. The evolution of the innovation attempt is analyzed in the final section, also highlighting the different translations of the innovation attempt **(7.5)**.

7.1 'Informed choice' through information chain optimization

In the early 1990s, the Dutch Ministry of Transport and Water Affairs conducted several studies on traffic information. They considered the recent ICT-boom to offer significant opportunities for traffic information provision, which could be made into an essential pillar in the ministry's congestion abatement strategy – an issue of increasing importance at the time (Min. V & W (1990, 1994), see also van Egeraat (1998) for in-depth analysis of Dutch telematica policy). In 1996 they followed up on these strategic considerations through a policy paper dedicated to travel information provision: The 'Beleidsnota Reisinformatie'. Whereas earlier travel information strategies had been parts of broader mobility policy packages, the document was dedicated exclusively to the subject. With this policy document a small group of policy officers of the Directorate- General Personal Mobility presented a future vision for transportation, indicating how new travel information arrangements could make it happen. The initiators explicitly sought to break with the past, as their ambitious future vision expressed firmly. Unlike its predecessors, the vision started from the perspective of the traveler. Putting the needs and preferences of the traveler centre stage, 'informed choice' they presented as the central goal. In 2010, reliability, flexibility, efficiency and cost-effectiveness would be crucial for the traveler, next to traffic safety. Transport would no longer be the 'unpredictable adversary of the sovereign, time-conscious traveler' (Min. V&W, 1996, 15). Information would allow the traveler to make informed choices not only on the moments of travel, and on routes, but also on travel modes (5). Information provision would contribute to congestion abatement, and multimodal information would lower the barriers against public transport use -another prominent policy spearhead at the time. 'Informed choice' was also to be valued in its own right however, the initiators indicated, as a matter of consumer sovereignty.

The bright future for 'informed choice' would require a number of barriers to be surmounted. Information provision would have to meet the future standards of reliable, consistent and integrated travel information, reliable travel information defined as 'actual travel time information, not older than 5 minutes, accounting for both normal travel time and possible delays' (6). In the light of their integration ambitions consistency was crucial: In order to be useful to the traveler, the information should cover entire trips 'from door to door' - the whole 'mobility chain', as it had become known. Information provision would have to cover both private car and public transport, and the options to combine those. Furthermore, the door-to-door approach implied

increased attention to the loose ends of travels: Availability of parking space, or the travel options between public transport station and end destination.

These requirements would have to be met through an encompassing action plan, integrating and optimizing existing arrangements. The initiators presented the 'information chain' as an organizational architecture for integrated and actual travel time provision: Mobility chain- oriented information provision should be managed in similarly integrated fashion. The chain had a tripartite build-up, with data acquisition, processing and information distribution as the key clusters of activity. Figure 7.1 displays these key functions, with data acquisition at the basis of the chain.

The 'information chain' concept specified the development path towards 'informed choice'. The functional specification had organizational implications: The innovators noted a diversity of actors to be involved with segments of the chain. Optimization of the chain as a whole would therefore require actors to cooperate, and 'build bridges' both within and between transport modes. Entrepreneurship would be the key to develop innovative acquisiation techniques and user-oriented information provision. This is why the policy vision also implied a governmental retreat from information distribution, so as to create space for the development of an information market.

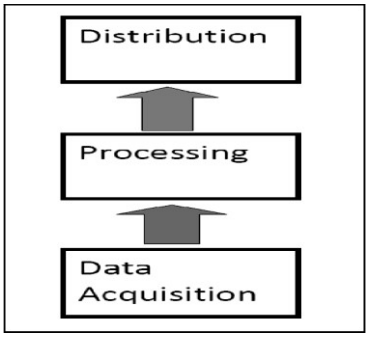


Figure 7.1
The travel information chain

The 1996 travel information policy paper contained a future vision that was to be attained through a manifold of innovations. 'Information chain optimization' linked the future vision of 'informed choice' with action, organizing the various activities in information provision. The innovation initiators considered it a collective challenge, to be taken up by different actors somehow involved in the information 'chain'. After the experiences of the initiators (7.2), section 7.3 describes other actors becoming involved in the information chain.

7.2 Developing the information chain

As one of the initiating policy makers noted, their policy document contained a manifold of changes entailed by the 'information chain' concept. Passing the policy vision through parliament went smoothly, however. It had certainly helped that it carried along hardly any investments, he explained. Less conspicuous amidst the heated debates about major infrastructural schemes and apparently without immediate effects, their more 'principled' choices caused little controversy (*30, 1-3).

The action plan for 'information chain' optimization could thus be set in motion. A first step towards realization of this goal was to establish a Traffic Information Centre (TIC). The TIC would ensure consistent processing of data; the backbone of the chain. The innovators had observed that up till then, activities had been rather dispersed and fragmented:

Eventual information distribution requiring knowledge about the actual traffic conditions, systematic data acquisition would be essential to chain optimization. At the

time it relied on traffic monitoring, such as detection loops in the road surface, cameras and traffic light installations, as well as on various direct observations by police officers, bridge operators, gas station owners, road users and the mobile repair service teams. All in all the innovators considered acquisition to fall short, however: Reliance on human observation was a weak spot, yet automated ways of monitoring had clear limitations as well. Rijkswaterstaat had their detection loop systems only on the main road network, and traffic light-based monitoring in the urban areas still left the far greater part of the secondary roads uncovered. Expanding these systems to cover the entire national road network would be very costly, however. Beyond these limited 'road side systems' they saw new technological options beginning to surface, however. 'A new generation' of on-board navigation systems would give a quality impulse to data acquisition, making use of 'Floating Car Data' (FCD). Unlike data acquisition from the roadside, tapping from the data 'floating' around the cars was not restricted to place (Min. V & W, 1996, 10, see further section 7.3 for this envisioned trajectory).

Information distribution being the interface with the end user, the innovators envisioned that the opportunities afforded by the ICT-boom should especially be seized upon at this end of the chain. They sketched a diversity of (emerging) technologies offering new information channels: Radio, television, but also information panels, mobile telephones, personal computers, pagers, watches and in-car navigation systems. It would be an industrial challenge to move from prototype development to large-scale application. Apart from technology development, customer-oriented information services would be essential to 'informed choice' however. This development would be the typical area for private sector initiative, the innovators considered. So-called Value Added Service Providers (VASPs) would devise commercially viable services, while governmental information provision would be limited to traffic management information and information on public transport.

Data acquisition flowing from a diversity of sources, the collection of separate observations would have to be processed into a general synopsis: Beyond the measurements at points, the relevant knowledge concerned the flows in between those. Anticipating on FCD as a new data source, data processing should therefore be equipped for 'multiple monitoring', merging and processing different data sources into information (Min. V & W, 1996, 10). Anticipating innovation both in the acquisition 'input' and the distribution 'output', the processing segment of the chain should be taken up by an organization ready for the complex task. The Traffic Information Centre would be an independent processing station and central repository for raw data. While serving a diversity of information needs, it would ensure consistency.

AVV, the research department of Rijkswaterstaat, elaborated the architecture for the TIC. Acknowledging the importance of unambiguous and integrated information provision, Rijkswaterstaat, the police (KLPD) and motorists' organization (ANWB) proved willing to cooperate in the initiative. It would entail changes in the separate chains they used to have. Rijkswaterstaat operated its own chain: As road manager of the main road network they had exclusive command of the detection loop systems, and broadcasted congestion information to the public through information panels and media channels such as teletext and radio. The national police forces (KLPD) operated another 'chain'. They obtained data through personal observations from police officers on the road and in helicopters, but also from Rijkswaterstaat. Their monitoring focused on accidents, ghost drivers and other threats to safety- the exceptional circumstances, rather

than the tidal flow of congestion patterns. Out of their concern with public safety and their enforcement responsibilities they sought to secure an independent position within the chain however: In some cases, public safety would be served by *not* disclosing information. Different from Rijkswaterstaat traffic management that was focused on peak hours, policing required constant monitoring around the clock. Out of a shared interest in traffic control Rijkswaterstaat and KLPD had taken initiatives for cooperation, even before the policymakers had unfolded their TIC ambitions (AVV, 1996, 10/11). Also the ANWB, the national drivers association, were operating their own chain. Unlike Rijkswaterstaat and the police they had no legal obligation to do so, but they did want to develop new services to drivers. Obtaining data from police, bridge operators, gas station owners, road users and their own mobile repair services, they disseminated the information to the public. Because of their mission as car drivers' association and their activities in data gathering they sought to become a key actor in traffic information provision.

ANWB aiming at services to its members and the KLPD seeking rather to shield sensitive information from public broadcasting, the TIC set up was refined with a separation of these chain purposes. The AVV made the explicit distinction between traffic management and control on the one hand, and traffic information as a service to users on the other. This common division between 'advanced traffic information systems' (ATIS) and 'advanced traffic management systems' (ATMS) took concrete shape in the TIC architecture as displayed in figure 7.2 (AVV, 1996, 9).

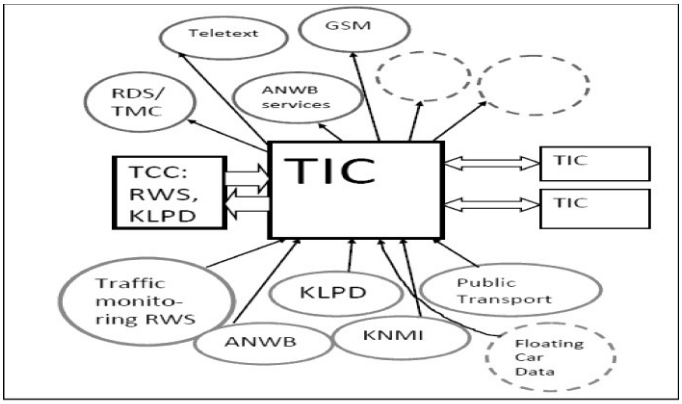


Figure 7.2 TIC architecture. Adapted from AVV (1996)

The TIC was positioned as a hinge between various actors active in data acquisition and information distribution. It would receive raw data from the bottom layer of data sources: Rijkswaterstaat, KLPD, ANWB, as well as the KNMI meteorological information. Public transport information and floating car data could be added on at a later stage. The information would be processed through models and protocols, and then disseminated to the upper layer of private sector distribution channels[1]. As an independent repository of information, the TIC 'view on the road' would serve both public and private uses. The public tasks of traffic management and policing retained an independent position in the Traffic Control Centres (TCC) - the TIC and the TCCs were

[1] RDS-TMC stands for the radio Traffic Message Channel, through which traffic information services were distributed by various providers.

'twins'. The two-way arrows indicate the TCCs' prerogative to overwrite the TIC 'view on the road', for example by adding detours or incident situations. Similarly the police could retain the prerogative to keep sensitive information to themselves, and prevent broadcasting of commercially interesting yet publicly hazardous information through the commercial serviceproviders (VASPs). Finally, TIC would also serve as a platform for European coordination between TICs, the need for which had earlier led to establishment of public-private networks around 'intelligent transport systems'[2].

The TIC was a first step in developing the traffic information chain. In January 1998 it was opened, delivering information to a manifold of users, mainly radio broadcasters. As explained in a newspaper report, TIC's basic information was 'the empty sandwich to be filled' by the service providers (NRC, 1998a). The TIC consolidated the principled choice for a public-private division of labor, the latter developing services to end-users and the former allowing them the space to do so. As one of the initiating policymakers remarked dryly, this aspect of their policy seemed to have escaped from the attention of some actors: Only after a few years Rijkswaterstaat seemed to realize that they really had to refrain from direct information distribution to the public (*30, 1). As executive department of the Ministry they had continued their distribution activities as part of their traffic management task, however. In 2003 the 'Traffic Information Service' (VID) therefore challenged this governmental information provision to end-users, taking Rijkswaterstaat to court for breaching their own market ordering stipulations. Pointing out the contractual terms of delivery as agreed with VASPs, the VID won the case. In August 2003 the verdict forced Rijkswaterstaat to stop offering SMS services via its website, which it had started in December 2002 (NRC, 2003c).

As a matter of course the VID appeal was directed not against Rijkswaterstaat but against the State as a whole, the policymaker explained. *"So in the end we lost that case as the State…And my position was a bit ambiguous there; on the one hand it is unpleasant to lose a case, on the other hand I could even be happy about it as it confirmed our policy…So Rijkswaterstaat had to shut down their website and their SMS-service, leaving room for market actors, and that is how the division of labor was reinstated."* (*30, 2). The policymakers had tough and complicated discussions with Rijkswaterstaat. They had a hard time to get the message through that the VASPs would bring real advantages to the end-user, and that it would be better to abstain from information provision to the end user. Their innovation attempt could be perceived as a threat to Rijkswaterstaat traffic ordering ambitions, the policymakers acknowledged. Still they were disappointed about the apparently little cooperation. *"So there you have the road manager who as a matter of keeping up a profile seeks to make himself known as the one who acquires, processes, but also distributes information as well…from the angle of profile. There is also the other angle that in that case the information is actually made use of, to steer, or guide…you name it. So there is also a substantive issue involved."* (*30, 1). Even apart from their statutory traffic management responsibilities, Rijkswaterstaat seemed to stick to its identity of controlling organization. In the tough discussions on technical specifics, the policymakers found themselves confronted with a discussion partner more powerful in several respects. Rijkswaterstaat not only outnumbered them in staff capacity, but also had far greater specialized expertise: In the end they were the ones in charge of traffic data and the systems to manage those. To the public servant on the policy-making side, the technicalities worked against the ambition

[2] See for the international ITS network http://www.itsnetwork.org/. The Dutch counterpart is Connekt.

to have some grip on the attempted innovation. *"Well, and then from the side of Rijkswaterstaat, they seek to render a picture of affairs as if it were purely about traffic management (…), and then I have to whine about the details, 'hey, they're doing this, they're not doing that'…or, they simply claim they're doing it while in practice they're not…And for these matters I can invoke my director-general one or two times, but not every week. And that is the power of Rijkswaterstaat, they have 50 projects that just will go on, if I happen to whine about three projects, well, those will be canceled, but the other 47 continue….and then the market parties have to whine in their turn, well, then you will have another five canceled, and in the end 40 of these projects go on unmitigated…"* (*30, 2). Rijkswaterstaat's myriad of plans and projects being sheer impossible to contain within the 1996 guidelines, and coordinative escalation to higher echelons only possible in exceptional cases, the initiators found they better invest in creating support among their colleagues.

One way for the initiators to 'retain some control on the process' was the public-private advisory commission on travel information. In February 2002 it was established to come up with 'rules of conduct' for traffic information distribution. Three months earlier it had been announced by the minister of Transport, who declared to clarify and disentangle the many linkages between the ministry and the motorists' organization ANWB. As the Minister indicated, the parties engaged with each other in different roles, the ministry as legislative and enforcement actor and the ANWB as contractor for road signs and provider of mobile aid services. The historically developed intertwinement had been scrutinized in the light of European tendering guidelines and the Dutch cabinet's view on market-state relations. Both called for transparency. The minister therefore announced specific updates of the relations with ANWB, regarding signposting, emergency phones, incident management and also traffic information (Netelenbos, 2001c, 2).

The latter issue was addressed through the establishment of the 'Laan commission', named after and led by the chair of the TIC advisory committee. The commission had high-level representatives from the main actors involved in the information chain: For the service providers it featured ANWB, VID, TMC4U, broadcasting organizations, and representatives from the traffic systems industry. Furthermore, metropolitan governments, representatives of the logistics sector, Rijkswaterstaat and the police were included (Prins & Laan, 2003, 2-3). The DG-P policymaker became advisor of the commission. He was especially content to have the Rijkswaterstaat director-general as a high-ranked representative for their ministry. The DG's presence would ensure agreement between Rijkswaterstaat and the policy-makers. *"So, at least as concerned the agreements made there, I could say, 'well, excuse me, but this is what your own boss has agreed and decided', and this reference made my life on the shop floor a bit easier"* (*30, 2).

The commission's task to develop 'rules of conduct' implied the possibility of mitigations in the 1996 policy (Netelenbos, 2001c, 3). On March 19th 2003 the commission delivered its final report, after several further bilateral deliberations. The report brought out several rule violations occurring on a regular basis: Regional Rijkswaterstaat departments delivering to ANWB directly, service providers mitigating TIC information, and TIC presenting information directly to users via its website (Prins & Laan, 2003, 12). The commission indicated its recommendations to be based on different yet overlapping interests. The end-user's interest in accurate traffic information

was the foremost criterion. *"The second criterion is the public interest of effective traffic management, combined with optimal usage of existing road infrastructure. This does not only concern the interests of the governmental organizations involved in a narrow sense, but also the paramount interest of the policy objectives they pursue. Finally there is the third criterion of the private parties operative in the market sector concerned. These parties accord their activities in traffic information great significance. With a few millions of euros per annum, the market concerned is as yet of only modest size however. Therefore this criterion comes third in weighting order."* (13)

Given these priorities the commission arrived at the following recommendations (16-19):

- Promotion of Floating Car Data was to be continued. This would require abolishment of the obligation to disclose the data to TIC free of charge, however. Secured property rights of service providers would be conditional for their investments in innovative techniques.
- TIC should enhance its processing through automatization. This should also allow for refined presentation of information; display of specific travel times, rather than general congestion information.
- Raw data of detection loop systems should be disclosed to all service providers. This would end the privileged position of the ANWB in this matter, and allow the service providers to develop innovative formats and services.
- Service providers should no longer be required to conform to the rigid TIC-format of information provision. Diversification and use of new sources of information should be allowed, unless public safety would call for uniform information provision. The fixed TIC-format should be replaced by a more flexible quality control system
- Use of roadside Dynamic Route Information Panels (DRIPs) should be stimulated, as a way to provide actual information to the drivers immediately concerned.
- The increasing pressure on the road network urging for strengthened, network-wide traffic management, coordination of information provision was required - both within Rijkswaterstaat and between road managers on the national and decentralized levels. Coordination would have to be administered through a national coordination centre (VCNL), established through integration of TIC and the national coordination centre for road works. This integration diverged from the earlier dualist TIC/TCC architecture.
- Specific procedures should prevent Rijkswaterstaat initiatives in traffic information provision from unnecessary market distortion, whilst keeping open the possibility for them to fill in (demonstrable) lacunae left by the service providers.
- Public and private roles in the information chain would have to be demarcated, beyond the general framework provided by competition law and regulation of public-private partnership.

The issue of 'rules of conduct' on the information market was also taken up by parlementarians. Around the time of the VID legal procedure, the professionals' journal 'Verkeerskunde' featured an opinionated article about 'the difficulty to develop innovative services in the shadow of the ministry, while still strongly dependent on this very ministry' (Verkeerskunde, 2003a). Only a few days after, an MP from the socialist party interrogated the minister about this apparent 'lack of a level playing field'

(Gerkens, 2003, 1). And considering the recent initiative to establish the national traffic control centre, the Minister was requested to explain whether this implied reconsideration of 'a statement made by one of her predecessors that travel information was an issue especially suitable to be taken up by private sector actors'. And after some more questions on the state of traffic information policy: *"To what degree, in your opinion, can traffic information contribute to alleviation of congestion problems? Can you indicate how these additional costs relate to the costs of achieving the same effect by means of extra infrastructure provision?"* (1).

The minister indicated not to share the assessment of 'great difficulties to develop market activities'. The 1996 stipulations were still in place, she reassured, and the problem of exclusive deliverance of roadside data to ANWB had been solved in the 'Laan' commission. This situation had arisen from an earlier attempt to disclose these detection loop data through the internet. The minister added that the findings of the commission, of which the VID had been a member, had already been published. About the VCNL traffic control centre she indicated that her reaction on the recommendations would soon follow, but that no great changes in information provision would occur. Still she considered traffic management in need of intensification, due to increasing pressure on the road network. This intensification involved both governmental information of the public and VASP activity, next to driver education, incident management and guidance of traffic under exceptional conditions. Traffic information provision being part of a 'palette' of congestion abatement measures, she could not indicate its isolated performance in comparison to road construction (Gerkens, 2003, 3).

On May 26th 2004 the Transport minister announced her adjustments in traffic information policy. The Laan recommendations were taken to heart with only two exceptions (Peijs, 2004b). First, the minister pointed out how Rijkswaterstaat's changing role as 'network manager' gave rise to a differentiated public-private division of labor. The arrangement would stay the same for cases of 'regular congestion' and communication of road works. In case of serious incidents, congestion due to trucks blocking the road for example, communication by service providers would be limited to route advice authorized by Rijkswaterstaat. In the fourth highly exceptional case of a 'traffic alarm' Rijkswaterstaat would be allowed to communicate directly with drivers, and service providers would be obliged to transmit Rijkswaterstaat information integrally. Second, Rijkswaterstaat communications to end-users would not be directly tested as proposed, but introduced to an advisory council instead. The minister concluded with a sketch of future developments: Through a public-private 'partnership for innovation', information provision would be tailored better to the individual interest, involving information that is real-time, predictive of travel times, and eventually multimodal as well. *"Also in technological respect the parties envision scope for further growth. Anno 2004 the basis for traffic management is generated mainly from the detection loops in the road surface, but new techniques are slowly emerging. These techniques are primarily based on GPS and GMS. As far now these are private initiatives allowing government (the road managers) a choice of technology, but gradually this will entail a shift in responsibilities. Apart from government also market actors are able to accomplish the acquisition and processing of basic traffic data. In addition, traffic information provision will expand to the secondary road network as well, requiring other road managers such as provinces and municipalities to play their parts as well."* The aforementioned advisory council on traffic information (ACVI) was to 'initiate and bind' in these future processes (Peijs, 2004b, 4).

By that time traffic monitoring in the main urban centers of the Netherlands was already taking off. As noted earlier by the Laan commission, the urban road managers engaged in processing and distribution of traffic information, combining TIC data with their own data on queues and road closures and with actual parking information. Coordination of these activities was limited as yet however, both between the road managers and with Rijkswaterstaat's national-level activities (Prins & Laan, 2003, 11/15). A senior traffic management officer from Rotterdam had seen it all happen, recalling well how they had started with rather haphazard tinkering. *"What we used to do in the past, for example, was buying a DRIP [dynamic route information panel –B.P], and then devise an application for it. We would place it on the road and it would display messages up to the Meuse tunnel…it still exists, and is functioning quite well too…However, once adding a DRIP on another route, it would be of another type, and when measuring travel times you would have other types of cameras…so the system was a long way from integration. And well, and what we did with 'Monitoring Rotterdam', is this grand-scale rollout, we said, we buy this singular big system at once, but then we really have this single system, without having any need to connect, or insert phasings and the like…And then we will have at least the intensities for all main routes in the city, indicated as main road network in the policy documents…"* (*31, 4, see also Deckers (2005, 2007) on the 2004 'Monitoring Rotterdam' initiative).

This is how they made the big step to 'catch up' at once, with more than 300 cameras and 400 detection loops throughout the city. Compared to the 'fragmented outroll' ten years earlier, they were now in a very different world, he explained. Beyond their initial preoccupation with technological systems and their local applications, they had made the shift to integrated management of road networks. The attention to technical possibilities had made way for a more strategic outlook in which policy objectives were the starting points. The initial fragmentation had also been due to the rapid technological developments, however: New protocols being introduced almost every one or two years, they wound up with incompatible systems. The development of open protocols had been essential: *"You can see a stabilization of communication and interfaces between systems, this is really something of recent years. In addition you see that the techniques have become a lot cheaper, and as a consequence it starts to dawn on the suppliers that being occupied only with the delivery of DRIPs…that it is a very sensitive market. (…) When only delivering products, your added value compared to other suppliers is very limited. So, you want to add a kind of service provision, integrated products, assistance…you name it."* (*31, 6). Initially they hadn't been very willing, but eventually the suppliers had started to offer the open systems required. As Rotterdam traffic managers they had actively communicated their requirements to the market. Acknowledging that as a municipality they offered a market of only limited size, they had teamed up with Den Haag and Brabant. More generally, it had been important that government turned towards network-oriented traffic management: *"…a certain coherence between networks, but also between systems and measures (…), a framework that had market parties realize that a development was going on to be taken seriously. So then it became feasible to invest in control centres actually able to communicate, and in open protocols…"* (*31, 8).

In 2006 the journal for 'network management' dedicated an article on the various initiatives to increase the availability of reliable information, as 'a critical success factor for network-wide traffic management' (NM, 2006a). The article noted how the need for traffic management beyond the main road network had called a manifold of regional

cooperations into being, yet the ambitious road managers on the decentralized levels were struggling to find their way amongst the increasing options for both data acquisition and data fusion. Next to the known techniques based on radar, detection loops and cameras, floating car data had become available, remote sensing techniques being another promise for the future. Even when starting from a sensible inventory of information demands and aware of the integral technical solutions available on the market, the road manager was advised to beware of the 'tailor-made' solutions on offer: However integrated, these systems were still based on particular data sources. Contracting out would therefore still leave a need for own complementary monitoring. Furthermore, the validity of information would remain in need of independent testing. Suppliers being generally very positive about their acquisition concepts, 'commercial interests shouldn't be in the way of objective evaluation'. And more generally, the road manager should be aware that the choice for a particular technological system would be inevitably committal: *"Changing for another supplier is often expensive and complex – more or less like changing for another administrative package always takes a lot of doing. This problem can actually only be tackled by making clear agreements with the market party about, for example, performance and quality (...), and about what to do in case the quality agreed upon is no longer delivered."* (NM, 2006a). The difficulty of migration to another supplier 'entailed a great dependency on the market party'. Later that year a joint interview with traffic management experts from the four main cities brought out varying experiences. On the one hand skepticism about the industry's potential and willingness to respond innovatively to open, functionally defined demand, on the other hand also more positive experiences- entrepreneurs consulting their potential customers in the course of product development, for example (NM, 2006b).

Already in 2005 the interprovincial deliberation comittee (IPO), the association of municipalities (VNG) and the association of urban regions (SkVV) had presented their joint vision on traffic data acquisition (ACVI, 2009, 20). The vision expressed the shared ambition for nationally coordinated data acquisition. With more and more actors active in the information chain, interchangeability of data became an urgent challenge. Setting reliable and predictable accessibility as the central policy goal, the 2005 mobility policy document Nota Mobiliteit only underlined the importance to have an adequate data base (Min. V&W, 2005). In December 2007 an agreement was signed to establish the National Data Warehouse (NDW), prepared for in the Laan commission. Fifteen governmental partners committed themselves to the unified information household, entailing considerable investments over several years. Similar to the earlier TIC, NDW was meant as a standardizing backbone to the national information chain, while ensuring compatibility on EU level. As an NDW official explained, *"...you see that on a policy level there has been cooperation for some time, and this is functioning quite well. What we did here, is making the step to actually doing something – real time. As Rijkswaterstaat we always used to be the party to have all the data, we knew exactly where traffic was standing still, and well, the provinces and the municipalities, they used to have some measurements and counts on the shelf somewhere, a couple of years old, not really telling much. And then it's better to make a plan for the future, isn't it, but you can't devise any plans to manage your traffic real-time, unless you start taking measures. And that is why we said, 'there isn't really any decent traffic management possible without adequate data'. That was just our proposition, and actually we have drafted an increasing number of parties to go along. We started on the administrative level, we visited all the aldermen and deputies, and then the officials".* (*32, 3). And

even apart from the gains in coordinated data acquisiation and processing, the cooperative structure also paved the way for future joint enterprises.

NDW was to 'roll out' a national system to cover a basic road network. Parking and multimodal information would be added over time (NDW, 2008). From the outset the arrangement was designed to follow a growth trajectory: *"Well, there is a great deal of ongoing developments, but as we say, this NDW is always a 'no-regret' of course. There is of course a reason why we do it for the shorter term. Of course you have these developments in road pricing, the developments in these techniques of acquiring data without hanging equipment above the road, with your cell phone, or GPS, or whatever…These developments go at a very high pace. (…) Once we start 'paying differently', and every car has an electronic license plate registering where and how many miles you have driven, then you could use those perfectly well as a source of traffic management information. Then all of a sudden it [data acquisition-B.P.] would turn into a kind of spin-off…instead of acquiring the information separately. Then you have arrived at a new situation, and will need to see how it develops further."* (*32, 5). The growth model anticipated upon adding floating car data as a data source. NDW was therefore built on functional standards leaving open the technology to be used. As a NDW-brochure stated at the time, FCD-technology 'could become good additions to the NDW over time', yet was expected to remain 'insufficiently accurate and complete to be useful for traffic management purposes' (NDW, 2008). The NDW official explained they had laid down their quality requirements on the market, and had consulted potential traffic data providers about the services they had to offer. Generally the responses from market actors had been 'very positive', but navigation systems producer TomTom had not been willing to join in. The latter proved reluctant to disclose their traffic information for release to end-users, seeking to protect their property rights. Moreover, TomTom had data to offer he considered remote from the quality needed for proper traffic management: *"You see, when you place higher quality demands, you're commited to buying more expensive stuff. That's not something government is very keen on, and nor are we. You do need adequate data, you need to know something's going on, and be sure there's really a queue over there. There are plenty of examples of that system TomTom are using now, that you had a truck parked at a halting-place, and at the traffic control centre you had a road section displayed in red to suggest there was a queue over there…just because penetration was low, and because no traffic intensities are measured. Then you just don't have a clue about how much traffic you're dealing with, and whether it is really jammed".* (*32, 4).

To the policymaker initiating the 1996 innovation attempt, the NDW set-up turned out different than he had wished for. In his department they had envisaged how tapping from floating car data would allow for a drastic expansion of data acquisition. Beyond the roadside systems coverage of 2500 to 3000 kilometers, a road stretch of up to 30.000 kilometers would become within reach. The NDW set up had been a regular topic in the public-private advisory commission, and all parties had had their say in the concept they had drawn up. *"Well, and when three years after they really start implementing, and it turns out that implementation diverges from all these plans everybody felt comfortable with initially, all parties having agreed thusfar, then some parties feel they had themselves fooled a little…"* (*30, 9). To his disappointment the quality requirements eventually arrived at effectively barred any contributions from in-car acquisition techniques. The standard he considered well too high, reflecting especially the demands of traffic management quarters. To his assessment, a part of the explanantion resided in

traffic management circles feeling threatened by TomTom. This navigation systems supplier offered real-time traffic information services to users, and rapidly rose to become a key player in information provision. Through powerful branding TomTom proclaimed to have already on the shelf what the NDW sought to develop only over time: coverage of some 25.000 kilometers stretch of road.

Again the initiators found themselves in a complicated technical discussion. A direct challenge of the standard would only undermine the NDW trajectory they had supported. And after all, the NDW had many road managers of decentralized governments cooperate, and join the information chain. And even if the stipulation of quality standards had been partly informed by a quest to retain traffic management control, or a need to maintain a public image, who was he, policy maker, to dispute those?! The standards had been established after consultation with leading experts in traffic management (*30, 6). Personally he had been happy to see TomTom entering the information market, even when it had taken them a rather long time to get there. Attempting to convince his Rijkswaterstaat colleagues of the added value for 'informed choice' he encountered mixed emotions even within the department: On the one hand the acknowledgement of better information provision to drivers, on the other hand the concerns about the disturbance of governmental traffic management. The conflicts between commercial traffic information provision and governmental traffic management they had foreseen in 1996, but at the time of the policy change the various road managers seemed not fully aware of its ramifications for their traffic steering tasks. *"So, now you see it with the municipalities as well, invoking another clause, they claim,..(...) 'I am* obliged *to inform citizens, that has been laid down in my municipal charter', or whatever they call it….(..), and then I always seek to bend it towards, 'it is your obligation to ensure those citizens* are informed'*, and that is just the nuance, and I say, 'and that is what you should bring about in the most effective and efficient way'".* (*30, 4). The municipal authorities were allowed to insurrect these roadside panels, he acknowledged, but they were costly and limited in functionality.

To his contentment most road managers restrained themselves 'not to place these panels at any 100 metres' however, thus leaving room for an information market after all. Very often the discussion involved a need to keep up a certain image, he noted. *"And well, this is something I do acknowledge, as in their turn, as road managers, they do have to invest in this acquisition, and in the traffic management, which tends to be expensive…and when you want to demonstrate the returns a little, well, often you do need to have something to show to the public…"* (*30, 4). It had been a difficult discussion regarding the NDW initiave. Basically, millions of euros would have to be invested into a pile of data stacked in a database. Strictly speaking, cost-benefit analysis brought out zero benefits, as these would only be generated once parties would actually use the information. As he had held to his Rijkswaterstaat colleagues, they better consider the investment in information as a basic ingredient to their traffic management activities.

In the same period that NDW was developed, quality of information provision had become a hot topic in public debate. "Muddling through villages, rather than halting in the queue," the national newspaper NRC read on January 10th 2007. *"Exhaust fumes, honking and screaming tires. Maddening. Every day, 17.000 cars drive right through the Zuid-Holland village of Zevenhuizen. (...) Many car drivers use the road to circumvent the intense traffic on the A13 between The Hague and Rotterdam. They*

reckon to reach their destinations more timely, but often end up halting in Zevenhuizen. To circumvent idling traffic, cars blaze even over the smallest of village roads. With all its concomitant dangers." (NRC, 2007a). 'Cut-through traffic'[3] proved a high-profile media subject in times of widely shared discomfort with congestion. Half a year earlier the Trouw newspaper had signaled heavy freight traffic winding up in the narrow streets of the city center of Roermond. As a small city on the border with Germany, Roermond had considerable intensities of freight transport passing through. The recent changes in its road network had not yet been corrected for in the navigation systems. The often foreign truck drivers relying on their navigation systems rather than following the detours indicated, the municipal authorities had felt compelled to erect traffic signs, summoning drivers to switch their navigation systems off (Trouw, 2007). Figure 7.3 displays one of these novel road signs.

Figure 7.3
'Switch off navigation system' road sign.

The problem of the 'socially undesirable routes' had already been brought forward by MPs by the end of 2006. Asked about her response measures, the Minister pointed out a range of remedial measures: Municipalities could use both environmental regulations and traffic safety regulations to bar heavy traffic from certain roads and areas, and furthermore they could organize detours. In addition she pointed out the regional initiatives to establish 'quality networks' for freight traffic; she intended to make agreements with navigation systems suppliers to have these routes communicated through navigation systems as well. The road managers were already held to keep track of the changes in the road network (Gerkens & Roefs, 2006). The problem of the 'unwanted routes' remained on the political agenda however. By the end of 2007 the 'foundation for research of navigation systems' had pointed out the dangers of widespread software errors in the navigation systems. *"The rejected navigators drive around like 'kid killers' along home zones and roads not suitable for through traffic. They don't manage to find the ring roads. Software bugs are the cause"* (SON, 2007). In January 2008 MPs had inquired about the report (TK, 2008), and the Minister of Transport reacted in March 2008. The phenomenon of navigation systems suggesting 'less desirable routes' had also been detected in ministerial research, he acknowledged. He mentioned also how independent research had brought out positive safety effects, through diminished 'parking space-seeking'. In any case, he definitely did not share SON's conclusion that the navigation systems should be banned for these imperfections. To the contrary: In accordance with his traffic management policy framework published only a few months earlier (Min. V& W, 2007), he stressed the rise of in-car systems to

[3] The Dutch 'sluipverkeer' bears more explicit negative connotations; 'traffic where it does not belong'. Alternatively, more liberal or libertarian points of view emphasize that roads are there to be used.

be both inevitable and feasible. Adequate public-private agreements he indicated as the way to proceed: *"As I have indicated earlier, exchange of desirable routes is a process that will only yield final results gradually, and on the middle term. This being a consequence of the many parties involved and the long chain of steps to be made by road managing authorities, cartography entrepreneurs, system producers and end-users"* (Eurlings, 2008c, 3).

The Minister fervently favored a collaborative approach, pointing out that several steps in the 'long chain' were already being made. Cartographers were doing efforts for the crucial updates of maps, for example, gathering the specific data required for the navigation of freight traffic. The collaborative approach materialized in the 'prevention of undesirable routes' project, later renamed more neutrally as 'data exchange route planners and navigation systems' (Connekt, 2009). It was hosted by Connekt, a network organization acting as intermediary between public and private organizations in the transport sector. Involved parties were road managers, navigation system suppliers and cartographers, but also the freight transport organizations. As a consultant involved with the project indicated, the parties agreed in the understanding that the 'undesirable routes' were a matter of good organization. The issue of 'who governs' he considered a non-discussion, only secondary to the main issue of providing adequate information to the users who took these roads (*33).

Considering the 'long chain of steps' to be made by a variety of actors, the Minister considered convergence on desirable routes a process only soluble on the middle term. Already at the time of the TIC set up in 1996 it was acknowledged that the interactions between different information channels could not be entirely predicted (AVV, 1998). With the 2010 horizon for 'informed choice' approaching, the 1996 initiative was followed up by a policy document no less visionary in outlook. By the end of 2007 the minister of transport launched a traffic management policy framework that was explicit about the changes in the information chain. *"Road users should be able to rely on good and reliable displacement quality from origin to destination. Far-reaching cooperation between road managers is therefore indispensible. In addition, a rapid and inevitable rise of in-car systems can be perceived. These systems are oriented towards (personalized) information and navigation, or driving assistance for example, for additional safety. Apart from that, travelers and traffic management have more and better multi-modal information and real-time data at their disposition. The importance of vehicle systems is augmenting, while roadside systems are of declining relative importance and magnitude. The rapid developments in technology and market entail new relations between stakeholders involved. The role of (vehicle) industry in development and implementation is unmistakably increasing, and also the role of government and road managers is in need of reassessment"* (Min. V&W, 2007, 5/6). The policy document maintained the vision laid down in 2005, aiming for reliable and acceptable door-to-door travel times (42). Considering the 'dynamic developments in market and technology', a long term vision and appraisal of long-term investments for 'road utilization' would be difficult and even unfeasible, however. Instead, the future of 'road utilization' was described roughly through overlapping development waves, each successive wave allowing for greater travel time optimization. Figure 7.4 displays these development waves.

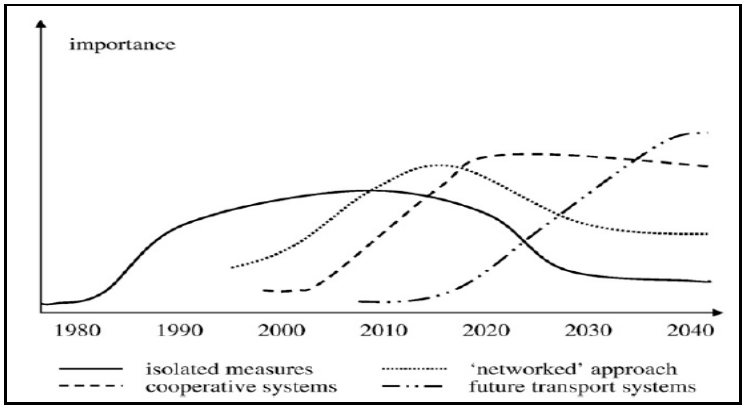


Figure 7.4 Development waves in 'road utilization' , (Pel & Boons, 2010).

Beyond the shift from isolated traffic management measures to a networked approach, the era of 'cooperative' combinations of roadside and in-car systems was indicated to have started already. Step by step the goal is coming closer, one of the policy makers behind the 1996 'informed choice' initiative evaluated in 2009. Looking back on almost fourteen years of information chain development, he saw how the envisioned in-car development had finally had its breakthrough, and how the NDW basically continued the earlier Traffic Information Centre arrangement. Yet even when they had already expected it would take a long time, they were still somewhat disappointed about the pace of developments. The tensions around the 'desirable routes', these would remain to some degree. And with road managers protecting their turf and market actors rather restrained in their investments, he considered it an endeavor requiring considerable stamina. *"So, things are moving forwards, but slower than we would like them to go…And with this modest group at policy management, well, you have to count your blessings, and get closer step by step…"* (*30, 8). Considering the urges to maintain established positions, actors would never go along completely. They were experiencing the same in the 'parallel trajectory' regarding information on public transport, he noted, where transport operators proved reluctant to release their data for general use.

After this description of initiators' experiences, the next section describes those of other actors. It will shed more light on the difficulties of welding an information chain.

7.3 Becoming involved in the information chain

Information chain optimization was an innovation attempt involving a manifold of actors. The initiating policymakers could not do it alone. Already when elaborating the TIC architecture, the operational specifications needed to reflect different stakes: The development of value-added user services (ANWB) and the development of better traffic management applications (Rijkswaterstaat), whilst retaining an independent position for policing (KLPD).

In line with the TIC arrangements, the police stopped its information services to users, and restricted itself to the activities in the Traffic Control Centers. Together with US telecom two employees of the former KLPD traffic information center decided to 'jump in the gap' created by the retreat. In 1998 they established the commercial Traffic

Information Service (VID). Initially, another VID partner recalled, he had only been an advisor. Before that he had been responsible for the process to get TIC operational. They had managed to pull that off, he recalled, but their second mission to attract customers was not successful. They had coaxed endlessly, but to no avail. Still he could understand very well the reluctance of entrepreneurs to engage in traffic information activities: *"Well, that had to do with a couple of things…(..)…The ICT-sector was booming at the time, they were just receiving loads of paid assignments, so then these companies, or the individuals working in the sector, are less inclined to go freewheeling on their own expense and risk…(…)…So, that wasn't really helpful…Second, I think it was also a matter of being unacquainted with the traffic information phenomenon in its various guises…and third, this is a kind of public-private partnership, really, as both public and private parties have their roles in the chain. And well, the engagement of public and private, as you know, that is just very tricky."* (*34, 4).

Around June 1998 people had started approaching him with the question whether he would like to do it himself. And as former TIC partners only encouraged his migration to the private sector, eventually he had considered 'why not'? It would be a challenge to demonstrate a decent living could be made from traffic information provision, and it would prove the information chain policy he had been involved with to be sound (*34, 1-2). In the beginning it had been far from easy, however. Main customers such as radio stations were used to get their information for free from the police, so their willingness to pay was low. In the beginning they had to settle for a low price, negotiating commercial air time for their phone services. Beyond these phone services they added an internet service by 2000. Apart from queue lengths, it featured information on weather circumstances, announced speed controls and traffic prognoses. After reorganization of their data processing systems and a test with travel time measurement, they developed an SMS-service: customers could enter their routes on a website to receive SMS-alerts in case of unexpected events. This customized service they launched in April 2002 (VID, 2009).

Competition hadn't been that tough, he explained. Essentially they and ANWB had been taking turns in conquering market shares, and only recently TomTom had entered the market. For some time ANWB had enjoyed the advantage of having exclusive access to raw traffic data, but that situation had been settled. As regards TomTom they had felt compelled to invoke the regulations for commercial advertising at one point, having TomTom withdraw an advertisement containing overly powerful branding vis-à-vis competitors. As the latter's claims about relative coverage and accuracy couldn't be sustained, the advertisement was withdrawn and the issue was settled. One of their high points, and simultaneously a low point, they had reached when taking Rijkswaterstaat, their main supplier, to court. Through its website and SMS services, Rijkswaterstaat returned to its distribution role.*"What they were doing, was constantly nibble on that 1996 policy promise, 'we won't engage in distribution of traffic information - period'. Then they said, 'weelll…but, if things aren't pulling off well…then we want to do it ourselves'. 'Pulling off well', that's extremely subjective, of course…you could also say that there is no interest for it on the market…I mean, the number of fridges sold on the North pole is fairly small…why?...well, they are not really needed, you could say."* (*34, 5). As in the end government was just 'snatching the jobs in their district', they had to take them to court. The judge reminding Rijkswaterstaat of the delivery contract, 'government went back into its cage'. Despite winning the trial they had also lost, he indicated. Unlike the state 'having a ride' on the taxpayer's account, they had had to

cover the process costs themselves. Besides the unfairness of the struggle it had also been unnecessary in the first place. A sad affair to have this clash, he looked back at it. Just after the verdict they had sent a letter for reconciliation, expressing they considered the episode a mutual loss that better be left behind (*34, 5).

Later on relations did improve, he noticed. If the Laan commissions had led to anything, it resided in the 'not unimportant' restoration of troublesome relations back to normal. As regards substantive issues and getting information provision on a higher level it had rather been a waste of time, however. *"For 50% it was all about, say, procedures, rather than content. And once we would even risk winding up in a discussion about content, really pertaining to something that makes you think, making people rise in their chairs, and these were people high-ranked in their organizations, well, and then it would be cut short again. We just couldn't discuss it, over there, no headway was being made…"* (*34, 6). To stir things up he had drawn up an action plan for future information provision, together with other service providers. Yet nothing concrete came out of the smothered initiative. More generally he expressed frustration about the repeated failure to arrive at a level playing field and about a government too capricious to be relied upon. The problems had been known from the outset, he recalled. The experiences with weather information provision had been exemplary for the risk of market distortion. Having analysed these problems from a business administration perspective, they had concluded that distribution and processing better be separated, with government abstaining from distribution. In his observation these insights seemed often not to be present with the people later involved with traffic information policy, however -apparently not bothering to delve into the matter. Of course, the high-level representatives needed time to become acquainted with the technical ins and outs. 'But if they don't get this time, it all comes to an end'. More in general, he indicated how too many people had been involved who just did not have a clue (*34, 15-16).

Eventually Rijkswaterstaat had confined themselves to their legally circumscribed domain, and through their open tendering procedures governmental actors proved better aware of the appropriate way to deal with the market. Together with other traffic information providers VID had established the Vemodis organization (Vemodis, 2010) as a joint contact for the newly established NDW. *"Even when Vemodis has existed for only one and a half years, it has ensured that customers are taken more seriously at NDW…that is especially important to us, as basic traffic information is a primary resource for us. If the resource disappears, we are basically forced to shut down the shop. (…) For others engaging on this market as an activity on the side, well, everything's fine, it's not their core business…The moment you're having changes on the side of NDW, or Rijkswaterstaat as it stands now, well, they will see what's coming, and don't need to be on top of it."* (*34, 13). Expressing their criticisms in the name of Vemodis made those a lot more forceful, he considered, at least avoiding the impression of stemming from 'that troublemaker again'. The installment of NDW implying new delivery contracts to be settled, it was yet again that the 1996 stipulations were subject to discussion. *"Now they're saying, 'yes, we have this NDW now, and these are our roads, but, that might change'…Well, you can't rely on that, 'it might change', that is not clear…Yes, it is all in development…but what is it that is in development? Tell me, please…'well, we don't know yet'…This unclarity, this is what you should avoid…make choices better…it is better to make the wrong choices, than no choices at all."* (*34,

12)[4]. Of course they sought to maintain the clause preventing government from 'snatching the jobs in their district'. To Rijkswaterstaat it hadn't been a problem at all. This time the regional and local road managers had started to resist, worried about the constraints on their activities. He didn't see the point behind their government-sponsored area-oriented management, though. Instead of 'throwing all problems together and making them insoluble', road managers would be better advised to stick to their own jobs (*34, 8/9).

Within the Ministry of Transport the DG-P policymakers were not the only division involved with travel information. The very idea of information chain optimization had been informed by the Rijkswaterstaat research department AVV and other departments concerned with ICT, geo-information, infrastructure, and traffic management. As a Rijkswaterstaat officer explained, the ministry is occupied with a great diversity of issues of which traffic management is only a small part. The policy visions being developed by the policymakers at the ministry, Rijkswaterstaat was more concerned with actual management of traffic. *"Well, not that they interfered, but…with us it is only a narrow area of attention, with a lot of intensity going into it, whereas the policymakers on the ministry have a much broader outlook of course, not delving into matters that deeply, and easily jumping over many details that really have to be pointed out to them, and the importance of which has to be explained, for if not…They are kind of hovering above it all, really the broad contours."* (*35, 6-7). As regards the 1996 initiative to 'leave it to the market' he noted how ever since, the vision had had its up and downswings along the political cycle: The initiating minister had wished to follow proceedings every few months, yet her successor was less interested – with repercussions for the policymakers behind the initiative. Later on there had been the fluctuating attention to either road construction or 'improved road utilization', and then all attention went to road pricing again. By contrast, Rijkswaterstaat operations had a relatively continuous character, priorities being guided more by budgetary constraints than by conscious political choices. As an executive organization, discussions about 'more or less market' weren't their 'cup of tea'. The idea to engage market actors in the provision of services, that had to be initiated by policy management (*35, 14).

Also at Rijkswaterstaat they had been active to draft the private sector for the development of Floating Car Data technologies, however. As a promising way to broaden the basis for information provision it had been an important ground for the policymakers' bet on entrepreneurial innovation. Yet even before it became this policy spearhead, Rijkswaterstaat's research department AVV had investigated FCD application[5]. In 1998 he had been project leader of a pilot with 60 probe cars, riding around in the Rotterdam Rijnmond region. This 'Prelude' project was set up as a showcase of cross-divisional cooperation for Rijkswaterstaat's 200th anniversary, as part of the ministry's 'Roads to the Future' innovation program (WnT, 2007). The pilot was to demonstrate not only the probe cars' usefulness for the generation of travel times, but also the presence of customers for this information - the ministry sought to communicate clearly its aim for new public-private collaborations. As its name already suggested, 'Prelude' was initiated to provoke further developments, as market stimulation (WnT, 1999, 13-17). The pilot was therefore followed up by the 'Multiple Monitoring' (MMC)

[4] See also NDW (2007, 11) for market actors' views on 'professional commissionership'.
[5] See AVV (2002) and van Egeraat (1998) for an overview of research reports.

meetings, where market actors, policy makers and traffic management professionals could exchange ideas.

Looking back on his project he recalled a number of challenges that popped up underway. The fleet of probe cars proved not easy to arrange, with all concomitant dependencies on other parties. Furthermore the communication equipment had to be installed, kept operative, and eventually removed without damage to the vehicle. Mobile telephony was still very costly at the time, presenting them with a tradeoff between accuracy and cost (*35, 1, see also WnT, 1999). In the three years they had the cars running they had gained only general technical insights, he recalled. They had learned, for example, how the absence of exits and entries greatly facilitated the following of cars, thus bringing out the relevance of geographical context. Through considerable exposure in presentations, television and images the project evoked enthusiastic reactions nevertheless. *"So, that is how we rounded off the project, everybody enthusiastic, and then it was considered, especially by our director-general, like, how to get on with it…and there were many market actors saying 'well, we would like to participate', …and that remained in a kind of stalemate for quite some time. Like, 'yes, all very nice, these ideas, but typically it is about obtaining funds from government again, to do some nice things, then the money runs out, and the business collapses again…We really want to get the business started, and we are willing to push it forward a little…we want to help a little, but after a while they need to be able to take over by themselves'…So for a long time we searched for a model, like, 'how to get this market party to the point of actually doing good investments with the money we as government put into it, and that the moment we pay him, that he really starts doing something, rather than purchase the equipment, collect the funds, and lean back...Well, we have really had a lot of those projects."* (*35, 2).

Market actors apparently waiting for government to make the first move, they had launched the 'Intermezzo' project in 2002. It was aimed to 'stimulate the development of a market for the application of mobile data acquisition technologies for traffic data', in its turn leading to '(large-scale) implementation and use of these technologies' (Rijkswaterstaat, 2002). The Intermezzo tendering procedure had incentives built in to ensure continuity. Remuneration was made dependent on milestones, the crucial milestone being the acquisition of a contract with a customer. This would prevent contractors from 'leaning back' after technology investments. The tender was won by a consortium of LogicaCMG and Siemens, with the province of Brabant as 'launching customer'. On June 18th 2003 the national news bulletin announced a world premiere for the Noord-Brabant province, announcing the start of their 'Better View on Brabant Roads' pilot on a press conference. The pilot was to gain experience with FCD techniques, accelerate the implementation of new acquisition techniques, and generate a good view on provincial roads. The FCD-systems would yield travel times, rather than the traditional queue lengths, extending onto the secondary roads as well. Figure 7.5 displays how the information was presented to drivers:

Figure 7.5

Travel time information in Brabant FCD pilot (De Wolff, 2005).

The consortium offered its 'Mobile Traffic Services' for a small section of the province, using the 'floating car' data tapped from telecom operator Vodafone. The pilot had a stepwise design, giving Noord-Brabant the option to renew its license for the information and scale up. Evaluation took place through a sounding board group of national, provincial and municipal road authorities, technical validation of the information quality, and cost-benefit analysis (see Schuurbiers & van der Vlist, 2004). Crucial for the continuation of the pilot was the question whether the 'floating' data were sufficiently reliable alternatives to the detection-loop data. This would determine the scope for application, and therewith the eventual returns on investment. On september 14th 2004 the province of Brabant gave MTS the benefit of the doubt, signing the service level agreement by March 1st 2005. They considered the quality shortcomings acceptable, but had also been convinced that LogicaCMG were continuously working on improvements (de Wolff, 2005, 22).

Several developments had had them embark on the project, the project leader of the Brabant pilot explained. Already in 1998 the province had espoused its ambitions to be a frontrunner in technological innovation, and this materialized in its Dynamic Traffic Management program as well. Furthermore, his predecessor had become acquainted with developments in FCD technologies through the meetings held by the ministry, and had established the first contacts with LogicaCMG. Intermezzo had been essential support, not only as a funding opportunity, but also for preparing the tender for them; if they had drawn up one by themselves, it would probably have failed, or at least have led to a different result (*36, 1-2).

Within the elected consortium of Siemens and Logica CMG, the first focused on GPS technology, the second on GSM. In advance, they had been especially interested in GSM: This preexisting communications network would save them the burdens of equipping and managing a fleet of cars. At the start the project leader hadn't known much about Logica's GSM-based system, except for their brochures. Earlier applications he knew to be small-scale, and confined to laboratory-settings. So even when perceiving a high potential for in-vivo application, they had also anticipated a great deal of complications: A basic premise for the pilot was that the technology yet had to prove itself, and that the pilot should be made into a 'flywheel' for further initiatives (*36, 2).

Indeed, the actual field operational test brought up complications raising questions and skepticisms, even with the project leader himself: *"…well, did the phone network yield sufficient input to generate real-time data…how about the accuracy of the system, can*

you actually match with the road network concerned, about which roads are you getting information anyway, are these the main roads you already have information about…or, is the system able to cover the lower-order roads as well, what is its range…is it functioning in the inner city, where there is competition from stationary phones…-phones on the bike, and in the bus -, and can you filter this to ensure it tells you something about car traffic…and the routes with the influence of traffic lights, can all this be…" (*36, 2/3). As the evaluation report specified, reliability ultimately depended on the number of GSMs detected on a certain road section. The moving dots observed should be rightly attributed to cars, rather than to stationary non-car traffic sources. At low-intensity roads, performance was therefore problematic. So apart from increased penetration of mobile sensors, i.e. more widespread use of mobile phones, also filtering and data processing could allow for enhanced information quality (de Wolff, 2005, 24-27). Once these measurement complications could be met, the project leader thought 'something beautiful' could be created. He had envisioned how the information could be marketed through navigation system providers, and increasing use of these systems would allow for a 'transition to widespread GPS-based data acquisition'. Using the GPS-signals of navigation systems would enhance accuracy, and solve the attribution and filtering problems – through the navigation devices the signals were unambiguously tied to cars. Such large-scale application would eventually economize (*36, 3).

Several things had to be done within the project's limited time span, however. Ensuring application and embedding in their Dynamic Traffic management-program proved more time-consuming than initially expected (*36, 7), and both market stimulation and province-branding ambitions required action in communication and publicity as well. And then the evaluation, crucial to inform further steps, proved to pose considerable challenges: *"Well, and then you're facing the problem, what are you going to take as a reference to ascertain its validity? And knowing that the reference systems have their flaws and shortcomings as well, what do you get out of it? The research set-up for that validation, it took me quite some effort to get it right, in the sense that the report describing the research be sufficiently clear to allow for discussion on the level attained…through what process did it come about, what conclusions were based on -irrespective of whether you subscribed to the conclusions or not."* (*36, 4). The eventual report he considered only 'just sufficient', but in any case, they had been convinced of the system's merits.

By the end of 2005 the province of Zuid-Holland tested the MTS system as well. While struggling to recall the nuts and bolts of measurement, filtering and aberrations, the former project leader did remember vividly the difficulty of arriving at an evaluation report. Their ambitions in network-oriented traffic management had led them to explore the FCD potential to monitor the underexposed secondary road network. They wanted to go beyond the periodically held traffic counts (*37, 1). Apart from the MTS system, radar systems were tested as well, allowing for comparison. This time around the test results raised even more severe doubts on FCD monitoring performance. After all, they were interested in traffic intensities, rather than travel times (*37, 4). *"To be honest, you could burn it down completely, if you wished to do so…but we weren't after that at all…nor was it about the merits of Logica, or about disqualifying them, but rather it concerned the assessment whether the technology was sufficiently mature to, let's say, perform that function…Well, our main conclusion was that the technology was insufficiently mature, and we did establish some recommendations, at the time with TNO, and together with Logica, about, what lessons (…) can be drawn from this, that*

are also, especially, instructive to the provider*….And I must say, this was a rather…ehm…particular period, as you are dealing with something that turns out to be really of concern - a business case, of a company. Yes, it is as simple as that, and you try to do it in a responsible way…you do want to get your message across clearly, but you also want to phrase it such that it is about the technology, and not its producer. Well, I think we succeeded at this, to prevent it from escalating."* (*37, 9). So notwithstanding the lessons learned and the perceived scope for refinement (de Jong et al., 2006), their pilot was not followed by further roll-out.

In the early half of 2006, researchers from Delft technical university conducted a validation for a final verdict. Considering the findings of Noord-Brabant and Zuid-Holland still inconclusive, Rijkswaterstaat/AVV had commissioned them to compare roadside systems and MTS through detailed performance measuring on the A13 highway (AVV, 2006b, 7). They assessed the detection systems on the basis of several criteria, but despite varying relative performances, overall comparison did not favor MTS. Only in case of ill-provided detection loop systems, as on the secondary roads, MTS came out well. Even then MTS information alone would not suffice for certain Dynamic Traffic Management tasks, however. Instead of focusing on separate data acquisition systems, a better advice would be to invest in data fusion techniques, the researchers recommended. Such fusion would reap the best of several imperfect systems. Notwithstanding these evaluations, FCD-based information provision to users was another thing. In the Haaglanden Mobiel project, it turned out to catch on among end-users, for example (see Ch.5). This was in line with the findings of the A13-tests: MTS was clearly outperformed on traffic intensities, but did give acceptable results for travel *times*- the latter being more relevant to end-users.

Also in Brabant, the improvements in the MTS eventually fell short of the expectations. To the project leader's disappointment, the FCD-trajectory was abandoned by mid 2007, when a new tendering procedure favored more traditional systems. As stated by the project leaders from Brabant and Zuid-Holland, the functional specifications of NDW had set such high a standard that they effectively excluded FCD technologies. Looking back, the Zuid-Holland project leader expressed that 'had they had already been under the umbrella of NDW, they wouldn't have gone inventing the wheel as they had' (*37, 10). His Brabant colleague had been disappointed about other road managers' limited willingness to jump on the train they set in motion. As the audit had indicated afterwards, 'the demand side was not yet ready for the product', road administrators on the decentralized levels seeming unaware of its possible gains (De Wolff, 2005, 42).

As the project leader of the 2002 Intermezzo initiative recalled, the trajectory hadn't been easy for either of the consortium partners. Siemens had considered stepping in, owning a navigation system themselves. *"And, Siemens in the Netherlands, that is really small, whereas Siemens Germany is huge…Siemens Germany wanted to go along, that is where the knowledge and know-how had to come from, and actually they sort of dropped out by a range of squabbles in the Dutch division of Siemens…Some people left, things weren't going that well, it was a bit of a crisis situation,…So, in the end it turned out that Siemens….that they couldn't manage what they had intended to do…and they have been struggling for quite some time to pull it off, and in the end they attributed it a little to the fact that a lot had to be invested to have that navigation system ready for FCD acquisition, a lot would have to be built around it to get it to work, and it would cost that much…"* (*35, 4/5). Siemens had also had the idea to 'return the data to

people' as services. In the end headquarters had the plans abandoned however, insufficiently convinced of the willingness to pay for traffic information. Also Logica CMG had had to solve a manifold of problems. In their case many odd complications had manifested only after closer scrutiny. The complications had them return to tinkering with the software and the underlying concepts, but in the end they had called it a day, and sold the system and its developers to TomTom. Logica CMG, they had concentrated on the technology aspects of retrieving the traffic data from the phones, without paying much attention to eventual selling of the information. Similarly, Siemens weren't accustomed to working with end-users either, the project leader explained, traffic lights and safety systems being their core business (*35, 5).

Even when the intended FCD-trajectory in traffic management came to a standstill eventually, the Brabant pilot had given considerable exposure to MTS. Logica CMG had presented it on the annual worldwide Intelligent Transportation Systems (ITS) conference, and eventually navigation systems producer TomTom bought over the business, including the staff involved with the system. As one of these TomTom employees explained, TomTom had been on the lookout for traffic information technologies already. Once Logica had started to boast about their system – in fact the technology of its partnering company Applied Generics-, TomTom had simply seized the opportunity, in 2006 (*38, 4). The Brabant pilot had really been something new to the field, he indicated, thanks to several factors coming together. *"In the first place, they were very enterprising in that direction, also towards government…I was one of the stakeholders there myself…and then you had a very innovative provincial government as well, again with the right people at the right positions, as is needed, not only a couple of innovative people on the floor, but of course the whole management, the board, the deputy, the whole line just fit together there, they all wanted to establish innovations…an opportunity was found, and actually seized upon."* (*38, 5). The Brabant people had already been well aware of FCD possibilities, he added, and the functional rather than technical specifications of tendering had certainly helped - that had been an important contribution of the Ministry.

Their introduction of portable and low-priced navigation systems had been a major thrust, and from about 2005 onwards, Tom Tom enjoyed excellent business results. The purchase from Logica CMG was part of TomTom's encompassing strategy of adding user services to their navigation systems. From that moment on, they had started to refine the basic technology. Integrating traffic information provision in a whole portfolio of services, they had managed to round the business case around real-time traffic provision - the prospects for which their predecessors had considered limited. Just before launching their HD Traffic system, at the end of 2007, their managing director declared in a traffic management journal that this system was only the beginning; a 'second generation' in navigation systems. It was to be understood as a move from 'find your destination' to 'find the optimal route to your destination'. This would be useful information not only for unknown destinations, but also for daily commutes (Groenhuijzen, 2007). This HD Traffic was based on essentially the same technology as in Brabant pilot, but 'every acquisition system having its limitations', TomTom had pursued a 'multisource-strategy'. They used not only Vodafone 'floating' data, but also the loop detection systems and the TMC messages broadcasted by government. Historic traffic data he pointed out to be an essential ingredient however, 'greatly underrated' hitherto: *"By now we have collected that much historical data, that we can construct an accurate week profile of tens of thousands kilometers of roads in the Netherlands. We*

know the travel time in a certain direction, including the dips in queues, traffic behavior on the Sundays, how much earlier people hit the road on the Friday afternoon, etcetera. Thanks to these historical data, we no longer need complicated and maintenance-intensive models to arrive at a good representation of traffic. You know, as it were, your position on the curve: We are measuring this, it's a Monday on this particular time, so the movement downward the slope sets in earlier…" (Groenhuijzen, 2007). The launch of HD Traffic took place with the NDW process underway. When asked about possible delivery to NDW, he stated: *"We have it already, and not of 6000, but of 23000 kilometers. And moreover, we have the historical data of 120.000 kilometers of road, the entire road network of the Netherlands. But NDW wants the guarantee of passing it through to all other parties, and this we don't want."* (idem).

'Of course they wouldn't deliver', the TomTom employee added in 2008, pointing out the millions invested to develop the system. He expected the situation to 'crystallize further', though (*38, 1). To their opinion, the required traffic intensities weren't actually needed: With real-time calculation of quickest routes, enhanced navigation would yield optimal use of the network. Without aiming to do so, they were engaging in traffic management. And if only government would only acknowledge this new state of affairs, he had written in 2007, they would abandon illusory steering ambitions (Rutten, 2007). Returning to the issue in 2008, he expressed to notice changes in government circles, however: *"At the ministry people are very well aware, that they have to go about differently…you just have to reconsider your position, and go back to the core of traffic management, to steering, coercion, and enforcement…those are the real governmental tasks…informing the public, this was taken up by government because it would not pull off otherwise. But I think now we are closing in on the moment that government will say, what we do now with policy, is no longer needed…You have to redefine your role, and I think that over there at the Ministry in The Hague…surely they see this, that things should be done differently…"* (*38, 5).

Notwithstanding the signals of policymakers adapting to the new reality, TomTom were still confronted with negative publicity. There were accusations of misleading marketing and unsupported claims, both from governmental actors and competitors, and the popular jokes about presumed system errors leading users to unexpected destinations. The problems of the undesirable routes he considered a rather complicated dossier. Media reports had put it 'rather starkly', he considered, even apart from using their name when actually referring to navigation systems in general (*38, 3). In the end the distinction between governmental 'desirable routes' and their 'quickest routes' wasn't that great however, he explained: According to standard settings, the most frequently used settings, drivers would be guided along 'desired routes' in 99 to 99,5% of cases. This congruence they could enhance through customers engaging in 'map-sharing', reporting inconsistencies between actual conditions and map indications. Consistency also depended on government disclosing its data however, he pointed out: *"And what we have been saying continuously, 'dear government, you have been declaring continuously that we are trampling everything down, but, if we don't have information, how are we supposed to navigate, then we just can't…(…), so then you need to indicate, 'this is prohibited for trucks'…(…)..if only these data are disclosed nationally, then we will enter them as soon as they become available..' And then, at the end of the story, the information is not available nationally after all. And of course we won't be making telephone calls and ask, in which streets would you like to have trucks prohibited…this cannot be expected from a business actor, that we are to establish such database…So,*

the story is a bit diffuse…" (*38, 3). The 'undesirable routes' he considered an exaggerated problem, just like another system flaw often held against them: Navigation-aided drivers seeking shortcuts would in turn become a source of congestion problems. *"Statements have been put forward by, for instance, Delft Technical University, that once reaching 20 to 25 % penetration, a completely unstable transport system emerges…Well, we haven't reached that point by far of course, but of course we do think about it, about what could be the following steps, and what we certainly do, is, say, just keep open the discussion with the Ministry and the road managers…We do acknowledge that in this field, we exert a certain influence."* (*38, 1).

More generally they were constantly anticipating new developments, he indicated, seeking to keep their competitive edge on an increasingly dynamic market. Competitors being eager to seize their technological concepts and facing the more general development of ubiquitous mobile intelligence through the i-phones and the Blackberrys, they needed to keep up with ever new products and services. On the longer term, navigation would constitute only a part of their portfolio. Only recently they had made a contract with a major car manufacturer, for example, but also their competitors were welding strategic alliances.

A crucial asset in their line of business was the availability of adequate geographical data. After a 5,7 billion dollar bid on Navteq by Nokia and a 1,8 billion bid on Tele Atlas by TomTom, the NRC newspaper reconstructed 20 years of digital map-making: The bids had been preceded by two decades of investments in digitizing map material on an increasing number of countries. Initially it yielded hardly any returns, leading several companies to abandon the endeavor after all. A Sisyphus ordeal; in order to keep up with changes in the road networks, the maps had to be corrected every four years. The release of portable navigation systems changed the situation, however: *"For Tele Atlas, it was a gift from heaven. The company had – and still has – hardly a position on the market for in-built navigation equipment. With the advent of portable navigation systems the company could finally gain new customers."* (NRC, 2007b). Even after this favorable market development the value of the maps remained unclear to both producers and potential buyers. Finally, the 2007 takeovers marked substantial returns on investment.

TomTom thus assembled new technologies on their navigation platforms that also yielded business opportunities for other industries. The Intermezzo project leader noted how recently their public-private meetings had an influx of new actors somehow active in the information chain. *"Well, you see the dust clouds clearing up a little now, you see parties getting involved from just a little different angles, just distantly related, a little less emotionally involved, and they are not acquainted with what happened earlier, a lot more inclined just to cooperate, 'no fuss, let's just do this together'…And you can see it getting bigger, this little band…People like Qpark, for example, telling 'we have a lot of information on parking'…before, they would not release the data, as of course it's not very pleasant for them when competitors can see your parking decks are poorly occupied…And now you see them taking steps to make the information available, because, for them it bears added value as well, as people will consider, 'well, that's where I should go, as you have this parking space becoming available'…and then you see municipalities becoming ready to facilitate your parking place in some way…Well, that is how you see parties coming to terms with each other."* (*35, 13). Starting from the 'multiple monitoring' meetings in 1998, the meetings had been continued through

the public-private Connekt organization, as three-monthly 'market acceleration mobility information' (MMI) sessions[6].

Working for a network organization in the rail sector, he was concerned with bringing together the various stakeholders for deliberations and joint innovative action. Beneath the common interest to have the sector flourish as a whole, there were also constant tensions: The railway operators' complaints about capacity shortage versus the infrastructure providers' insistence on proper scheduling, for example, but also the tensions between public transport operators. Public transport was dearly in need in innovation, he considered. This is why they sought to initiate and stimulate a range of innovations: Recently they had focused on public transport nodes, for example, the crucial challenge being to stimulate operators into integrated efforts for improved service to users. Even for the much praised multi-modal arrangements at Schiphol airport there was room for improvement, he considered. Integrated information provision he deemed essential, ideally in the form of real-time information encompassing both public transport and road traffic. Compared with the state of the art abroad the Dutch situation was quite well advanced, he considered, with the integrated route planner OV-9292 for the public transport modes and TomTom for car traffic. On the other hand, this integrated route planner offered only static information, rather than the real-time services available to car drivers. *"Well,…real-time information provision for the car is a bit easier to bring about, I think, as you only have to focus on one party…whereas real-time information on public transport, there you're dealing with a diversity of parties, and on top of that, these parties think, or have the feeling, that this real-time information might even work against them…"* (*39, 5). He had observed how, despite apparent endorsement, the project seemed to stagnate: *"Well, and that is the funny thing about the public transport sector, you're all gathered around the table, 'oh yes, multimodal travel information, we are definitely in favor of that, we all want to participate', but when it comes down it, you see people retreating again, and say, 'well, it is a bit sensitive', and do I really want to be the first to risk my neck…"* (*39, 5).

He saw the transport operators endorsing the general concept of integrated information provision, but stay reluctant to disclose the actual travel times. It would amount to releasing sensitive information about actual operation, the flaws in which could easily be held against them. The OV-9292 conglomerate of public transport operators had initiated a broad collaboration to pull it off, but in the end he considered direction by government indispensible. *"Actually I think government has retreated too much from this this area, that is so pivotal for…for an integrated transport system…I think government does benefit from a smooth exchange within these chains, and from multimodal travelers' information…and I think, if they would exert direction a little more, and for instance oblige the operators to disclose their actual traffic information, that they could play a major role in this…"* (*39, 8).

OV-9292 had been established in 1992 already, as a joint venture of all public transport companies in the Netherlands. Starting with a phone service and later adding internet, SMS and i-phone services, they developed a public transportation route planner they gradually enriched with a planner for car traffic, prices, incidental delays and schedule changes (OV9292, 2010). For a couple of provinces they could offer dynamic information as well: Separate operators and governments throughout the country had

[6] See Connekt (2010) for an overview of recent presentations.

been setting up 'dynamic route information systems', presenting expected departure times to travelers through displays at stations. By 2009, 10% of stations was equipped with such displays (KIM, 2009, 12). Beyond the local arrangements, the authorities of the Noord-Holland province and the Amsterdam metropolitan region had launched the initiative for mutual couplings in 2007, under the heading of 'boundary-crossing transport information' (GOVI, 2010). National coverage would not be served with transport authorities establishing their stand-alone systems, the consideration had been, and sharing of development costs would economize. *"The aim for standardization does not only make the transport information phenomenon more attractive to licensing authorities, but also to road managers, suppliers of information panels and transit operators. They can serve a greater market without devising tailor-made solutions time after time. The advantage also manifests in case of changes in license agreements; a uniform information system does not have to be adapted to possibly deviant techniques in use by the new operator, as long as they keep to the standard agreed upon. This is already beneficial to operators, but the information also yields yet another advantage. Analyzing the data over longer periods allows for a better view on actual performance. In case of structural delays on certain lines, times or traffic nodes, this management information can be used to adapt routes, traffic light cycles and schedules when needed. This will enhance accuracy and quality of public transport."* (Kamerik et al., 2008, 36). The GOVI-database was based on standards and interfaces that themselves were subject of joint development as well. In September 2008 the association for management of information standards in Dutch public transport (BISON) was founded, hosted by the Connekt network organisation. Its members from transit operators, authorities, industrial parties and travellers' organizations could propose adaptations to a 'Change Advisory Board', and agreed upon changes would be fed back to its members (BISON, 2010).

In spring 2008 their minister had actually taken them by surprise, the official of the Transport ministry recalled. MPs had presented a critical memorandum about travelers winding up 'on the wrong track', asking the minister for measures to catch up on information provision at railway stations (Koopmans & Mastwijk, 2008). Apparently the minister had considered it an opportunity to make his mark, and announcing an 'offensive on multi-modal transport provision' he even offered more than had been asked for. This is how they needed to update and expand their earlier plan on public transport information, and prepare it for presentation to parliament. Devising the plan had taken them more time than announced, though. They had awaited the outcomes of the Laan commission deliberations, and had carefully consulted the various stakeholders – it was not supposed to be an 'ivory tower' project (*40, 1). Eventually the offensive could be presented on July 2nd 2009: *"Improved accessibility results partly from good travel information to travelers, as they can choose – any time and anywhere – optimally and consciously on the basis of A, actual, B, reliable and C, nationally covered multimodal travel information, from door to door. Currently such travel information is still insufficiently available, which asks for an upgrade in availability and quality of data, resulting in multimodal travel information available both before and during travel."* (Min. V & W, 2009, 1). The plan built forth on initiatives already taken by stakeholders themselves, the Minister indicated, but also entailed intervention to enhance information provision (2). The plan announced the establishment of a national database for dynamic data. This NDOV would take a position independent from information providers, and transit operators would be obliged to disclose their dynamic data. The obligation would be effectuated through amendment of the personal transport

stipulations. *"In order to leave sufficient space for market parties while giving adequate protection to transit operators, governmental actors and transit operators will jointly establish terms of use and delivery for NDOV and market parties"* (3).

As the official explained, the NDOV initiative seized the direction over a stagnant process. First the transit operators had questioned whether it was really necessary, then they had accepted the release of dynamic data - yet still without taking appropriate action. As policymakers they had finally decided to make disclosure enforceable by tendering principals, while being responsive to the operators' demand not to disclose management information (*40, 7). Separating data acquisition from distribution, the NDOV arrangement would discontinue 9292OV's effectively monopolist position. Opening up the market would stimulate the development of the essential personalized services, he explained. *"The big fear of 9292, but also of the public transport companies, is that release of the data and allowing anybody to go about giving travel advises would have public transport under a cloud. To our idea, there is no need for this; a market party will soon lose credibility when giving unreliable travel advice. Travelers have a need for objective information, and when it is wrong and they feel themselves being manipulated, they will quit soon enough. So, we're not really worried about that…instead we believe that, especially because of competition, there will be the incentive to have one's information in order…with the navigation systems you see a considerable competition, so companies invest more and more to improve their information…"* (*40, 11). Observing the 'enormous rise' of the market for traffic information services and the rapid increase in travelers consulting (mobile) internet, he saw plenty of scope for new multimodal information services.

Multimodal information provision would not be instrumental in an actual modal shift towards public transport, he believed: Due to habitual behavior the larger part of travels did not involve travel choices anyway. The policy objective of modal shift had already made way for the aim to facilitate conscious choice, and have people choose their optimal solutions. On the other hand he pointed out a minority of trips really being subject to conscious choice, with increasingly relevant 'push-factors': Through flexible mobility budgets, leasing companies were actively stimulating incidental public transport use. The rises in parking fees had people reconsider their travel choices as well (*40, 4). And service providers had started to see this too, he indicated. *"Well, up till now they have focused on the car driver, but they also see their competitors broadening their activities, and as regards parking information or Park & Ride information, they're surely interested to have it. They don't want to do the investments themselves, but if we make sure the information is there, they will certainly use it…Because it is a fact worth knowing that as for now, parking is the big unknown variable in travel guidance. On average 10 to 30% of your travel time with the car is spent looking for parking space, and well, there is no travel guide accounting for that…or wait..,yes, recently ANWB have included it"* (*40, 4). Next to TomTom he also noted a rapid rise of Google, becoming an ever more important player in the field through their services on mobile phones and smartphones. Excluding parking from travel guidance essentially rendered an all too rosy picture of car travel, he indicated, as public transport information *did* contain waiting times. More generally he considered 'informed choice' to involve a lot more than travel times only. With regard to the concrete factor of travel times public transport was generally outcompeted by car travel, but for reliability, cost, and comfort, things were less clear. They were looking for ways to have these relatively elusive factors articulated in travel guidance. Similarly they were investigating possible

inclusion of environmental parameters, and intended to organize a symposium to inquire into market parties' interests in such module. Future road pricing he expected to gather all the relevant data for car travel, but for public transport a system had yet to be developed. OV9292 had developed a prototype earlier on, he recalled, but eventually they hadn't succeeded in selling it (*40, 12).

Disclosure of travel information proved to be a sensitive issue for public transport operators, but posed its challenges to governmental actors as well. Even with the FCD systems still in their infancy, the Brabant pilot had evoked critical questions about the privacy of the phone users tapped from (*36). In 2007, a newspaper article on the NDW initiative featured the alarming heading: "Soon the State will determine where you drive", using the connected senses of 'determine' to the full: *"The final goal is to have the car driver directed like a bottle in the beer factory*." (NRC, 2007c). Beside monitoring of traffic, improved data acquisition techniques were also used to monitor individuals: Automated license plate scanning proved a highly efficient tool in tracing and enforcement[7], for example, and similar tracking techniques would allow for fine-tuned road charging. Especially the latter option evoked resistance from people objecting to 'have a Big Brother in my car' (Kilometerheffing-nee, 2010). The increasing access to information posed practical dilemmas, a Rotterdam traffic management official explained. Some of the city surveillance cameras would certainly come in handy for his operational traffic management ambitions. The cameras in the alleys wouldn't be of much use, but there were plenty of cameras covering the main traffic routes as well: *"I think they have about 300 cameras there, which, in case nothing frightening happens, could be used to have a view on traffic. You see, when a murder is taking place out there, I'm not too interested to see whether there is a traffic queue either.. So, the people charged with it can zoom in on what terrible thing is going on…But well, I would like to gain some experience with this, like, could it be of any help…in any case I would consider it pretty stupid if, with the city adorned with cameras like a Christmas tree, if I would add two more camera's of my own…Well, that's something you need to consider, whether that is what you want, in the end it turns out to be necessary that they are separate systems…"* (*19, 8).

Over thirteen years of information chain development, an increasingly wide range of actors became involved. After the following timeline of events, an assessment of innovation outcomes follows in section 7.4.

[7] The police used the new monitoring techniques for 'nodal policing'. See also Ch.4 on the 80km/h zones: Advances in traffic monitoring allowed for the section controls as effective enforcement instruments.

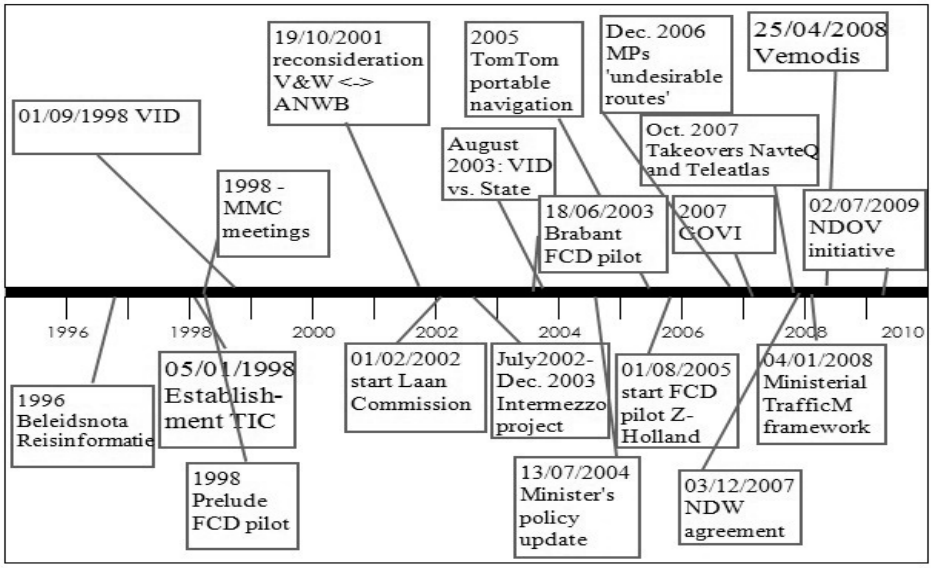


Figure 7.6 Timeline information chain

7.4 Innovation outcomes

7.4.0 An initial ordering of footage

Having described the innovation's circulations through the experiences of various initiators and translators, a rather chaotic picture arises. The first step to gain understanding of this innovation journey is to step back, and take stock of some basic characteristics. Ordering this relatively raw material through initial assessments of outcomes and development patterns helps establish striking events, salient issues and rudimentary patterns. These can be used as leads for subsequent translation-dynamic analysis **(7.5)**. The following three questions help to develop a basic overview of the innovation journey as a whole: *Was the innovation attempt successful, as perceived by initiators and stakeholders* **(7.4.1)***? What was achieved in terms of system innovation* **(7.4.2)***? What basic innovation patterns can be distinguished* **(7.4.3)***?*

7.4.1 Innovation success

One question relevant to any innovation process is what its yields were, and whether it met expectations. Yet considering the aim to approach innovation as two-way traffic, it is important to consider that 'success' and 'failure' are in the eye of the beholder, and that evaluation of success is bound to be ambiguous and contested. Hence the following question:

Was the innovation attempt successful, as perceived by initiators and stakeholders?

'Information chain optimization' was an innovation attempt guided by the future vision of 'informed choice'. Optimizing and attuning the acquisition, processing and dissemination of travel information, provision to the end-user would become more reliable, consistent and integrated. Looking back in 2010, the projected horizon for the

1996 initiative, one of the initiators saw part of their ambitions fulfilled: *"So, things are moving forwards, but slower than we would like them to go…And with this modest group at policy management, well, you have to count your blessings, and get closer step by step…"* (*30, 8). This ambivalent assessment can be understood through the following successes and setbacks:

The innovation attempt started favorable. A first success was **passing** the policy initiative **through parliament** without much ado. As indicated by both initiators and other stakeholders, its ramifications seemed not to have been appreciated to the full. In a sense the proposal passed as a 'wolf in sheep's clothing'.

Information chain optimization was to result from the actions of many actors, both in the public and the private domain. The key action for the innovators was to create the institutional preconditions for this, the 'architecture'. A second observation on innovation success is the **successful implementation** of the traffic information center, the **TIC**.

Establishment of the traffic information center was soon followed by the founding of VID. Seizing the market niche left by the police, this commercial service provider took over their reportings seamlessly. The police could retreat from information provision to end-users, and focus on their core tasks: A public-private reshuffle of responsibilities that was exemplary for the information chain philosophy. The initiators did find their new institutional architecture being clogged by remnants of the past, however. The driver's association had become closely intertwined with government, for example, which was at odds with the liberalized arrangement. Through the cabinet's increased attention to market distortions it was disentangled in 2001. Also the Ministry's internal organization proved ill-adapted to the chain architecture. Out of their strong traffic control commitments, Rijkswaterstaat continued their broad activities, including a website and SMS service. To VID this amounted to 'government snatching the jobs in their district', however. The law suit in 2003 was a marked setback: 'Both parties lost', public and private parties agreed. Even then, it remained difficult to road managers to refrain from initiatives in traffic information. A third observation on innovation success is that is was **hampered by remnants of the old order**.

Beyond the VID, the innovators had to wait long for the intended information market to take off. The Intermezzo project leader described a recurring 'stalemate' situation, and one of the initiating policymakers expressed similar disappointment about the slow FCD trajectory. The rise of TomTom marked a breakthrough, however, after which the market started to grow after all. Such breakthrough proved even harder to accomplish in the public transport sector, as testified by the renewed attempt for an NDOV in 2009. Further observations on innovation success are therefore this **initially hesitant market development**, and as regards commercial traffic information provision, the **breakthrough after all**.

Driven by the aim to engage in network-oriented management and facilitated by increasing availability of traffic management equipment, the traffic management activities on the decentralized levels displayed a marked growth. The road managers arrived at more user-oriented, dynamic, and better coordinated traffic management, their coordination ambitions culminating in the NDW arrangement. These **advances in traffic management** constitute a sixth observation on innovation success.

The innovators addressed the hesitant information chain development by facilitating continuous deliberations between the chain actors: The public-private MMC meetings, the Laan commission, its successor ACVI and the subsequent 'Strategic Deliberation' were platforms for coordinated chain development. Also the establishment of intermediary organizations such as Connekt, GOVI, Vemodis, ITS and their international counterparts created durable alignments within the chain, manifesting in joint projects, conferences, demonstrations, pre-market deliberations and public-private network sessions. A seventh observation on innovation success is this **network formation**.

These institutional arrangements could not ensure a fully harmonious chain development, however. The 2009 ACVI report noted improved relations between actors, the Intermezzo project leader saw the 'dust clouds' making way for constructive chain development and 'market acceleration', but the chain continued to display internal tensions. In 2009 the Laan commission chairman himself noted how despite the specified division of labour, 'lasting, grating conflicts' between the public and private domains remained - arising typically with regard to incidents requiring governmental intervention (NM, 2009b, 23). More generally, truly integrated information provision still left much wanting by 2009: Terms of delivery had TomTom and NDW as yet go separate ways, the 'undesirable routes' problem would still take time for resolution, and the desired multi-modal information provision required further development. Regarding innovation success an **ongoing integration process** can be observed.

7.4.2 System innovation achievements

One question is the innovation journey's significance in terms of various actors' ambitions, yet another is its significance in terms of *system* innovation – the typically organization-transcending changes that alter the relations between actors, and mitigate dominant cultures, structures and practices. Instead of moving the camera between various initiators and translators, this rather involves the researcher's helicopter view on the changes in the network as a whole:

What was achieved in terms of system innovation?

As indicated earlier, the 1996 policy vision can retrospectively be considered a 'wolf in sheep's clothing': Even when not immediately apparent, it was meant to bring about not only a technological revolution in travel information provision and a changed choice environment for travelers, it also entailed a fundamental shift in responsibilities: In these respects the initiators aimed for a system innovation.

In order to arrive at to arrive at reliable, consistent and integrated information provision, the policymakers placed their bets on entrepreneurial innovation and set themselves to provide the preconditions. The TIC, VCNL and NDW arrangements were milestones for their strategy; these were the institutional backbones to consolidate organization-transcending chain development. A first conclusion on system innovation achievements is the establishment of this **new institutional architecture**.

The chain architecture would have to yield substantive improvements in travel information provision, primarily through entrepreneurs seizing the technological opportunities afforded by the ICT boom. The establishment of VID was an early pay-off for this strategy, but beyond VID's successful development of services, market development remained hesitant for a while. The FCD-trajectory was the acid test for the bet on entrepreurial innovation. Despite growing acquaintance with the basic

technological ideas and potentialities, the trajectory proved difficult to push beyond technical and operational challenges; pilots were often short-lived. The rise of TomTom marked a breakthrough, however, rounding the businesscase around information provision through their portable navigation devices. They thus unleashed an innovation race involving competing navigation producers, telecom companies, map makers, traffic systems producers and a range of small-scale technology developers. The major takeovers of map making industries by Nokia and TomTom marked the growing interest in a formerly disregarded basic resource. A second conclusion on system innovation is this **cascading technological revolution**, yielding ever new information services.

This technological cascade also entailed a reshuffling of responsibilities in travel information provision. In 2007 the Transport minister clearly acknowledged the new reality, indicating the rise of in-car systems and the concomitant entrepreneurial involvement to be both inevitable and feasible. He envisioned the shared public-private system responsibility to develop further in the next development wave of 'cooperative' roadside and in-car systems. A third conclusion on system innovation achievements is this shift from governmental steering, with the private sector as contractor, to **shared system responsibility.** As indicated in the 2007 traffic management policy document, the wave of cooperative systems is only beginning.

Next to the technological breakthough in in-car systems and commercial information provision, there were significant advances in traffic management as well. The developments took place simultaneously, but the 'undesirable routes' revealed consistency problems. The NDW terms of delivery had TomTom stick to its own chain. A third track in chain development was the development of dynamic public transport information. In 1996 this track was foreseen to integrate eventually - as for now it exists as a separate chain, still in development. Whereas public transport sector actors remain doubtful whether full integration will benefit the sector, the information chain initiators are more confident: Especially the articulation of parking information, price, environmental parameters and 'soft' travel characteristics they consider promising. A fourth conclusion on system innovation achievements is that **integration** of travel information provision is as yet **incomplete**, informing choice not fully consistently.

Apart from the advances in in-car traffic information, traffic management and public transport information, two related but different development tracks can be perceived. Next to the advances in traffic monitoring there is the more general advancement in monitoring: As a NDW official indicated, the monitoring systems could also be used for dynamic road charging schemes; an application of floating car data already envisioned in 1996. Furthermore, license plate scanning and camera surveillance are on the rise as effective but controversial enforcement instruments. A traffic management official noted tellingly how it would be rather wasteful to invest in parallel monitoring infrastructures - even when understanding the grounds for separate systems. A fifth conclusion on system innovation achievements is this emergence of traffic monitoring in other domains. Monitoring serving other purposes than originally intended, the phenomenon became known as **'function creep'**.

7.4.3 Innovation patterns

Moving the camera along a variety of actors yields a multitude of views on what is difficult to decipher as an ordered sequence of events. Setting up a timeline is one way to order the footage, another is to observe whether the capricious innovation journey displays apparent turning points, repetitions-of-moves or accelerations:

What basic innovation patterns can be distinguished?

As indicated under innovation success, market development was initially hesitant. The TomTom breakthrough marked a point of take-off, however, with service providers turning their attention to information on parking and public transport information as well. A first basic innovation pattern is this **slow takeoff and rapid acceleration** of market development.

One of the innovation initiators noted a slow 'step by step' development, commission chairman Laan noted 'lasting grating conflicts', and the VID spokesman noted repeated failure to establish a level playing field. The intended demarcation of public and private discussions later became known as a lasting 'domain discussion' that could not be settled at once. A second observation on innovation patterns are the **relapses into the old order.** The relapses also occurred in the public transport sector, enthusiasm about chain integration repeatedly making way for reluctance to disclose sensitive information.

As the Intermezzo project leader noted, the dust clouds have recently started to settle; the sometimes precarious relations between public and private actors improved, and the arrival of 'fresh' actors made for more constructive chain development. The restoration of relations had also been an important mission for the Laan commissions. One of the key initiators indicated that one factor had been the wish for road managers to keep up a public profile as guardians of traffic order; on the other hand TomTom manifested themselves as champions of informed choice. A third observation on innovation patterns is this rather **conflictual image-building**.

Information chain development was a continuous process. After the 1996 innovation attempts many attempts followed in the form of the Laan commissions, networking sessions, pilots, stimulation programmes and deliberations; noteworthy is the 2009 NDOV initiative, effectively reinstating the policy turn taken in 1996. A fourth observation on innovation patterns are these **repeated innovation attempts**.

One of the initiating protagonists admitted ambivalent feelings about losing the VID trial; most unfortunate, but it did reinstate the 1996 stipulations. The policymakers themselves hadn't managed to ensure this conformity. A fifth observation on innovation patterns is this striking **tension** in the innovations **initiators' own organization**; the ministry of Transport.

7.5 The information chain translation sequence

7.5.0 Developing translation-dynamic insight

Having assessed innovation outcomes, it becomes easier to distinguish rudimentary storylines within the innovation journey. Yet as theorized in chapter 2, a key to understanding the course of innovation evolution is to consider the particular ways in which an innovation attempt is translated. Circulating through a polycentric society, an innovation transforms, and engages translators in different ways. Theoretically, certain *types* of translations can be expected to occur: Starting from a basic distinction between 'affirmative' and 'negating' translations and further differentiating within these categories, the discovery of translation-dynamic *patterns* can be enhanced. Distinguishing between 'non-translation', 'interference', 'embracement', 'modification', 'alien modification' and 'self-translation', translations tracing was sensitized to several

foreshadowed problems and issues. Another point of attention was whether and how actors managed to 'synchronize' their translations. This initial categorization helps to carve out case-specific translation patterns: Construction of those involves first a closer look on the occurrences of interferences and non-translations, shedding light on the counter-forces encountered by initiators **(7.5.1)**. Next, the embracements, (alien) modifications and self-translations elicit rather how the innovation attempt was met affirmatively, and did manage to spread **(7.5.2)**. Having highlighted these dimensions separately, case-specific translation-dynamics can be established **(7.5.3)**. These 'configurations' form the input for comparative analysis.

7.5.1 Innovation ignored or resisted: 'Non-translation' and 'interference'

The idea behind these categories comes primarily from Luhmann: An innovation attempt may be very promising and meaningful to its initiator, but in a differentiated society translators are likely to receive it as irrelevant or even as disturbing. In the first case translations are marked as 'non-translation', in the second case as 'interference'. The latter category is especially salient as it highlights the counter-forces the initiators ran up against.

From the outset the innovation initiators knew chain optimization to depend on the work of many. Chain optimization would eventually serve its separate segments, they sought to convince translators, but above all it should serve the societal interest of 'informed choice'. The successes in commercial information provision and traffic management, the network formation and the system shift to shared system responsibility indicate substantial willingness to join the chain and predominantly affirmative translation. On the other hand the incomplete integration, the relapses and the tension in the innovators' own organization suggest that the translation sequence was certainly not free from interference, and that non-translation formed part of its discontinuous rhythm:

The Traffic Information Centre materialized an elaborate chain architecture, yet after the establishment of VID the innovators had to wait long for further fish to bite. The VID spokesperson and the accounts of the FCD trajectory bring out various reasons why the bait was hardly appetizing to entrepreneurial investment. The ICT boom offered a manifold of attractive business opportunities, to begin with, and amongst those the FCD trajectory posed relatively uncertain and risky territory. It required considerable initial investments, with only nebulous returns: Entrepreneurs had low expectations of consumers' willingness to pay for the quasi-public good, and governmental failure to establish a level playing field only added to the reluctance to invest. Due to the **nebulous business case**, the translation sequence started with prevailing non-translation.

More generally, the various translators displayed moments of non-translation even if alternated with more affirmative translations. The NDOV initiative marked the Transport minister's discontentment with the public transport sector's half-hearted translations, developing the chain with a close eye on their immediate interests. Similarly, the chain-orientation of Rijkswaterstaat and the road managers on the decentralized levels depended on instrumental considerations; the chain was meaningful primarily as another lever to pull, as means to fulfill their traffic management ambitions. Because of these **instrumental attitudes**, **non-translation** was a **recurring** phenomenon in between affirmative translation.

Instrumentalism helps understand the relapses signaled under innovation outcomes. It manifested in hesitance and non-translation, but also in interference Next to affording

opportunities for its constituents, chain optimization also posed threats: The chain wasn't always as meaningful to public transport operators, but beyond 'half-heartedness', they also felt that disclosing actual travel times conferred serious liabilities - either through principals sanctioning flaws in performance, through competitors acquiring competitive advantages, or through critical consumers. More generally, relinquishing the data could easily expose them to competition with car mobility on unfavourable terms. If at all, the beauty contest was unlikely to be won on travel times from door to door. The chain **interfered** with **public transport operators'** ambition to maintain control of their **market position**.

The innovation initiators had a hard time convincing their Rijkswaterstaat colleagues to refrain from developing information services, and allow the information market to develop. The Intermezzo project leader elicited that such restraint was easier said than done, however, and that interference went both ways: In the first place he pointed out the continuity of Rijkswaterstaat operations in the face of ever-changing policy preferences. In the light of their mission to keep the country smoothly running, 'leaving things to the market' was not immediately meaningful to them. Moreover, they were the organization eventually charged with the nuts and bolts of implementation, the complexity of which the policymakers not always seemed to appreciate. Their traffic management duties consisting for a great part in information provision, the required abstinence they experienced as most interferential: It would be odd not to materialize their substantial data acquisition investments, and withhold tangible gains to the public. The chain **interfering** with **Rijkswaterstaat's traffic management ambitions**, the same applied to the **road managers** on the **decentralized levels**. With congestion levels continuing to rise, ever better technological options becoming available and networked traffic management setting new challenges to aspire to, they were inclined to develop more, rather than less, information services to users.

The rise of TomTom confronted the road managers with a new institutional constellation: The commercial information providers proved to have a significant impact amongst its users. So while the pressure on road managers to 'deliver' only mounted, consumer-oriented information provision appeared to challenge the very need for traffic management. Against TomTom's claims of 'having on the shelf' what NDW painstakingly sought to develop, traffic management experts pointed out the flaws in TomTom's system: The parked truck driver falsely taken to indicate a queue, but also the 'undesirable routes' problem as indication of failing self-organization. In this period, public-private chain optimization seemed to degenerate into a competition *between* chains: Tom Tom as champion of customer satisfaction, and road managers as guardians of the collective interest - protecting society against the disruptive forces of irresponsible entrepreneurship. Appeasement followed soon; the antithetical relationship may actually have been an occasion for both sides to uphold their identities to the public. As indicated under basic patterns**, interference** with traffic management actors went particularly deep for **challenging their identity**.

A closer look on the interferences makes the relapses more understandable. Moreover, it brings out that the 'tension in the own organization' pattern was fundamental. From the perspective of Rijkswaterstaat, the innovation attempt turned out as a 'wolf in sheeps' clothing' indeed. Nor for nothing, the initiating policymaker was happy to have the Laan commission as a strategic ploy to maintain unison within the **ministry** that effectively found itself in a **doubled state**: On the one hand the 1996 policy shift towards more

self-organizing traffic order, on the other hand the traffic steering ambitions that were only increasing. On the level of the ministry as a whole, the innovation attempt entailed **self-interference**. In its turn, this 'doubled state' manifested itself to entrepreneurs as a capricious, unreliable government.

7.5.2 Innovation adopted or adapted: Embracement, (alien) modification and self-translation

These categories stem primarily from earlier studies into the translation of innovations. They highlight that even when an innovation is not ignored or resisted but engaged with more affirmatively, this generally occurs not as 'adoption', but rather as adaptation. In the first unlikely but possible case, translations are marked as 'embracement', in the latter it is marked as 'modification'. If adaptation diverges markedly from the innovation intended by initiators, it is marked as 'alien' modification. Finally, adaptations by the initiators themselves are set apart as 'self-translations'.

The interferences explain why system innovation achievements did not come easily, but still a new institutional constellation came about. The acceleration following initial stagnation, the new actors entering the chain and the new applications they develop - all this suggests the occurrence of affirmative translations to counterbalance interference. The translation sequence actually started with crucial **embracements**; **parliamentary endorsement** for a plan entailing considerable changes, and also the support of the **police** and the influential **motorists' organization**.

After this embracement the initiators could proceed and set up the traffic information center, the backbone of the chain that was to integrate the innovative translations hoped for. With the **TIC** the initiators established the typical **boundary object**, ensuring the coherence to have the various modifications reinforce for 'informed choice':

The VID took the chain as a **business opportunity**. Similarly, the ANWB motorists' organization continued their involvements in information provision as service provider. Several other parties threw in the towel, however, not managing to turn technological progress into returns on investment. Taking over Logica CMG, continuing its translation process and combining it with other technologies and products, TomTom did manage to round the businesscase. The FCD trajectory was walked further, data fusion techniques allowing for refinement. Crucial was their circumvention of the 'willingness to pay' for traffic information, including the service in an encompassing service package. The strategic takeovers and alliances on the increasingly dynamic information services market display more widespread integration of entrepreneurial value chains. Being **integrated into** a diversity of **value chains**, the information chain eventually proved highly transferable. Oriented more towards consumer choice than towards the governmental idea of 'informed' and multi-modal choice, the business-oriented modifications were not alien to the chain initiators - they did evoke interferences with other modifications, however:

Road managers sought to integrate the chain into their operations as well. For them the chain was instrumental in filling in the blank spaces in traffic monitoring, it was an **enabler** of **network-wide**, **dynamic traffic management**. The various traffic management modifications came together in the NDW that helped synchronize them. For road managers the chain became especially promising once the pressures to combat congestion mounted, the scope for area-oriented management broadened, and the

equipment for data processing became more powerful and mutually compatible: This modification emphasized the chain's contributions to traffic *control*.

The development of dynamic **public transport information** is another distinct modification. These cautious translations fell short of full embracement. Rather than joining wholeheartedly, the operators rather modified the 1996 initiative into 'informed choice' about a particular line. Despite attempts to integrate public transport information, provision of dynamic information was a sensitive issue. The NDOV initiative intervened to synchronize the stand-alone translations, and align the OV-9292, GOVI and BISON modifications. The initiators sought to reduce interference with operators through stipulations in the terms of delivery, and through the promise of joint translation. Moreover, they envisioned modifications articulating neglected aspects of 'informed choice' and highlighting the merits of public transport. As the NDOV policymaker indicated, several service providers were interested in such advanced modification of public transport information.

The chain was highly transferable, allowing various translators to adapt it to their needs. High transferability speaks especially from the 'function creep'. An optimized chain affords a better view on the road, but also on the road inhabitants; it can inform choice, but can also inform *about* choice. Road charging was a branch of the chain actually anticipated by the initiators, yet the **surveillance** applications can be considered **alien modifications** – they were not intended, and their controversiality did not help the 1996 initiators.

Rather than suppressing alien modifications, however, the initiators primarily sought to ensure that modifications were made at all, and that they would last. Still they had to mind the abundant initiatives by road managers, as these modifications were experienced to be market-disturbing, as the VID trial had expressed clearly. In order to safeguard chain development, the initiators had to maintain consistency amongst its 'segments'. In that respect both the **traffic control** and **business opportunity** modifications posed **alien modifications** at times.

Setting up the TIC 'boundary object' did not suffice for harmonious chain development, the relapses and repeated integration attempts testify. The chain initiators can be seen to have done continuous efforts to keep the intended innovation trajectory on track: First the verdict in the VID trial 'reset' the translation process to its intended trajectory, reinstating the 'root' translation by legal force. In order to prevent further interferences and ensure sustained translation, the **Laan commission** was insurrected as a platform for the main translators to **synchronize**, a platform the initiators could also use for **self-translation**. Furthermore the initiators self-translated through their **sustained attempts** to convince translators of the chain's advantages, through their attempts to bring translators together**,** and through various **market stimulating pilots**. Chain development did not depend on these self-translations alone, however: The crucial **synchronization** amongst translators was enhanced through the initiators' deliberate interventions, but also through the more spontaneously **increasing network formation** between chain actors: The network-oriented road managers, Vemodis as organization of service providers, OV-9292 and GOVI in the public transport sector, and Connekt as network organisation in the Intelligent Transportation Systems field.

Synchronization still proved **hard**: In 2004 increasing congestion pressure had the transport minister allow for traffic management modifications, in case of insufficient market-based translation. This clause was to the dissatisfaction of the VID spokesman,

seeing government to compromise its espoused ambition to establish a level playing field. Also more generally he deplored how the NDW had become under the sway of traffic management ambitions. **NDW** terms of **delivery and quality requirements** effectively worked against FCD-translations. This rather rigid boundary object primarily served traffic management**,** both the chain initiators and entrepreneurial translators considered. Standard setting was crucial throughout the translation sequence: The road managers' struggle with fragmented traffic systems was relieved through the market development of open standards, the public transport sector had its standardization initiatives, and FCD-pilot project leaders had carefully chosen their evaluative yardsticks, so as not to discredit the maturing entrepreneurial translations. A crucial **synchronization challenge** was posed by the **'undesirable routes'** problem. This incoherence between traffic management and entrepreneurial modifications yielded a controversial interference. On the one hand the 'turn navigation systems off' signs, the alarming newspaper reports and the SON foundation's appeal to ban the 'kid killers' suggested deep interference, on the other hand the TomTom official considered it an exaggerated issue. Moreover, he pinpointed that it was not just a matter of 'disruptive' navigation systems, but also one of poorly disclosed data.

The TOR data exchange project strikingly reframed the interference as a temporary 'synchronization error', however, and in 2008 the Transport minister explicitly avowed a synchronization strategy. The rise of in-car systems being 'both inevitable and feasible', the future of road utilization would be shaped through active translation into cooperative systems: The information chain translation sequence can thus be expected to **continue through multiple modification** in a new institutional constellation. 'Informed choice' will be served through a multiplicity of distribution channels, entrepreneurial modifications typically aiming at personalized services. This diversification brings to life Greenaway's introductory reflection: *"Perhaps it was not impossible that other travelers had different maps of this territory, simpler and more straightforward maps. Perhaps the country only* existed *in its maps, in which case, a traveler created a territory as he walked through it. If he should stand still, so would the landscape."* The chain initiators trusting in translators' synchronizations to resolve interferences and inconsistencies where needed – with the self-translated NDOV initiative they did seek to ensure that public transport remained part of travelers' landscapes.

7.5.3 Conclusions on the translation sequence

Having highlighted the ways in which the innovation attempt was ignored, resisted **(7.5.1)**, adopted or adapted **(7.5.2)**, innovation outcomes can be appreciated as results of a chequered translation sequence. Considering the apparent occurrences of translation types and further interpreting the fit between these theoretical constructs and the process described, translation-dynamic patterns can be identified. Overseeing the translation sequence as a whole, the case displays the following striking translation dynamics:

The information chain turned out as a largely successful innovation attempt with significant system innovation achievements. Still one of the key initiators showed only moderate contentment, 'counting his blessings over the step by step by process'. A closer look on the interferences brings out that chain development could hardly be expected to be a straightforward process, however: The innovation attempt ran into interference with Rijkswaterstaat's ongoing and only augmenting traffic management ambitions. On the level of the Transport ministry as a whole it thus effectively led to

self-interference; the organization landed into a twilight zone between governmental steering and the new constellation of public-private system responsability.

Apart from the interference 'at home', the initiators also met with **recurring non-translation and evaporation**. The nebulous businesscases and the interference with public transport operators' market strategies slowed down chain development, giving it a hesitant start and subsequent relapses. A second conclusion on the translation sequence is that the chain wasn't always as helpful to translators as the innovators believed it to be.

The initiators eventually harvested a growing and branching chain, however. The pivotal self-translation was the establishment of the TIC as a boundary object. This Traffic Information Centre functioned as a central repository and processing centre, serving a variety of translators and stimulating coherent growth. Yet beyond this founding arrangement, the initiators undertook a long series of efforts to coax actors to join in, to develop new plans and pilots, to elaborate the envisioned division of labor and to address interferences hampering the chain. A striking translation-dynamic is this **sustained self-translation**, extending well beyond the initial innovation attempt.

The TIC boundary object could not completely ensure coherence, however. The translation sequence was marked by multiple modifications that sometimes interfered. On the one hand the market distorting traffic management modifications, on the other hand the entrepreneurial FCD-modifications. The interference culminated in the 'undesirable routes' problem. A fourth conclusion on the translation sequence is this typical problem of **mutually interfering modifications**.

The 'undesirable routes' were taken up as a collective synchronization challenge for shared public-private system responsibility. In 2008 the Transport minister had explicitly endorsed this system shift, envisoning further synchronized translation under the heading of 'cooperative systems'. More generally the chain initiators could note increasing network formation - partly because of their repeated innovation attempts, but also partly through translators organizing themselves. A fifth conclusion on the translation sequence is this **increasing synchronization** through network formation.

Finally, the increasingly broad branchings of the information chain are striking, considering that the chain smiths themselves constituted only a small group of policymakers. As can be read throughout the case report, the various modifications and innovations can partly be attributed to the 1996 initiative and the subsequent self-translating activities, but also stem from many translators' responses to changing opportunities, pressures and technological means to deal with those. The 1996 innovators knew the success of their innovation attempt to rely on the efforts of many translators, of which the private sector actors would be particularly difficult to control. Overseeing the translation sequence as it developed thusfar, a striking translation dynamic is indeed how it **leaned on other translation sequences** – not necessarily revolving around the future vision of 'informed choice'.

Chapter 8 Synthesis: Towards generic translation dynamics

"The ultimate in shaping an army is shapelessness. "

Sun Tzu – The art of war

8.0 Introduction

This chapter synthesizes case-specific findings into a more generic understanding of translation dynamics. Having described and analyzed four 'diverse transformations', meandering through the traffic management action field in their particular ways, these in-depth investigations can be used to inform broader insight. The key to this broader understanding is to consider that these innovation journeys, however diverse in content, are comparable as translation sequences: These sequences taking shape through innovations' *patterned* circulations through networks of translators, comparative analysis can establish solid answers to the first central research question:

How can innovation attempts evolve into system innovations?

The research question is answered by building on and abstracting from separate case analyses. Beyond this comparative analysis, highlighting the evolution of innovation attempts, a third source of insight is to consider the co-evolution of translation sequences: Following Luhmann, translators are understood to form parts of each other's environments. If a translation sequence poses relevant changes to translators in another, it affects its evolution - if this happens mutually, these 'intersections' are indicative of co-evolution. Synthetic analysis proceeds as follows: First, a brief comparison of innovation outcomes helps identify cases as shining examples, as demonstrations of pitfalls, or as combinations of those. This serves as a first ordering of diverse 'innovation journeys' **(8.1)**. Second, the case-specific translation dynamics are compared. As they were progressively developed through mutually informing case investigations, analysis can be condensed into discussion of ten distinct patterns. Eliciting differences and similarities, generic translation dynamics are explicitly related to their concrete manifestations **(8.2)**. Third, the translation sequences are analyzed for their intersections. Having summarized comparative analysis under three main conclusions, this co-evolutionary analysis adds a fourth **(8.3)**. The developed generic translation-insight subsequently informs the answer to the second research question. This question, after situated actors' scope for intervention in innovation evolution, is answered in chapter 9.

8.1 Comparison of innovation outcomes

All case studies started from case description, followed by establishment of innovation outcomes and analysis of translation dynamics. Along the same logic of investigation, a brief comparison of innovation outcomes yields preliminary distinctions between shining examples and demonstrations of pitfalls, before engaging in more extensive analysis of translation dynamics. Innovation outcomes in separate case analyses were established through the following investigative questions: *Was the innovation attempt successful, as perceived by initiators and stakeholders? What was achieved in terms of system innovation?* The case-specific answers to these questions are gathered in figure 8.1. As the diverse entries do not allow for full-fledged assessments of effectiveness and goal achievement, comparison sticks to the broad contours. 'Innovation success' lists assessments of success as voiced by initiators and translators, whereas the 'system innovation achievements' reflect the researcher's assessments. The latter are of central concern, but stakeholders' perceptions allow for more balanced appreciation of those. The ambiguity involved becomes more clear in the following:

	Ch 4. – Greening traffic/ 80 km/h zones	**Ch.5 – network turn/Luteijn**	**Ch. 6 – Rolling back traffic order/ Shared Space**	**Ch.7 – Informed choice & the information chain**
Inno-vation 'suc-cess' to trans-lators	*Deeply controversial *Smooth implementation *Diffusion; follow-ups *Declining endorsement *Phased out	*Quick wins achieved *Successful growth model *Wide diffusion *Relapses *Goal ambiguity *Calls for fortification	*Controversial *Successful upgrading *Cumbersome process *Compromises *Ongoing negotiation *Diffusion	*Parliam. acceptance *Succesful implementation TIC *Remnants old order *Hesitant market development *Advanced traffic management *Network formation *Ongoing integration
System innovati on achieve-ments	*Temporary solution *Problem articulation *Interdisciplinary knowledge production *New innovation attempts *New surveillance practices	*Problem redefinition *Shift to systemic approach *Connection traffic professionals <-> administrators *Policy integration *Boost private sector problem ownership	*Between fashion & institutionalizati on *Articulation alternative vision * 'Main-streaming'/ consolidation *Reconsidera-tion guidelines	*New institutional architecture *Cascading technol. revolution *Public-private system responsibility *Integration incomplete *Function creep

Figure 8.1 Innovation outcomes

Overseeing these innovation outcomes, it is surprising to see that none of the translation sequences displayed plain failure. None of them died out in an early stage, remaining unnoticed as a 'great step for an innovation initiator, yet indifferent to mankind'. As can be read off from the system innovation achievements row, they all yielded these organization-transcending changes in cultures, structures and practices. Considering the theorized challenge to surmount a heterogenous environment, especially when it involves more than marginal change, this is surprising - even when the successful attempts are the most conspicuous to the researcher, and failures are easy to overlook. **A first observation on innovation outcomes is that none of the attempts remained without system innovation achievements.**

Still, the cases are not all shining examples either. The most prominent indication of limited system innovation achievement is the 80 km/h zones case: The zones were actually phased out. A similar assessment applies to the Shared Space case: Even when it managed to set foot on the ground as a well-known 'brand', became implemented at various sites and slowly slipped into the routines of various translators, its system

innovation achievements remain modest all the same. Moreover, even the cases with the most impressive system innovation achievements had their setbacks underway: The information chain case shows the 'initially slow market development' and the 'ongoing integration attempts', and also the network turn case displays various 'relapses'. **A second observation on innovation outcomes is therefore, that instead of clear-cut failures and successes, the cases display a mixed picture of system innovation achievement.**

Apart from this mixed picture of system innovation achievements, stakeholders' assessments of innovation outcomes are pervaded with controversy. Especially in the 80-zones and Shared Space cases, recipient translators displayed striking disagreements about what the innovation attempt was to achieve, and therefore, what constituted innovation success. Were the 80-zones health measures, misguided elements of a congestion abatement strategy, or were both objectives mere façades for the zones' latent function as taxing machines? Was Shared Space a failure for its creation of chaos, or did this rather constitute its success? Even if less apparent through major controversy, the other sequences displayed similar contestations. In line with theoretical expectations, controversies occurred in all cases: Not primarily interested in the initiators' system-transformative intentions or convinced by the innovations' 'intrinsic value', the various translators were concerned with the opportunities and threats posed to their particular goals. **A third observation on innovation outcomes is the pervasive ambiguity of perceived innovation success.**

Considering the mixed picture of system innovation achievements and the ambiguity of innovation success, the comparison of innovation outcomes offers little foothold. Taking into account this caveat, a tentative distinction between shining examples and demonstrations of pitfalls can be made, however. The 80-zones do stand out for their phasing out, to begin with. Phasing out did not occur with Shared Space, yet neither could it be considered a shining example. The 'network turn' and 'information chain' cases both stand out for their relatively substantial system innovation achievements. **The fourth and concluding observation on innovation outcomes is thus that rough distinctions can be made. The 80-zones yielded relatively limited system innovation achievements, and the 'network turn' and 'information chain' cases represent the more prolific examples. On the other hand, this comparison yields a mixed picture of system innovation achievements. Further considering the ambiguous and contested nature of what counts as innovation 'success' for translators, no clear-cut ranking order can be established.** These differences in outcomes will become better understood through extensive comparative analysis of translation dynamics, and analysis of intersections.

8.2 Comparative analysis of translation dynamics

8.2.0 Comparing translation dynamics

The translation typology helps to render capricious innovation journeys into comparable 'configurations'[1] of translations that can be systematically compared across particularities.

[1] Chapter 3's introductory quotation from Byrne (2005) emphasized the added explanatory value of comparing case –specific 'configurations', beyond analysis of singular innovation trajectories.

	Ch 4. – Greening traffic/ 80 zones	Ch.5 – network turn/Luteijn	Ch. 6 – Shared Space	Ch.7 – Information chain
Non-tr.	*Exclusive decision power of initiator *Crumbling political support	*Initial skepticisms *Personal changes *Decreasing benefits	*Inconspicuous innovation *Recurring marginalization	*Nebulous businesscase *Instrumentalism; recurring non-transl.
Interference	*Environmental standards *Infrastructure *Enforcement *Car users *Traffic flow *Self-interference	*Autonomy/discretions *Yearnings for decisiveness *Reward structures *Business administrations *Productive use of interference	*Vulnerable road users *Bicyclist emancipation *Enforcement practices *Traffic safety code/guidelines *Expectations of participation *Productive use of interference	*Public transport competitiveness *Traffic control; Rijkswaterstaat & decent. road managers *Traffic management identity *Self-interference
Embr	*Initially massive (scientific, media, political, public)	*Fashionable concept *Quick wins	*Appealing concept	*Parliament *Motorists assoc. *Police
Modification	*Environmental measure *Norm compliance solution *Experimental trajectory	*Tangible deliverance *Coherent infra bids *Levers problem ownership *Advancement professionals' position *Entrepreneurial innovativeness *Cost saving *Region-specific approaches *Policy benchmark *Fortifying successors	*Iconoclastic symbol *International elaborations *Formula spatial design *Steering philosophy *Traffic solution *Open design process	*Business opportunity * Integrated into value chains *Public transport information *Enabler DynamicTraffic management
Alien-mod..	*Health cordons *Enforcement instrument *Fining machines	*Centralizing network authorities	*Simple traffic solution *Superficial iconoclasm *Marketable design *Fashionable façade	*Surveillance *Interferences between modifications
Self-translation	*Four follow-ups *Policy framework Overschie *80 on ring study *Remedial measures *Dynamax (user-oriented)	*From management of flows to 'area tables' *Differentiation areas /innov. themes *Beyond shallow cooperation *Arrangements as temporary catalysts	*Remedial measures *Process turn	*Sustained self-translation *Knowledge exchange meetings *Network building *Pilots *Public-private commission

Figure 8.2 Translation types

Figure 8.2 charts the segments these configurations consist of: Non-translations, interferences, embracements, modifications, alien modifications, and self-translations. Apart from these foreshadowed problems and issues[2], a constant point of attention was how, if at all, translators managed to 'synchronize'[3] their translations.

Beyond this overview of translation types, the keys to generic insights are the case-specific translation dynamics, however[4]. These patterns are listed in figure 8.3 below. Developed through progressive interpretation of apparent similarities, contrasts or common denominators, these patterns are sufficiently generic for direct comparison: The 24 case-specific entries can therefore be covered through analysis of ten distinct translation dynamics. As discussed more extensively in chapter 3, case-specific insights can be solidified through theoretical replication: Comparison of common themes can ascertain whether striking dynamics should be considered extreme examples, or rather regular displays of what turns out as a normal course of affairs. Similarly it can established how cases fit a constructed generic pattern; as more or less pronounced manifestations, or even as paradigmatic examples **(8.2.1 – 8.2.11)**. In the final subsection these observations are rounded up into generic conclusions, also eliciting the confirmations, revisions and refinements of theoretical expectations **(8.2.12)**.

	Ch 4. **Greening traffic/ 80 km/h zones**	**Ch.5** **Network turn/Luteijn**	**Ch. 6** **Rolling back traffic order/ Shared Space**	**Ch.7** **Informed choice & the information chain**
Translation dynamics	Deep interference	Wide embracement	Deep interference	Self-interference
	Synchronization difficult	Recurring interference and non-translation	Synergetic replication	Recurring non-translation (evaporation)
	Self-interference	Oscillation between interference and modification	Productive use of interference	Sustained self-translation ('chain' as boundary object)
	Backfiring replication	Productive use of interference	Diverse modification	Mutually interfering modifications
	Self-translated dilution?	Leaning on other translation sequences	Dilution dilemma	Leaning on other translation sequences
	Capture	Synchronized translation	'Process turn' to synchronization strategy	Increasing synchronization

Figure 8.3 Translation dynamics

[2] The translation types are defined in section 3.1.2.

[3] See section 2.5 for the theoretical background of 'synchronization'. The concept was only loosely defined; a sensitizing concept to be developed further in the course of empirical investigation.

[4] Developed in sections 4.5, 5.6, 6.6 and 7.5.

8.2.1 'Deep interference'

Innovation attempts in a polycentric society can easily be received as irrelevant 'noise'. Interference indicates more specifically how innovation attempts can even be received as disturbances, evoking resistance amongst translators interfered with.

The innovation attempts were expected to be interferential to different degrees, foreseeing prominent manifestations in the 80 km/h zones and Shared Space translation sequences[5]. Indeed, these case analyses bring out particularly 'deep' interference, showing the innovations' collisions with entrenched societal structures: With regard to the 80 km/h zones, this manifested through the initiators' uphill struggle against the 'design speed' of the highway. Even when the automated speed controls effectively enforced the desired speed, they still evoked resentment amongst drivers. So however technically sophisticated the concept to 'green' traffic, the interference lasted. Eventually the ministry of Transport wound up as reluctant innovation owners, reconsidering and phasing out their attempted innovation. The heated debates about the zones illustrated clearly how interferential attempts not merely fail to gain interest and support, but even evoke resistance from actively opposing translators.

It is telling that interference occurred especially strongly in the relatively unfortunate case. Shared Space, also relatively limited in system innovation achievement, displays similarly 'deep' interference, though. On top of the interferences with various groups of road users, its interference with the 'traffic code' is instructive: The divergence from existing guidelines on road design and traffic safety met with sometimes fierce resistance from professionals, experts and enforcement officials alike: The 80 km/h zones and Shared Space hit upon similar deeply entrenched routines on road design. In the other two cases that were relatively prolific in system innovation achievements, similarly 'deep' interference did not manifest. Interferences did occur, but less severely. The attempted turn towards network-oriented mobility policy 'oscillated between interference and modification'[6], for example, rises to boundary-crossing cooperation alternating with relapses into self-centered behaviors. Nor was 'welding an information chain' free from interferences – even to the extent that the initiating ministry came to interfere with *itself* [7]. Interference turned out similarly adverse in these cases: Had networked action not interfered with public and business administrations as it often did, administrative boundaries would arguably have dissolved much easier. Similarly, had information chain development posed only opportunities to translators and no threats, the 1996 future vision would have been realized to a greater extent.

In line with theoretical expectations, the occurrence of interference has an adverse effect on system innovation achievements. It is by no means exceptional. Considering their particularly 'deep' interference, the 80 km/h zones and Shared Space cases can be considered exemplars for interferential innovation attempts.

[5] See section 3.4 for the ex ante expectations about occurrence of interferences, based on the innovation attempts' particular divergences from common practice.
[6] See 8.2.2 for further discussion.
[7] 'Self-interference' is addressed in 8.2.4.

8.2.2 'Backfiring/synergetic replication'

Aiming for diffusion, innovation initiators may seek to 'roll out' or replicate their innovation attempt. Yet as the successors are never exact copies, translators can take either the shining examples or the manifest failures to represent the innovative concept as a whole. In the first case replication is 'synergetic', occurring as development of an appealing 'brand'. In the latter case replication 'backfires', and the brand is contaminated. Regarding these dynamics, the 80 km/h zones and Shared Space cases display strikingly opposite evolutionary possibilities:

The first zone in Overschie was widely embraced for its environmental gains without apparent drawbacks. After this initial success, the Transport minister had the innovation attempt carefully 'rolled out' to four other sites. Two of them displayed dramatically rising congestion levels. The 2006 'congestion alarm' brought to light an interference not occurring earlier at Overschie: The inducement of congestion. Further investigations into the so-called 'complex weaving sections' helped understand why replication proved even more intricate than estimated beforehand. It is striking how the imperfect copies backfired onto the very concept: In the heated debate after the 'congestion alarm', the interferences occurring at the 'complex weaving' sections were not only taken as local aberrations, but even as falsifications: New versions raising the attention to undesirable side effects, translators reconsidered their initial embracement.

The Shared Space case displays the striking mirror pattern of 'synergetic replication', however. Gathering various sites under the self-translated 'Shared Space' umbrella, the initiators managed to develop Shared Space as a distinct brand. During the decision-making process on the Haren Rijksstraatweg reconstruction, precursors in the Friesland province served as showcases; later on, Haren became a Shared Space showcase itself. Through deliberate self-translations the initiators welded a common identity that elevated the separate sites into demonstrations of an increasingly well-known alternative approach – an alternative that, however odd at first sight, had developed a modest track record. On a closer look, the 'network turn' case offers comparable dynamics. Both the Luteijn approach and 'GGB', i.e. network-oriented traffic management, became strong brands. The 'information chain' did not display comparable replication dynamics.

'Backfiring' and 'synergy' are two opposing evolutionary possibilities. These opposites are only two sides of a coin, however. To which side it flips is contingent upon translators' appreciations of the imperfect replicas, sometimes changing through incidental events. This contingency speaks from the fact that both translation sequences displayed traces of the opposite dynamic as well: There were translators who emphasized the successes of the later 80 km/h zones, as well as translators holding Shared Space flaws against its further application. In their internal evaluations Haren officials therefore seriously reconsidered the feasibility of the label, noticing how part of the citizens had started to mistrust the concept. In order to understand the volatility of replication dynamics, one could consider how a traffic accident in Shared Space – due to whatever unfortunate turn of events – could have fatally contaminated the concept.

Through self-translation, innovation initiators can deliberately seek to replicate their attempts. As replication tends to be imperfect, systematic 'rollout' is exceptional however. Instead, attempted replication will generally yield a series of similar yet different applications. Translators taking shining examples or manifest failures to represent the concept as a whole, replication can display synergy, or alternatively, it may backfire. Considering how the two possibilities depend on

incidental events, replication bears ambiguous effects on system innovation achievement.

8.2.3 'Capture'

Innovation attempts tend not be adopted, but are rather adapted in various ways. The dynamic of 'capture' indicate how translators actually take over the innovation. The pattern corresponds with the so-called 'alien' modifications: Ending up in shapes alien to the initiator, these particular forms of affirmative translation were theorized to invite interference between initiator and translators[8].

The '80-zones' case displayed precisely such scenario in which the innovation initiators were slowly disenfranchised from their initiative: After the Overschie zone was evaluated positively, a broad coalition of translators ambraced it and argued for widespread replication of the successful measure. The environmental activists of Milieudefensie were trailblazers, mobilizing support for what they dubbed 'health cordons'. The minister explicitly rejected this radicalized modification; it was 'alien'. And once the ministry itself became disenchanted with the innovation for its apparent failures, Milieudefensie still insisted on its success - as proven technology to combat traffic-related health hazards. Especially embarrassing for the innovation initiators were Milieudefensie's legal procedures to wrest loose the measure. Beside this strong manifestation of interferential 'capture', the translation sequence displayed more generally how various modifications pulled hard at the evidence-based trajectory the initiators envisioned: Next or even opposed to the 'health cordon' modifications, translators 'captured' the zones as 'congestion inducers', 'fining machines', or as efficient enforcement arrangements. Neither of these modifications stayed true to the original[9].

The other cases had their occurrences of 'alien modifications'as well, albeit not as dramatic. The Luteijn recommendations were generally modified in conformance with these guidelines, translators typically tailoring the recommendations to their particular ambitions and assessments of the situation at hand. The proposal for a National Road Authority was a notable exception. It did follow the network rationale, yet argued that the very networked characteristic of mobility problems asked for centralized control - distinctly 'alien' to Luteijn's cooperative model, but not manifesting in marked interference. This did occur clearly in the Shared Space translation sequence: The concept was stretched and elaborated in a myriad ways, and not always to the initiators' liking. They took explicit distance through the 2008 Shared Space booklet, adressing 'alien' modifications that either diluted the concept or commodified it into simple formulas. Finally, the 'information chain' translation sequence displays translation dynamics reminiscent of 'capture', its branchings yielding the striking phenomenon of 'function creep' - traffic monitoring systems also proving functional for surveillance

[8] See section 3.1. for the translations typology. This translation type echoes not only the well-known innovation drama of Frankenstein's creature acquiring a life of its own, but also what in system innovation literature is known as 'capture': Radical innovation attempts being neutralized or deformed by defensive incumbent actors.

[9] Through changes in administration and therefore in the policy objectives of the ministerial innovation initiators, the interferential nature of these captures changed along. In the light of a political shift from the centre-left towards the centre-right, some of these captures were actually in line with changed objectives.

purposes[10]. The initiators were concerned more with development than with containment of unintended uses, however; 'capture' did not lead to interferences[11].

The 'Capture' pattern shows how 'alien' modification is by no means exceptional, but simply one of the forms modifications can take. The environmentalists' 'capture' of the 80-zones is a paradigmatic example of affirmative translations turning into interferences. 'Capture' is embarrassing for the innovation initiator. Yet as radicalized modifications they could turn out as forceful contributions to system innovation nevertheless – this is what the environmentalists sought to achieve.

8.2.4 'Wide embracement'

In a differentiated society, straightforward adoption of innovation attempts is unlikely. Still, such embracement proves very well possible. 'Wide embracement' indicates how an innovation attempt is endorsed in different quarters, with beneficial effect on system innovation achievement.

Wide embracement occurred especially prominently in the 'network turn' case. The logic behind the Luteijn recommendations was compelling to the degree of being unavoidable. *"To the road user, administrative boundaries are irrelevant"*. It was an argumentative ploy to get things done: Presented with this common sense logic, administrators would have a hard time to explain their constituencies why not to follow it. The networked, user-oriented way of thinking could easily develop into a 'mantra' needing little further argumentation. Embraced by a wide range of translators, the network idea became a benchmark for mobility policy, the wide range of modifications testifiying how it could be adapted into many different actions. Also in other cases embracement occurred widely: Even the problematic 80 km/h zones started with broadly shared embracement of what seemed a measure deserving of further roll-out. Shared Space displayed similar gathering of support and 'enrollment', once becoming known as an interesting and practicable 'brand'. Finally, the 'information chain' initiative started out from a solid coalition of policymakers, the motorists' association, and the police force, and saw many translators follow in the course of its development. These examples show in diverse but similar ways how embracement supports system innovation achievements. Beyond this conclusion, however, pure embracement proved rare, most appreciative translations involving at least some modification. In retrospect, 'embracement' and 'modification' are hard to distinguish from each other.

Wide embracement signals the importance of innovation attempts being highly *transferable* to translators. It is a normal occurrence, the Luteijn recommendations standing out as a particularly strong example. Furthermore, it turns out that 'embracement' and 'modification' are not essentially different categories. They are both affirmative translations with more or less adaptation. Unlike the 'alien' modifications they have a clear beneficial effect on system innovation achievement.

[10] Similar 'function creep' occurred in the 80 zones translation sequence. The traffic enforcement bureau made enthusiastic use of the section controls as effective enforcement instruments – modifications potentially harmful to the 80-zones initiators for their additional evocation of resentment.

[11] This dynamic is discussed under 'mutually interfering modifications', in subsection 8.2.10.

8.2.5 'Oscillation between interference and modification'

An innovation attempt can be transferable, lending itself to various modification, or it can be received as irrelevant or interferential. Oscillation indicates a pattern in which these moments *alternate*. It was particularly prominent in the 'network turn' translation sequence, but occurred across cases.

However transferable the attempted innovation, the Luteijn translation sequence did not yield the avalanching evolution into system innovation this would lead one to expect. Embracement of the idea did not automatically translate into action: Upswings of boundary-crossing action alternated with relapses into self-centered behaviors. Sometimes administrative boundaries mattered a great deal, as testified by the recurring interferences with the autonomous operation and reward structures of the home organizations. Typical for the oscillations was the initial enthusiasm for joint action and the later hesitation, participants reconsidering whether it was really that necessary in their particular area. Similarly, working out regional traffic management scenarios was attractive in abstracto, yet once worked out into concrete ramifications, administrative boundaries proved very relevant again. The significance of the oscillation dynamic becomes more clear from comparison.

Recurring 'non-translation' in the information chain translation sequence displays strikingly similar oscillation: Translators widely subscribed to the ambition to improve travel information provision. Yet throughout the development of the information chain, these affirmative translations were interrupted by translators shying away, losing interest, or experiencing disturbance. The entrepreneurs often perceived the opportunities ahead, but just as often they eventually abandoned the undertaking for its nebulous returns on investment. Similarly, the public transport operators hovered between enthusiastic embracement of integrated information provision, and reluctance to relinquish control over it. Overcoming various interferences underway, the oscillation still showed a clear upward trend, however. By contrast, the 80-zones translation sequence displayed a downward trend. Its oscillation can be described as one singular upswing of affirmative translation (the initial hype about the Overschie zone), followed by the disillusion about the interferential follow-ups. Finally, the Shared Space translation sequence as a whole did not display clear oscillation, yet the experiences in Haren did. Shared Space initially evoked considerable interference with worried citizens, became more accepted after the temporary 'noncompulsory bicycle lane', but also met with recurring calls for zebra crossings, traffic signs and intensified enforcement.

The 'oscillation between interference and modification' can be considered a regular pattern. It reminds of the theorized probability of 'evaporation' - initially affirmative translation turning into non-translation. The signaled oscillation displays this evaporation in alternation with the inverse trend that can be described as 'crystallization'. Across these upswings and downswings, a general upward or downward trend can be noted. Momentary assessments of success and failure risk to overlook this longitudinal development.

8.2.6 'Synchronized translation'

Innovation attempts were expected to be translated in various ways. Considering the attendant coordination challenge in an otherwise chaotic innovation processes[12], a constant point of attention in investigation was therefore how translators managed to attune, to synchronize their translations.

The most striking example of synchronized translation is posed by the 'network turn' case. As conveyed by the 'foam' structure of its translation sequence (see section 5.6.3), it evolved through a myriad of innovating groups. Translators jointly elaborating the general idea into concrete boundary-crossing actions and attuning their envisaged modifications, the networked feats were all collective achievements. The Luteijn commission had envisioned such evolutionary course through their growth model: Once the general idea would prove viable and materialize into quick wins, these would be stepping stones towards more demanding, interference-prone, translation challenges. Strikingly, the growth model was not so much geared to particular predefined goals (particular traffic management solutions, improved salt sprinkling, or management of the demand for mobility), but rather sought to unleash the self-propelling innovation process as unfolded: Translators would become acquainted, develop trusting relationships, and learn to settle mutual interferences. In hindsight, the innovation attempt was more precisely a *synchronization attempt*. This bet on synchronized and therefore sustained translation turned out prolific.

The 80 km/h zones case poses an instructive contrasting example. Translators pulling at the envisioned trajectory from several sides, the innovation initiators wound up in a cacophony of irreconciliable translations. The environmental motivations for the attempt even getting lost in the turbulent and adversarial translation process, the case only corroborates the importance of synchronized translation. In this regard Shared Space is interesting for its 'process turn' towards synchronization. Initially, synchronization was not what the Shared Space protagonists seemed to be after: The innovation attempt was rather provocative in its message to roll back traffic ordering and stop 'treating people like idiots'. Unsurprisingly, the confrontational approach met with considerable resistance and skepticisms. Once Shared Space had been established as a well-known 'brand' nevertheless, the initiators took a strategic turn to consolidate and expand achievements. Shifting focus onto *negotiation* of space, they chose for a broadened synchronization strategy. Finally, the 'increased synchronization' within the information chain bears the most similarity with the translation dynamics in the 'network turn'. The chain also being an organization-transcending arrangement, this case can similarly be understood as a synchronization attempt. The commission on 'rules of conduct', the various intermediary organizations and the 'market acceleration' meetings similarly stimulated attunement and connections between public and private translations. Both typical and crucial synchronization took place within the 'desirable routes' project, addressing the interference between traffic management and entrepreneurial information services. These agreements on data exchange *synchronized* information provision, similar to the various initiatives for standard-setting and interoperability.

Comparative analysis strongly confirms the theorized importance of attuned translation. Synchronization helps reduce interference, avoid fragmented translation and achieve sustained translation. Whereas the 80-zones case highlights

[12] See section 2.5.

lacking synchronization as a typical pitfall, the 'network turn' and the 'information chain' constitute positive examples.

8.2.7 'Productive use of interference'

Interferential innovation attempts are unlikely to yield substantial system innovation achievements; they evoke resistance. The earlier discussed 'deep interference' confirmed this expectation. Yet there is also the counterintuitive evidence of 'productive use of interference', indicating how system innovation is successfully pursued by seeking interference instead.

Shared Space is a paradigmatic case, in this respect. Explicitly challenging the control-oriented paradigm in traffic management and road design, the innovation attempt evoked considerable interference. Against strongly codified knowledge about traffic management, it was likely to be discarded as irresponsible resistance, needlessly interfering with the self-evident. It is therefore counterintuitive and insightful to see how interference did not prevent Shared Space from becoming a successful brand, but even seemed to help it: Standard bearer Hans Monderman had developed an elaborate repertoire to make productive use of interference, turning the apparently pointless interference around. The 'rollback' of traffic control did not interfere with the normal order of public space and traffic, he held - rather, this allegedly normal order was itself interfering with social interaction, livelihood and the human standard. *What interferes with what*, he asked his audience essentially, cleverly appealing to common sense, responsibility and more general dissatisfactions with overregulation. Interference thus became a ploy to render the self-apparent discussable. The 'productive use of interference' helped to carve out Shared Space identity as an appealing brand[13].

The apparent anomaly is not that exceptional, however; also the Luteijn translation sequence featured the productive use of interference as a striking translation dynamic. The 'mobility managers' in the 'Luteijn' pilots incited the synchronization process through changing mixtures of reducing and modulating interference. They sought to 'lubricate' in the translation process by appeasing people, softening up tensions, seeking byroads to get the network message across, minding the timing of initiatives, and ensuring that individuals would not fall 'in between' network allegiance and loyalty to the home organization. On the other hand, they also sought to irritate in a mild way: Confronting administrators with particularly conspicuous network failures, they raised the rhetorical question: "Does network action interfere with the home organization, or wouldn't you agree it is rather the other way around?" Apart from the typical reversal-of-logic, the similarity with Shared Space extends to the appeal to common sense and the user-orientation. The other cases did not display similarly striking 'productive use of interference'. In 'information chain' development interference-avoidance prevailed, and in the '80-zones' case interference was mainly a source of stagnation. On a second look, the articulation of traffic-related health hazards can be traced back to the modulation of interference, however. Overschie citizens' cries for action and the subsequent 'health cordons' campaign raised the rhetorical question whether the zones interfered with traffic flow and driving freedom, or whether it was rather traffic flow interfering with the health of citizens. Through this framing of interference, they managed to arouse

[13] See also the 'synergetic replication' discussed in subsection 8.2.1.

massive media attention to what used to be a rather abstract issue of compliance with norms.

The 'productive use of interference', however counterintuitive, is by no means exceptional. Especially the paradigmatic Shared Space case shows how the typical reversal-of-logic can open up system-transformative opportunities, by challenging the apparently self-evident. The (expected and earlier confirmed) importance of avoiding and reducing interference should therefore be reconsidered and refined.

8.2.8 'Dilution dilemma'

In order to survive a heterogenous environment, innovation attempts better be transferable, and avoid needless interference. This is why initiators engage in self-translation, to fit in their attempt. Yet in the course of cultivating transferability, they may come to wonder whether too much concessions are made. The dilution dilemma referes to this hard choice between adaptiveness and staying true to original intentions. It casts a shadow over the theorized and empirically confirmed importance of transferability.

A telling turn in the Shared Space translation sequence was the protagonists' withdrawal of their initial iconoclasm. Not only Haren experiences, but also the various European projects had led them to understand Shared Space as a broad and long-term synchronization process, rather than a rapid revolution or a series of projects rolled out. This reinvention also reflected their awareness of compromise being practically unavoidable. The tinkering with the Haren Rijksstraatweg layout displays in a nutshell how the initiators constantly moulded the innovation attempt for greater transferability. Yet in the course of adapting to the demands of translators, the protagonists also saw themselves confronted with the 'dilution dilemma'. However prudent as ways to reduce interferences, too much adaptations and concessions would leave little of their ambition to do things radically differently.

In the other cases the 'dilution dilemma' played a less prominent part. Still they display comparable self-translations, reducing interferences ahead – an activity reminiscent of curling players, softening up the ice track. The 80 km/h zones, as direct interventions in the flow of traffic, underwent self-translations very similar to those in Shared Space: The red-bordered '80' signs ensuring that the road told the right story to its users, the noise shields slightly narrowing the road surface, and the later speed reductions on adjacent highway sections smoothening the transition from 120 to 80 km/h. The interferences on the problematic successors were targeted through several remedial measures as well. Other than 'diluting' the zones, these self-translations rather repaired them, however. Only the shift to a dynamic speed regime, likewise intended to reduce interference, could be considered a serious compromise - releasing the initial emphasis on environmental gains. To the Transport minister the multi-objective arrangement was rather a matter of flexibility gained, however. Similarly, possible 'dilution' was not the main concern of the 'information chain' initiators. They acknowledged the dilemma when they observed the controversies about quality standards. Whilst understanding well why traffic management experts put high accuracy requirements on delivery of traffic data, they also saw these to endanger the involvement of market actors. As their innovation attempt was primarily a synchronization attempt[14], they left it to be resolved

[14] See subsection 8.2.2.

by the various translators, however. In the same vein the Luteijn commission left their recommendations to synchronized translation by others. The appointed trailblazers were constantly devising ways to fit the general philosophy to particular circumstances, however. The 'dilution dilemma' was generally considered secondary to keeping synchronized translation going, but it was clearly a concern. The 'boxing' manifestation served to remind that 'Luteijn' was not just a matter of interference-avoiding cooperation: On the basis of trusting relationships, it should be possible to reach higher than the easy picks – the shallow versions of what the commission had attempted to set into motion.

Throughout the cases, innovators' self-translations confirmed the expected result of interference avoidance. Its shadow side of susceptibility to dilution was generally acknowledged, yet only in the Shared Space case did it appear as an actual dilemma. The two cases of 'synchronization attempts' explain why 'dilution' need not be corrosive of system innovation achievement, and need not pose a grave dilemma. They show it as an issue integral to collectively sustained innovation, to be settled through synchronization.

8.2.9 'Self-interference'

Following Luhmann's sobering views on system innovation, innovation initiators were expected to meet with resistance from various translators. The possibility of *self*-interference the translations typology did not anticipate however: Surely the initiators would not innovate to obstruct themselves?! Taking 'self' to refer to initiators' wider organization that is affected as well, self-interference loses its slapstick-like appearance.

Information chain development illustrates perfectly how 'self-interference' differs from plain self-obstruction: The initiative for market-based innovation in information services stood at the basis of the currently emerged public-private system responsibility. The initiators interfered with their colleagues from the Transport ministry's executive department, however, the devolution of governmental control bearing painful ramifications for ongoing operations. Initially the latter welcomed the future-oriented policymakers' initiative, anticipating enhancement of the desired 'dynamic' traffic management. Yet how could they be expected to abstain from communication with car drivers, while the options to do so were increasing and the pressures to combat congestion only mounted?! The road managers thus continued their information provision activities, until a commercial information service provider appealed to court. The State lost the case for its inconsequential policy, conferring uncertainty and competitive disadvantages onto entrepreneurs: An episode showing most clearly the stagnating effects of self-interference.

Self-interference, however odd, is not that exceptional. It also featured prominently in the 80 km/h zones case. Once the attempted 'greening' of traffic became known as an congestion-inducer, the ministry slipped into an embarrassing position. A public image was arising that it engaged in self-inflicted congestion, in stark contradiction with its avowed offensive on congestion abatement: The Transport minister felt compelled to reconsider the burdensome measure. The other two cases displayed self-interferences as well, albeit less strikingly. The Shared Space case shows how the intended mixing of traffic did not only meet considerable resistance from stakeholders, but also entailed tension within the Haren municipal organization: On the one hand the commitment to continue with the refreshing approach, on the other hand the need to be responsive to

calls for reliable enforcement. Remembering Shared Space's typical 'productive use of interference', self-interference can thus be considered a normal byproduct; part and parcel of the rather anarchist approach. Just like the information chain initiators, they sought to handle the transition period with care. The 'network turn' case involved self-interference too. The standing organizations experienced mildly irritating interference from the 'Luteijn' network organizations, and *intendedly so*: In the end, it would pay off in terms of more adequate problem-solving. These occurrences of intended self-interference stand in contrast with the rather unintended interference occurring in the 'information chain' and '80-zones' cases. As regards the latter, self-interference was certainly unintended: As discussed earlier under 'backfiring replication', it only manifested in the course of innovation evolution, as an unfavorable evolutionary surprise.

Self-interference is not as odd a phenomenon as the counterintuitive expression suggests. As a quite regular translation dynamic, it tends to occur between groups of translators within composed organizations. This can very well be intended, as an integral part of attempts at organizational change. Self-interference can also occur wholly unintendedly, however, as unfortunate evolutionary surprise.

8.2.10 'Mutually interfering modifications'

Innovation attempts tend to undergo various modifications. The multitude of modifications can enrich a translation sequence synergetically; 'the more, the merrier'. Yet as transpires throughout the cases, the modifications can also pose mutual interferences between translators, and yield incoherent translation sequences.

The information chain initiative illustrates this incoherence particularly well: With the TIC traffic information centre the initiators set up an independent repository to serve a variety of translators. This 'boundary object', flexible enough to allow for diverse uses, yet rigid enough to maintain a coherent identity[15], was to further integrated information provision. The various translators had strongly instrumental relations with the collective 'chain', however. To road managers it was primarily interesting as enhancement of traffic management activities – an instrument through which to deliver to the public. For the commercial translators it was an extension of their value chains, i.e. an input to their production, and governmental traffic management purposes were not their immediate concern. Meanwhile, the public transport operators doubted whether integrated information provision would do their share in transportation any good. Furthermore, as discussed under 'capture', other translators envisaged various non-traffic purposes as well. Through these instrumental translations the various translators attempted to stretch and bend the information chain, in divergent directions. Repeatedly landing into mutual interferences, the very variety yielded incoherent development: The 'undesirable routes' problematic has great symbolic significance for this.

Similar fragmentation can be seen in the 80-zones case. Even this rigid object proved surprisingly malleable. The controversy arising around the zones shows how the various translators moulded the innovation attempt through competing and adversarial framings. The other cases display contrasting dynamics, however. Shared Space underwent diverse modifications; into a model for citizen empowerment, into a radical traffic solution, or into a formula for public space design. The developments in Haren showed a

[15] See section 2.5.

further miscellany of propositions to share space. In the case of this 'boundary concept', the diverse modifications coexisted fairly peacefully. Similarly, the various modifications of the 'network idea' involved mutual struggles that were actually intended to surface. The translators could generally negotiate specific boundary-transgressing actions, however. Such synchronization was more difficult in the information chain: The translators all communicating with the same travelers, their competing modifications had overlapping working grounds. This posed a fundamental consistency challenge. Quite understandably the governmental road managers and the private sector entrepreneurs confronted each other's modifications not always as welcome additions, but sometimes as disturbing obstacles as well.

The phenomenon of 'mutually interfering modifications' is not exceptional. Within a multitude of modifications, this is bound to happen unless translators and initiators manage to synchronize their modifications. This synchronization becomes especially important once the translation sequence as a whole starts to suffer from incoherence. The attempt to arrive at coherent, integrated information provision to travelers is an exemplar case in this respect.

8.2.11 'Leaning on other translation sequences'

Innovation attempts trigger translations and translation sequences, but should not be mistaken for unique sources of those. 'Leaning on other sequences' indicates how innovation initiators tap from, and assemble, other innovation attempts and translation sequences.

This assembly is typical for all cases, but the information chain is particularly illustrative: The initiators knew its development to be a collective achievement. First they needed the endorsement of the police forces and the motorists's association to develop a viable innovation attempt, and parliamentary acceptance was critical too. Still their main challenge was to attract entrepreneurial innovators to seize the given opportunity. Only after almost a decade of market stimulation efforts, the initiators saw chain development accelerate: TomTom entered the stage and encountered competitors; telecommunication providers, car manufacturers and information systems producers started to form alliances; producers of digital maps suddenly became attractive for major takeovers. In roughly the same period the road managers made considerable advances in dynamic traffic management and organized themselves. And even when the desired integrated and dynamic provision of public transport provision left much wanting, the operators had set up dynamic route information panels for themselves. The chain initiators had an important role in synchronization – yet only this manifold of other innovation attempts ensured that there were indeed translations to synchronize. 'Leaning' indicates how the chain initiators tied together a manifold of innovations that were partly modifications from their own initiative, partly other innovation attempts, and partly entire translation sequences themselves – TomTom's business case alone rested on systematic and large-scale assembly.

'Leaning on other translation sequences' was no less striking in the 'network turn' case. Sometimes more, sometimes less overtly, translators indicated that the boundary-crossing actions they had been involved in had their origins well before the Luteijn recommendations. Especially the much-praised 'quick wins' in incident management and traffic management could rely on preceding translation sequences: Amongst traffic professionals the network logic had already started to hold sway. This 'hitchhiking' on

riding innovation trains was integral to the 'Luteijn' growth model, deliberately geared to seize stepping stones towards further, riskier innovations. These initiatives were much less likely to have pulled off 'from scratch'. Other than passive 'leaning', i.e. merely piling up the achievements of others, system innovation achievements thus accrued from active assembly. The information chain initiators similarly used a growth model, chain improvement fueling further growth through increasing technological options - assembled synergy between the sequences' constituent parts. In the other two cases 'leaning' occurred as well, although less strikingly. The 80 km/h zones relied crucially on reliable section control systems, and so did the later dynamic speed arrangements. Shared Space may appear as a contrasting case, however, for the self-translated 'brand' out of virtually nothing. Yet the heroic image of the lone innovator is not only defied by the agency of a larger Shared Space network, it would also obscure how the very concept leaned on other translation sequences: The broader wave of resentment against overregulation; the slightly radicalized idea that 'the road tells the story'; the attention to the cultural history of roads and places; the idea to 'mix traffic'- all of these concepts had been hovering around already. As a former colleague of Monderman remarked, Shared Space gained attention for its appealing socio-philosophical storyline, adding novelty to its assembly of ongoing trends. Shared Space being as much about recycling and assembly as about innovation, it only corroborates the importance of 'leaning on other translation sequences'.

'Leaning on other translation sequences' is a normal course of events. Even in cases with apparently autonomously operating innovation initiators, their reliance on other translation sequences proves significant after closer examination. The 'information chain' and 'network turn cases' show especially insightfully how beyond passive 'leaning', deliberate assembly following a growth model is particularly promising for system innovation achievement.

8.2.12 Conclusions on translation dynamics

Underneath great diversity, innovation attempts and their evolution can very well be systematically compared as translation sequences. Comparative discussion of ten translation dynamics shows this. Further considering how several translation dynamics display interrelations, the ten patterns can be summarized under the following conclusions:

1. First of all, it has become clear why it is indeed sensible to speak of innovation *attempts*. All cases showed that the innovative initiatives did not spread or 'diffuse' for their sheer intrinsic value or the good intentions of the initiator. Instead, they needed to be meaningful and useful to the recipient actors in order to be adopted, supported or developed further. The cases also showed that innovation attempts often entail disturbances. The various and pervasive 'interferences' underlined the tentative nature of innovation. **As regards the requisite properties of the attempted innovation, it can be concluded that innovations need to be highly *transferable*.** Several translation dynamics elicited aspects of this transferability. The transferability of an innovation attempt resides on the one hand in its malleable character, allowing for diverse modification and widespread embracement. On the other hand the transfer through a diverse environment is also enhanced if the attempt manages to avoid interferences - with recipient 'translators' and between those, but also with the initiators' own organizational ambitions. Transferability is, other than an intrinsic value to meet a

certain societal challenge, a cameleonic quality. Its importance to innovation amidst a diverse and potentially hostile environment confirms expectations about modification and the formation of 'boundary objects'. Transferability also reinstates the age-old strategic principle that introduced this chapter: 'Shapelessness' as a way to immunize against threats, by moving along with the surrounding environment. The cases show more specifically that transferability is not a static quality that is possessed or not, but is rather a quality to be developed, maintained and exerted through sustained self-translations.

2. Second, it can be concluded that transferability is important, but by itself it is not enough. Notwithstanding the evidence supporting its importance and confirming theoretical expectations, several translation dynamics raised anomalies and complications. They lead to the understanding that transferability alone cannot account for the system innovation achievements made, and that this general picture needs to be revised and refined. They converge onto the understanding that sheer maximization of transferability would lead not only to shapeless, but also to *toothless*, i.e. diluted, innovation attempts. **System innovation achievement does not depend only on the avoidance of interference, but rather on how it is resolved, managed or even cultivated.** The discussions of the translation dynamics 'productive use of interference', 'capture', 'dilution dilemma' and 'self-interference' each elicit aspects of what could be called interference management: Especially odd are the dynamics of 'self-interference' and 'productive use of interference'. They indicate how system innovation achievement can very well be served by *seeking* disturbance, and by stimulating translators to reflect on the question of what disturbs what. That such interference-seeking behaviour tends to confer disturbance onto the initiators' own organization is the other side of the coin: The cliché 'no pain, no gain' does apply here. Moreover, while interference need not always be avoided, neither *can* it always be avoided. 'Capture' and the 'dilution dilemma' show insightfully how transferability can yield modifications and hybrids that can themselves evoke interferences: What is transferable, is prone to be 'captured' in not always satisfactory ways. The 'dilution dilemma' expresses how interference-avoidance has its shadowside of acquiescing in shallow transferability.

3. Third, **beyond the transferability of the innovation attempt and the management of interference, the decisive, overriding dynamic is synchronization.** This attunement of translations was already expected to be important, but only in the course of empirical investigation it became clear that the most successful innovation attempts were in fact synchronization attempts – joint elaboration of the 'network idea', for example. The discussed 'synchronization', 'leaning on other translation sequences' and 'mutually interfering modifications' help understand why this is not coincidental: First of all, they underline how the translators proved at least as important as the initiators. The system innovation achievements in the most succesful cases could become that impressive primarily because the various translations were synchronized: This reduced or resolved mutual interferences, prevented the innovation process from lapsing into fragmentation, and enhanced sustained translation. As became clear from 'leaning on other translation sequences', synchronization in the more succesful cases rested on initiators' growth models for continuing, self-propelling and assembled translation.

4. Furthermore, it became clear that the system innovation achievements of the translation sequences depend not only on the initiators, translators and their more or less successful attempts to synchronize, but also on a range of contextual factors. Especially

the discussed 'oscillation between interference and modification', 'backfiring replication', and 'leaning on other translation sequences' highlight the changing circumstances of translation and synchronization. The following analysis of intersections elicits more specifically how system innovation also involves the *co-*evolution of translation sequences.

8.3 Intersections analysis: System innovation as co-evolution of translation sequences

8.3.0 Introduction: Analyzing intersections

The various translation dynamics converge onto the insight that transferability, the handling of interference and especially synchronization are crucial to system innovation achievement. The following analysis of intersections between translation sequences elicits how system innovation comes about not only through the evolution of innovation attempts, their translations and the synchronization between those, but also through the co-evolution of translation sequences.

As discussed in chapters 2 and 3, investigation into translation dynamics tends to focus on local innovation processes. By contrast, *system* innovation, as a complex phenomenon of layered, nested and intertwined systems interacting into emergent patterns, typically consists of a multitude of such innovation 'journeys'. The methodological key to bring these interactions into sight range was to select simultaneously developing cases with a reasonable probability of intersecting. At these intersections translations can be seen to take place amidst a multitude of surrounding developments. Situated actors will appreciate these developments selectively: The distinction between 'relevant' and 'irrelevant' changes allows them to respond in a targeted way[16]. The 'contextual factors' to translation dynamics therefore need to be analyzed as changes in the world that are relevant to particular translators. If these relevant changes stem from developments in other translation sequences, the sequences can be noted to intersect. Practically it amounts to imagining oneself in the place of initiators and translators, asking where and how they encountered the other translation sequences. *In what ways did these developments constitute relevant changes in their environment? And which other 'relevant changes' affected their translations?* Intersections analysis proceeds as follows. After an inventory of intersections **(8.3.1)**, analysis addresses mutual intersections **(8.3.2)** and absent intersections, i.e. parallel development **(8.3.3)**. After a brief reflection on translators' wider environments **(8.3.4)**, findings are synthesized to specify the fourth conclusion on translation dynamics **(8.3.5)**.

8.3.1 Inventory of intersections

Translation sequences are shaped by translators who confront each others' translations in various ways. In the course of innovation evolution the number of modifications tends to increase (into a variety of network-oriented actions, or a series of Shared Space areas), and these diverse multitudes do not quietly coexist: As shown clearly through 'backfiring/synergetic replication' and 'mutually interfering modifications', the interplay between translations can be synergetic (mutual reinforcement), or interferential (mutual dampening, competition). Through this multitude of translations, translation sequences have a compounded character: In this regard information chain development

[16] See Chapter 2 for Luhmann's theory of self-referential systems.

exemplifies the possible emergence of problematic incoherence; apparently its translation sequence consisted of closely intertwined 'subsequences'. By contrast, both Shared Space and the 'network turn' branched into a variety of modifications that formed rather loose structures. These sequences are better conceived of as translation 'clouds'. The various modifications did have to be synchronized into agreed upon and practicable measures, but otherwise they could develop in relative independence – the more, the merrier. Considering the compounded nature of translation sequences, their internal dynamics could thus be analyzed as 'self-intersections'. Yet in contrast to translators' interactions *within* translation sequences, intersections analysis concerns specifically the interactions *between* translation sequences.

Intersections signal translators coming across relevant events posed by developments in other sequences; they indicate co-evolving, rather than merely simultaneously developing translation sequences. Figure 8.4 below shows more concretely what intersections analysis seeks to uncover. Merging the four case timelines in a singular graph, the simultaneous development of the translation sequences becomes visible: *'Meanwhile, elsewhere in the traffic management action field…'*.

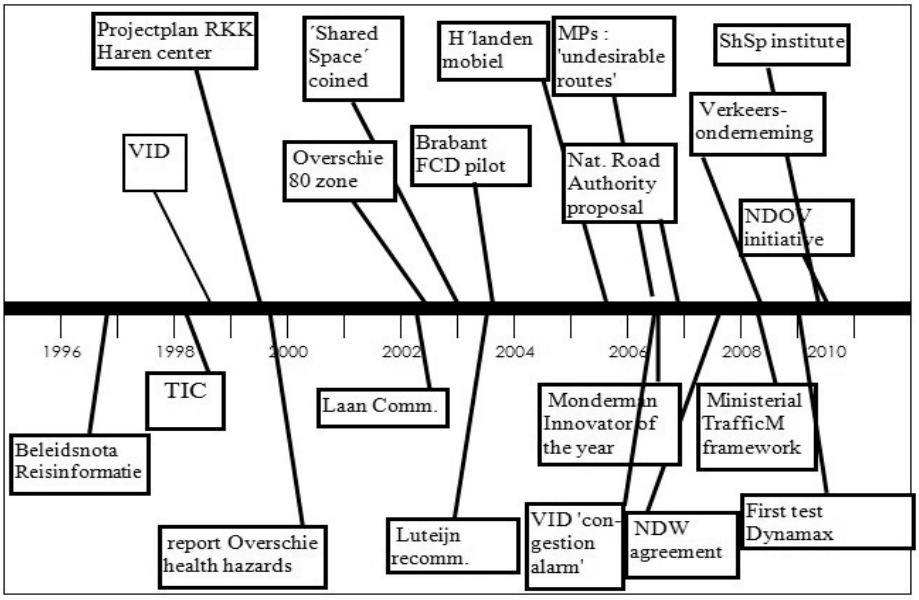


Figure 8.4 Nested-case timeline

The overview makes felt the argued need for selective observation, in order to make sense of the bulk of events. Having investigated innovation processes in an area as large as the traffic management action field and over periods up to 15 years, the potentially relevant changes to these innovation processes must be innumerable. It can safely be said that none of the translators could possibly have taken in all of the developments in their environments. Even when displaying only a few events per case, the overview is still of near overwhelming complexity. As yet displayed as a confusing simultaneity, it remains to be seen how the translators related the events to each other, and whether the sequences co-evolved or merely co-existed. Analysis proceeds through a targeted inventory of intersections within the clew of events. For the four translation sequences a

4x4 matrix covers all theoretically possible intersections. It can be completed through the indications of intersections that transpired in earlier analysis: In figure 8.5 the rows indicate how translation sequences appear to translators of the other sequences, the columns display the inverse relation. As co-evolutionary analysis typically investigates mutual relations, the mirror cells are analysed jointly.

Transl. seq. acting/ acted upon	**80 zones**	**Luteijn**	**Shared Space**	**Travel information**
80 zones	See 8.2	Not significant	Not signif.	**'Greening traffic' as market stimulation and technological development**
Luteijn	Not significant	See 8.2	Not signif.	**Need for network coverage as market stimulation Intensified control Public-private synchronization**
Shared Space	Not significant	Not significant	See 8.2	Not significant
Travel information	**Technological options:** **(Section controls, congestion alarm, in-car systems, dynamic speeds)**	**Technological options:** **(Mobility management, dynamic traffic management)**	Not signif.	See 8.2

Figure 8.5 Intersecting translation sequences

The intersections are displayed in condensed fashion; behind every entry there is a larger story to be told. Even then the table provides several leads for further analysis: The blank cells, indicative of parallel development, and the information chain standing out for its multiple intersections. Detailed analysis can take place in clusters: Four mutual intersections **(8.3.2)**, and eight occurrences of absent or insignificant intersection **(8.3.3)**.

8.3.2 Mutual Intersections and emergent trajectory formation

Having identified four intersections out of 12 theoretical possibilities, they appear as exceptions to overall parallel development. As all mutual intersections involve information chain evolution, the straightforward question to answer is how translators in the 'network turn' and the '80 km/h zones' sequences encountered its development as relevant changes, and inversely, how the latter posed relevant changes to information chain development. More specifically, the question is whether the sequences displayed mutual synergy or rather mutual interference. And as far as the intersections co-evolved synergetically, a further question is whether they mutually reinforced into coherent innovation trajectories. As discussed earlier, such merged streams of innovation are of

particular interest to system innovation and transition research[17] - they promise to deliver the major system shifts.

8.3.2.1 Network turn <-> Information chain intersections

The 'network turn' and the 'information chain' sequences intersected in multiple, and generally synergetic ways. The synergy speaks most clearly from the information chain's role as enabler of network management: 'Network turn' translators being concerned with network-oriented mobility measures, information chain development became highly relevant to them as a source of technological options. Illustrative for this intersection are the very quick wins that kickstarted Luteijn's envisioned innovation wave; traffic light programming proved a surprisingly effective way to capitalize on the network logic[18]. Similarly, traffic professionals were enabled to develop traffic management commensurate to the task of tackling network problems, and move beyond haphazard tinkering with local bottlenecks: More accurate data acquisition, more efficient data processing, better communication of information and greater compatibility between equipment components. Technological advances allowed them to release the earlier preoccupation with the technically possible, and to concentrate on the desirable. Next to the increasing scope for network management, the in-car systems were also promising as infrastructure for mobility management and future road pricing: These synergies were explored through the pilots with Rush Hour Avoidance.

Inversely, information chain translators also encountered 'network turn' developments as relevant changes in their environments. It is telling that the 'chain smiths' themselves considered information chain development a means to the end of stimulating 'informed travel choice', and therewith better usage of the road and rail networks. The increasing ambitions and initiatives in network management thus mattered as augmenting demand and legitimization for the information household they were setting up. In the same vein, various information chain translators experienced the 'network turn' as a source of market stimulations: Governmental actors seeking better network coverage, they initiated various pilots and public-private network sessions for development of in-car systems. For the entrepreneurial translators these were especially useful as sources of knowledge generation and reduction of development costs. Later on in the 'FCD-trajectory', ambitious road managers were again important as 'launching customers'.

Yet notwithstanding the above synergies, the co-evolution between the sequences involved interferences as well. Information chain development did not simply enable network management. As also addressed under 'mutually interfering modifications', the in-car systems also appeared as 'jammers', enabling self-organizing drivers and undermining governmental control. Governmental translators with traffic management ambitions lamented how the commercial information services misinformed drivers and enabled them to take 'undesirable routes' - only increasing network vulnerability through shortcut-seeking drivers. Inversely, the upswing of network management did not only pose market stimulation, but market disturbances as well. Eager to exert their augmented instrumentarium for traffic control, road managers improved and expanded their information provision to the public, eroding an already limited market for information services. Similarly, the NDW data repository promised to boost the

[17] See section 1.2 on the concepts of system innovation and transition, but also the critical contributions challenging overly linear accounts of trajectory formation.

[18] See section 5.2 for details on these technology-enabled quick wins.

development of value-added services - yet once under the sway of intensified traffic control ambitions, it started to work against novel technologies. Finally, the upheaval about the 'undesirable routes' is typical for the recurrent interferences that compromised overall synergy: The network turn developments incited governmental translators' interest in the information chain, but also their control ambitions that the very information chain initiative required them to restrain: To entrepreneurial translators this self-interferential ambivalence presented itself as uncertain conditions for investments.

8.3.2.2 80 km/h zones <-> Information chain intersections

Compared to the strong intertwinement between the 'information chain' and 'network turn' sequences, the 80 km/h zones' intersections with the information chain are less pronounced. Also the zones' initiators received information chain development as a source of enabling technologies: The very possibility of a properly functioning section control system was essential to their divergence from the A13 highway's design speed; the account of the project leader spoke volumes about the possible consequences of technological failure. Similarly, technological advances towards dynamic traffic management enabled the Transport minister to move beyond the 80 km/h zone as self-interferential 'straightjacket', and arrive at the more flexible and therefore transferable dynamic speed arrangements. These multi-objective arrangements exemplify how the proliferation of technological options allowed for more fine-tuned and less interferential 'greening' of traffic.

Information chain evolution changed the information-technological landscape for the 80 km/h zones translators. Inversely, the zones did not pose similarly relevant changes to translators in the information chain. They appeared as changes in the demand for traffic information systems, and as fruitful test sites: The section controls were the first to be applied in vivo, for instance. Moreover, as the system proved sufficiently reliable, the enforcement instrument could be applied further- not necessarily for the initial environmental purposes. Yet the broader trend towards environmentally-sensitive traffic management was significant: Also on the secondary road network the proliferation of 'green waves' (synchronized traffic lights ensuring continuous flow and thereby reducing emissions) showed road managers responding to pressures to 'green' traffic. Traffic systems suppliers were keen to develop ever more ingeneous systems to meet the demand. And finally, when the information chain initiators launched their offensive on integrated public transport information, they reassured the hesitant sector that the commercial information providers could help articulate environmental parameters of travel -and not only the less flattering travel times. Even when the 80 km/h zones themselves were only of limited relevance to information chain developers, the broader trend of 'greening traffic' thus stimulated the development of 'smart' traffic solutions.

Information chain evolution did not only enable the 'greening' of traffic, however. Next to this synergy, especially the development of commercial, personalized travel information raised interferences. The 80 km/h zones' interference with drivers incited some to seek alternative routes, and commercial information services facilitated these choices for 'undesirable routes'. The advent of non-governmental information services became especially relevant through the 2006 'congestion alarm', however; a turning point in the 80 zones' evolution. The alarming congestion reports by a service provider set in motion a politicized debate, which dramatically upset the minister's intended trajectory of cautious and evidence-based 'rollout'. Suspicious MPs raising critical

questions about the congestion reports, the minister claimed these to be largely based on governmental data. The presentation and distribution of information she could no longer unilaterally control, however - that information monopoly had been relinquished 10 years earlier. Information chain evolution thus changed the 80 km/h zones' information landscape in largely synergetic but also interferential ways: It enabled fine-tuned governmental steering for environmental purposes, but also supported self-organizing behavior not always 'in synch' with these ambitions.

8.3.2.3 Conclusion on occurring intersections

Overseeing the intersections, especially the 'network turn' and 'information chain' come to the fore as closely intertwined sequences: They are tied together through what can be considered a shared subsequence; dynamic traffic management. The two sequences display strong synergy through the interplay of a supplying information chain and a demanding network turn. This 'invisible hand' indicating how synergy emerged through spontaneous synchronization between translators, it should not be forgotten that co-evolution involved interferences between the sequences as well. The deliberate synchronization attempts within and between the sequences can be considered as anticipations and reactions – seeking to have synergy prevail over interferences. On top of spontaneous synchronization, these efforts targeted remaining interferences between public and private sector translators. The intersections between information chain development and the greening of traffic display weaker intertwinement. Synergy emerged through similar interplay between supply of and demand for 'smart' and 'green' technologies. Deliberate synchronization attempts were less prominent.

To conclude, both the 'greening of traffic' and the 'network turn' intersected with the information chain. Co-evolution was largely synergetic, in both cases resting on the interplay of demand for and supply of technological options. Notwithstanding overall synergy, this co-evolution was not without mutual interferences, however. On top of spontaneous synchronization, deliberate synchronization came forward as anticipation of and response to interferences. All in all, the three sequences display traces of an emergent innovation trajectory: Translators in the respective sequences converge onto an increasingly 'smart', i.e. technically sophisticated, network-oriented traffic management, also involving efforts to 'green' traffic[19]. Especially the intertwinement of the network turn with the information chain sequence shows how deliberate synchronization can strengthen trajectory formation.

[19] Explicit support for such trajectory spoke from the Transport ministry's 2007 'road utilization' policy framework, indicating considerable reductions in travel time losses (Min. V&W, 2007, see also Ch's 5 and 7). Beside the crucial endorsement of this key group of translators, a similar future vision was advocated through a broad group of entrepreneurial translators. Their 2010 'Clearing the way for Ingenuity' manifesto is a most clear expression of the spontaneous synchronization the trajectory could rely on: *"Through smart, technology-enabled organization of traffic and transport, existing roads can be utilized up to 15% more efficiently with reduction of environmental impacts up to 20%, within three years time. And that is helpful! At 15% more efficient utilization of roads, travel times can be restored to manageable proportions. Required investments remain well within current budgetary constraints, but do require clear choices to be made. [NIO] is initiated by leading companies, ready to sign for the result. The budgetary economizations are considerable, and results can be achieved quickly. The choice is therefore self-evident; especially now. Politicians are called for full embracement of this initiative. Also as this is not a political matter. Who wouldn't like to achieve more with less, in times in which this is so dearly needed?"* (NIO, 2010, 4).

8.3.3 Absent intersections: Evolutionary watersheds or remote co-evolution?

The above intersections showed how synergetic co-evolution between translation sequences yields trajectory formation. The picture arises of information chain development posing a changing information landscape to the network turn and the greening of traffic, while inversely being fed by those - as developing demand for technological solutions. By contrast, the eight instances of non-intersection indicate this trajectory formation to have emerged amidst overall parallel development, as exceptions to overall fragmented evolution. As fragmentation and coherence are equally pertinent to system innovation, the non-intersections merit closer attention. Moreover, considering that the four sequences produced a multitude of changes, there is at least a great potential for intersection. Indeed, several resemblances and apparent connections between translation sequences speak against completely parallel development. *Did the eight occurrences of absent intersection really indicate translation sequences being irrelevant to translators in other sequences? And if yes, how can this irrelevance be understood?*

The 'network turn' and '80 zones' both intersected with the information chain, but no mutual intersection could be established. This is odd, especially when considering that some of the networked initiatives impinged on the very A13 motorway where the Overschie 80 km/h zone was installed: The success-story of traffic light adjustment down the ramp unloaded the A13, and the later Luteijn pilot Rotterdam addressed network problems on the Rotterdam end of this motorway. Meanwhile, the successful 'Overschie effect' resulted partly from 'shifting back' queue formation in the Delft/Den Haag direction. Later on the Transport minister also decided to lower the speed limit (from 120 to 100 km/h) on the Den Haag and Delft A13 sections, so as to smoothen the transition towards the 80 km/h zone: The 80 km/h zones thus affected, and were affected by, the traffic flows up and downstream. Even when these translation sequences lacked conspicuous intersections, this geographical overlap between the sequences arguably entailed interdependencies - at least constituting a clear potential for intersection. This adds nuance to apparent parallel development.

As mentioned, the A13 highway did stage several intersections between the 80 km/h zones and information chain development. It thus appears as a focal point where two, and potentially three, translation sequences intersected. The same example signals that the Shared Space translation sequence unfolded at a distance. Its initiators sought to 'roll back traffic management' mainly in the rural areas, while simultaneously the urbanized and traffic-intensive areas of the Netherlands saw a proliferation of section controls, information panels and monitoring systems. While the section controls interfered with driving freedom, the Shared Space protagonists precisely sought to reduce such interference: A striking display of translation sequences heading in divergent directions. Yet however striking this simultaneity of opposite developments, the translators in both sequences understood them to be hardly related. Shared Space initiators never meant to 'create chaos' on highways. Inversely, the other translation sequences typically addressed roads and areas with high intensities, with less attention to the residential areas. They responded to other societal pressures than those of livelihood or 'restoration of the human standard'. Shared Space thus evolved parallel to the other sequences, and intendedly so. Shared Space's non-intersections can thus be understood to result from translators' assessments that it was not of direct relevance to the other sequences, and

vice versa. The non-intersections signal an evolutionary watershed between the translation sequences – in this case of a geographical-functional nature.

Despite the observed evolutionary watershed between Shared Space and the other sequences, there remain intrigueing indications of co-evolution *across* this watershed. First of all, Shared Space's rollback and the other translation sequences' intensifications of traffic management did concern a common Dutch road network. The parallel sequences' effects on driver resentment being arguably not completely disconnected, the evolutionary watershed 'leaked': While Shared Space stimulated reliance on eye contact, the simultaneous development of in-car intelligence stimulated drivers to keep an eye on their screens. In fact, the changing information landscape did prove relevant to Shared Space translators, as manifested through the development of navigation aids for the visually impaired. On the longer term these could reduce Shared Space's interference with a group of translators initially overlooked. Inversely, the social sharing of space *could* have been relevant as regards the 'undesirable routes'. This nagging interference in information chain development indicates a problematic sharing of space, after all. Finally, there are also indications of such remote co-evolution between the 'network turn' and Shared Space. They display commonalities in the kind of change they sought to bring about: Countering overregulation in favor of a user orientation, their respective 'productive uses of interference' played out common sense against bureaucratic logic. Translators also undertook similar attempts to bridge the divide between administrators on the one hand, and technically oriented traffic professionals on the other.

The absent intersections between Shared Space and the other translation sequences 'on the other side of the watershed' can be understood through deliberate disconnect: The attempts differed in intentions, geographical scope and functional area of application. Yet the above leakages in the evolutionary watershed also show that behind the absence of intersections, there is a more intricate story to tell. Shared Space displayed weak intersections with the network turn and the information chain; the sequences display what could be considered 'remote' co-evolution. **To conclude, absent intersections can reflect deliberately parallel development. In the case of such evolutionary watershed, translation sequences are irrelevant to each other's translators. Yet considering the various ways in which translation sequences can pose mutually relevant changes, apparently absent intersection can be deceiving. The weak, 'remote' or latent intersections could become more significant in the course of further translation[20].**

8.3.4 Translators and their 'relevant environments'

Intersections analysis shows traces of trajectory formation amidst predominantly parallel evolution: Other translation sequences can pose relevant changes, but often they are of no or limited relevance to translators. The many instances of non-intersection help understand why parallel development is often intended, translators seeing no reason to synchronize. By contrast, as becomes clear from comparison of singular sequences, translators experience many relevant changes stemming from their own translation sequence. The own translation sequence tends to be *more* relevant than developments in

[20] The high-tech future of mobile intelligence and Shared Space's restoration of old order can interfere, but can also coevolve synergetically. As different forms of self-organization they may reinforce towards eradication of traffic signs, for example.

other translation sequences. Next to the developments in their own and adjacent translation sequences, translators are generally occupied with a range of other developments as well, however. Their relevant environments are also shaped by the varying demands of day-to-day management. Intersections analysis therefore concludes with a brief consideration of what can be considered translators' 'wider environments'. This brings out most clearly how system innovation emerges from the evolution of and co-evolution between translation sequences, and through the agency of translators with only partly overlapping 'relevant environments':

Translators are concerned with their own sequence translation sequence and sometimes with other innovation processes as well, but also with developments only relevant to them alone. Information chain development exemplifies how these particular concerns, the 'wider relevant environments' of translators, can be strongly dispersed: The governmental translators responded mainly to the changing opportunities, threats and pressures for intensified network management. Apart from information chain development itself and the simultaneously developing 'network turn', they also had to deal with the demands of administrative reality (coping with acute traffic bottlenecks, securing budgets, demonstrating responsiveness to the public). Meanwhile, the entrepreneurial translators were primarily concerned with their positions on the traffic information market. Initially opaque and later increasingly dynamic, the turbulent market developments were of immediate relevance; they had to manage their respective value chains. In the same vein the public transport operators responded primarily to changes affecting their positions on the transportation market: An altogether different market, further branched into submarkets (e.g. local and supralocal transport, bus, train, tram and metro). Beside their shared interest in traffic information, the translators in the information chain's subsequences had otherwise very different 'wider relevant environments'.

Similarly, translators in the 80-zones translation sequence had their particular relevant environments in mind too: Changing environmental regulations, developments in combustion technology, traffic psychological insights, and drivers' willingness to accept the constraining measure. Just as in the 'information chain' and 'network turn' sequences, congestion levels were highly relevant to many translators. Still, translators disagreed about its relative importance compared to pollution levels. The other two translation sequences only add to the general picture of only partly overlapping 'relevant environments': In the Shared Space case, some translators were passionate to address the system pathologies of overregulation, others were were more concerned with creating attractive places, or with the safety of vulnerable road users. And finally, the 'network turn' translation sequence highlighted how translators struggled to engage in network-oriented actions while minding their particular parts of the network too. Network allegiance did not always combine easily with responsiveness to the own constituency; similarly, translators struggled with allegiance to the information chain on the one hand, and the importance to take care of their own segment on the other. As pointed out earlier, both translation sequence had their typifical 'oscillations' between interference and more affirmative translation. The other sequences displayed similarly alternating upswings and downswings.

Analyzed as the evolution of singular translation sequences, these oscillations came to the fore as striking aberrations from linear development. Yet having considered how translators respond not only to developments in their own sequence but also to changes

posed by other sequences and their 'wider environments', this oscillation appears rather as the normal course of affairs. Overlapping 'relevant environments' being more the exception than the rule, translators' responses may change - even if the attempted innovation would remain the same.

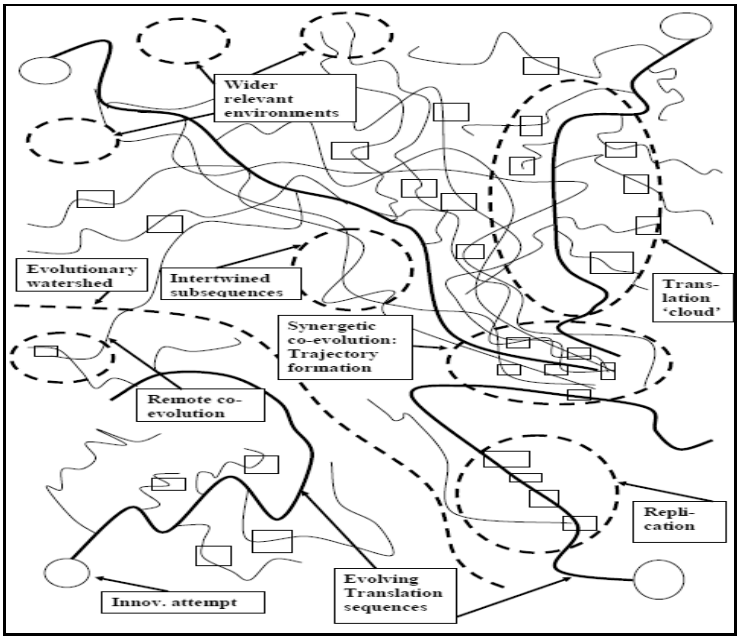


Figure 8.6 System innovation as evolving and co-evolving translation sequences

Figure 8.6 captures the findings of intersections analysis graphically, combining them with insights on the evolution of singular translation sequences. It shows how system innovation takes place through the evolution of and co-evolution between translation sequences: Singular translation sequences take their courses through the transferability of the innovation attempt, the ways initiators and translators handle interference, and especially on the synchronization of translations. In this regard the distinction between unstructured translation 'clouds' and intertwined clews of subsequences reminds of the assembled, compounded nature of translation sequences. They tend to be assemblies, through multiple modifications or self-translated replication, and the constituent parts can display mutual interferences and synergies. Furthermore, their co-evolution with other sequences is a further source of interferences and synergies. Generally, translation sequences develop in parallel, posing no changes of direct relevance to translators in other sequences. This leads to evolutionary watersheds between translation sequences, with occasional manifestations of 'remote co-evolution' across such watershed. Amidst fragmentation and parallel evolution, synergetic co-evolution appears as the exception rather than the rule. This mutual reinforcement between sequences manifests through trajectory formation, indicating how translators converge on mutually supportive translations. Reflection on translators' various 'wider environments' pinpoints the general non-overlap between their 'relevant environments', however. Considering this circumstance it becomes especially clear that translations occur under changing circumstances: Translators' shifts between affirmative translation and interference appear as the normal course of affairs.

Due to pervasive oscillation, synchronized translators are easily driven apart again; deliberate synchronization efforts are therefore of only temporary effect. They can be seen to bolster translation sequences against oscillations, a pervasive phenomenon. The signaled trajectory formation can be understood to rest on spontaneous synchronization as well; on translators' convergent responses to their respective 'relevant environments' that display overlaps – the convergence on the wish to develop 'smart' road utilization results only partly from *deliberate* synchronization.

8.3.5 Conclusion: Oscillations and the transient effect of synchronization

Section 8.2 ended with a four-fold conclusion. Stated briefly, the evolution of innovation attempts towards system innovation was noted to depend on the transferability of the innovation attempt, on initiators' and translators' handling of interference, and especially on the synchronization of translations. The fourth conclusion briefly indicated that these translations and synchronizations prove to be made under changing circumstances. Intersections analysis having elicited the co-evolutionary dimension to system innovation, this fourth conclusion can be specified as follows:

Conclusion 4: Under pervasive oscillation, synchronization is of transient effect. Amidst mutual interference and fragmentation, system transformative trajectories can emerge through either spontaneous or deliberate synchronization. Intersections analysis elicits how the translations of initiators and translators take place under changing circumstances; it confirms the general expectation that co-evolution is crucial to innovation attempts' evolution to system innovation. Translators responding to relevant changes stemming from their own translation sequence, from other translation sequences and from their wider environments, it becomes more understandable why translation sequences 'oscillate' between negating and affirmative translation. Considering the general lack of overlap between translators' 'relevant environments', these oscillating shifts can even be considered inevitable. Especially when translation sequences are shaped as intertwined subsequences instead of unstructured 'clouds', oscillation is to be reckoned with. Considering furthermore that sequences are not only compounded entitities themselves but also form parts of broader co-evolutionary processes, it becomes clear that synchronization is not only important for attunement *within* translation sequences, but also *between* sequences. In order to achieve synergetic co-evolution and coherence rather than mutual interferences, the translations of actors need to *remain* attuned somehow – 'together, for better or for worse'. Synchronization can emerge spontaneously, as translators' responses to their respective relevant environments converge. In the face of pervasive oscillation and only partly overlapping 'relevant environments', it is transient, however. Deliberate synchronization attempts are therefore crucial to bolster translation sequences against pervasive oscillations and evolutionary drift. These interventions contribute to system innovation not only by harmonizing separate translation sequences, but also by ensuring synergies and trajectory formation amidst fragmentation.

Having synthesized generic translation dynamics and summarized those under four main conclusions, the research question after the evolution of innovation attempts into system innovation has been answered. This leaves the question after situated actors' scope for intervention in these complex processes. This question is taken up in the next chapter, in the form of a synchronization strategy.

Chapter 9 Outline of a Synchronization strategy

"A 'lock-in' is simply an (old) 'equilibrium' that someone has defined as sub-optimal. And as long as technology and society continue to develop, today's 'equilibrium' will eventually become someone else's 'lock-in'."

J. Meadowcroft (2009, 337)

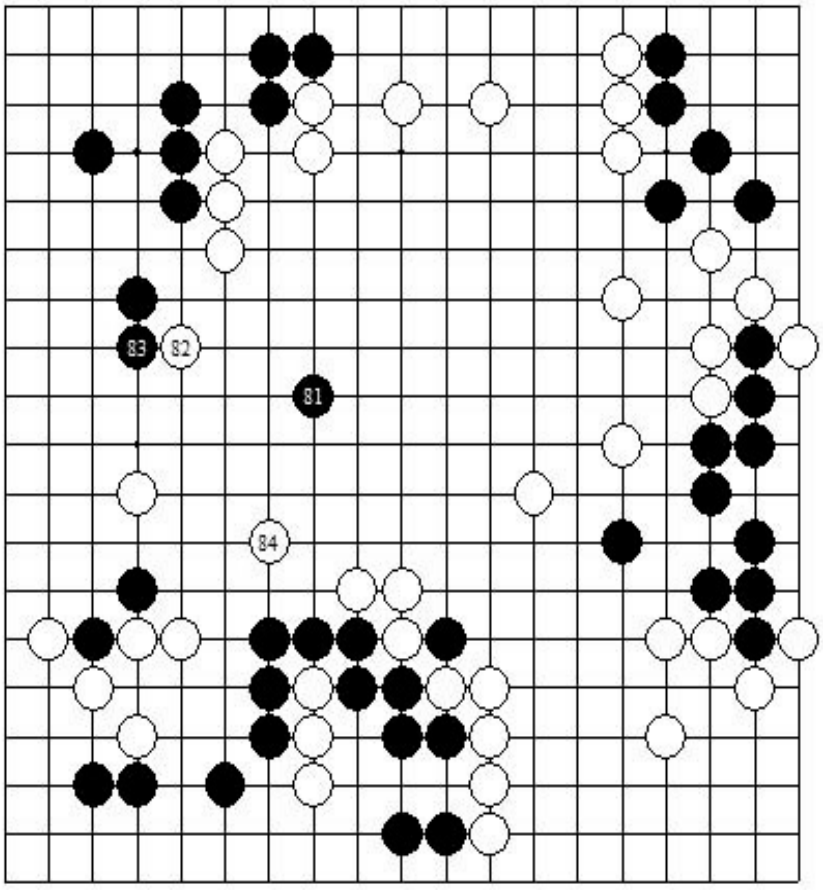


Diagram 27
B81 Invades, And W82 Blocks His Egress.

9.0 Introduction: Intervening in translation dynamics

This chapter answers the second part of the central research question. Having analyzed how innovation attempts evolve into system innovations, the practical question is ***how situated actors can intervene in that evolution*.** This step from insight to intervention is emphatically nontrivial, however. As discussed in the first chapter, it typically invites the 'transcendental temptation': Mounting the analytical helicopter, systemic problems and strategic pathways can be discerned more clearly, yet the ever-contested nature of systemic change is easily neglected. The translation-dynamic insights, by contrast, follow an immanent logic. They are derived from the interplay between situated actors, varying in system understandings and ambitions. The search for translation dynamics stemming from the aim to investigate system innovation as *two-way* traffic, the step from insight to intervention should reflect similar attentiveness to diversity – to 'diverse transformations' rather than 'integrative transitions', as Stirling (2009, 2011) expressed it. The challenge is then to arrive at prescriptions consistent with polycentric commitments but still pertinent to system innovation. Recommendations should instruct actors' quests for systemic change, but should also situate action within the observed clews of translations. Considering intervention from such collective viewpoint and placing it in the context of nested-system evolution, its intricate normative implications surface. This may seem to detract from practicable instructions for intervention - it does allow the challenge to be appreciated in its full complexity[1].

The step from insight to intervention is taken as follows: First it is sketched how an 'interventionist' could seize translation-dynamic insights to maximize and accumulate system innovation achievements. There are translation-dynamic levers to pull *within* translation sequences, but ultimately it is a matter of deliberate synchronization or 'modulation' of ongoing co-evolution into trajectories. Facing pervasive oscillations, relying on spontaneous synchronization asserts itself as a robust strategy. As this could easily exacerbate systemic problems or invite new ones, however, synchronization is shown to be a double-edged sword **(9.1)**. Second, the normative implications of this confusing predicament are confronted, considering several positions. Out of an instrumentalist quest for synergy, synchronization serves formation and mitigation of trajectories. The position of 'postmodern modesty', by contrast, shows how it could be handled more reflexively - *questioning* trajectory formation, *negotiating* relevant environments. Both attitudes having their drawbacks, the normative disorientation is alleviated by adopting 'system versatility' as a strategic compass. While acknowledging the ambivalences of steering, it helps move beyond a relativist stance that would leave system innovation ambitions pointless **(9.2)**. Third, the question after intervention in innovation evolution is answered. The guidelines for intervention are presented as a synchronization strategy, consisting of five elements. Beyond the practical implications of the developed translation-dynamic insights, the normative orientation towards system versatility is the fifth element. Discussing these strategic elements' pertinence to the system innovations debate, recommendations are formulated for further research **(9.3)**.

[1] This is a deliberate choice regarding the transferability of these instructions. More instrumental and less complexity-sensitive recommendations would lend themselves easier to translations, but would also be vulnerable to modifications alien to the writer of this thesis. Intervention into system innovation processes is very well possible, but easy or obvious it is not.

9.1 Intervention and the phenomenon of nested-system solutions

9.1.0 Introduction

As immanent dynamics, the developed translation-dynamic insights are relatively easy to elaborate into situated interventions. Zooming out from translators' situated actions to the evolutionary processes they are part of, the scope for system-innovative intervention turns out not so clear, however: In the following it is elicited how the pursuit of system innovation involves targeting a moving object, presenting itself as largely unknown and contested. The interventionist typically runs up against the difficulty to accumulate system innovation achievements **(9.1.1)**. He could seek to achieve synergies, but his synchronization efforts will have to rely on spontaneous synchronization as well **(9.1.2)**. Furthermore, if succeeding to 'modulate' ongoing co-evolution into trajectory formation, the interventionist is bound to pose relevant changes to other action fields as well. Through these next-order synergies and interferences, his efforts could easily turn out to be counterproductive, however. The emergent 'smart road utilization' trajectory is exemplary for the elusiveness of nested-systems solutions **(9.1.3)**. Translation-dynamic insights can thus usefully inform intervention, but they also show synchronization to be a double-edged sword **(9.1.4)**.

9.1.1 Intervention and the non-accumulation of system innovation achievements

The developed translation-dynamic insights help understand innovation evolution. *How to capitalize on those insights, and use these to inform situated efforts to further system innovation?* In the following it is sketched how an 'interventionist' – any actor with systemic changes in mind - could do this.

The line of action suggesting itself is to use them as strategic tools to nurture translation sequences. The interventionist would undertake a kind of 'strategic niche management', guiding innovation attempts through a generally less than receptive selection environment (Kemp et al., 1998, Schot & Geels, 2008). In order to maximize system innovative impacts, he would have a range of translation-dynamic 'boosts' at his disposal: *Cultivating* the *transferability* of the innovation attempt would help him to draft allies. He would make sure to introduce malleable and fashionable ideas, flexible and adjustable objects, and inspiring, not overly specific guidelines for action. He would not shy away from interferences, but rather seek to resolve them or even make productive use of them: This could raise translators' awareness of societal institutions getting in each others' way, and have them reflect on the nature and sources of the interference. Beyond this *interference management*, the interventionist would undertake deliberate synchronization attempts to attune translations. He could organize network meetings, joint pilots or systematic knowledge exchange, or have translators negotiate how to put the attempted innovation into action. His *synchronization efforts* could prevent the innovation process from running dry, or succumbing to fragmentation. In any case he would not be fooled into attributing system innovation achievements to the features of the attempted innovation itself. He would be aware of their emergence from a preceding translation process, a particular configuration of translation types, and would tailor his intervention to its translation-dynamic footprint thus far: In stagnant processes he would seek to increase transferability, and in case of widespread yet shallow translation, he would not circumvent interferences, but rather seek to play these out.

By responding to sequences' particular translation dynamics, the interventionist would acquire a certain strategic lenience[2]. Set to seize the opportunities presenting themselves underway, he would therefore eagerly consider other translation sequences as sources to tap from, as opportunity to join forces. He would follow the general idea behind system innovation, envisioning a multitude of changes to build up into a broader stream of systemic change. For example, the technological opportunities from information chain development could be interesting; as instruments for more forceful network management, or for sophisticated and only moderately interferential 'greening' of traffic. Intending to accumulate impacts, a certain strategic circumspection is indispensible: Taking stock of separate system innovation achievements, a strategic map can be drawn like figure 9.1. The proliferation of system innovation achievements suggesting considerable scope for accumulation, the interventionist could identify sources to tap from - drawing dotted lines between the check boxes.

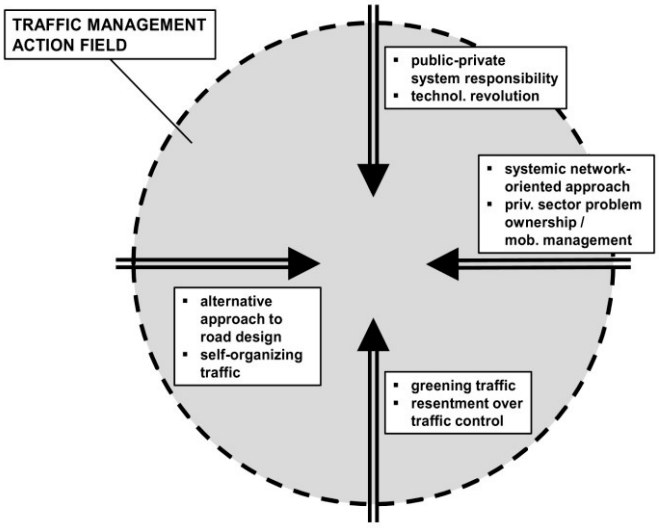


Figure 9.1
'Accumulating' system innovation achievements

Yet in the course of intervention, he would find the map to offer disappointingly little guidance. First of all, he would experience that, notwithstanding occasional convergences, the translation sequences are headed for different directions: The respective initiators and translators aiming for different kinds of system innovation, the transformative feats are not all that encouraging. (The case studies speak volumes about this 'directionality' of system change). Seeking to accumulate towards more efficient traffic control, for example, the interventionist would encounter other translators favoring a more self-organizing traffic order; seeking to accumulate towards 'greening', other translators could pinpoint the fragile balance with driving freedom; seeking to join forces for more humane forms of sharing space, questions would arise about the ramifications for various kinds of road users. The interventionist would find the transformative achievements hard to add up along a singular dimension. Despite

[2] He could consider this lenience opportunistic, compromising the system innovation endeavor, but it is just the other side of the desired transferability and 'shapelessness'.

apparent convergences, combinations would remain ridden with contestations and tradeoffs - unlikely to yield a singular, coherent system shift.

Second, apart from the differences in direction, the interventionist would also experience the achievements to be passing moments in ongoing translation. Once engaging with 'system innovation in the making' he would be bewildered by the typical oscillations of translation sequences: The proliferation of information services and technologies may have seemed inexhaustible, but anticipating market saturation, the targeted market actors could easily withdraw their investments. Similarly the network organizations may have seemed attractive facilitating structures, but in between administrations, the interventionist would be looking in vain for the hibernating networks. The opportunities for joining of forces could even disappear altogether: Shared Space resonated nicely with sentiments against overregulation, but societal moods could easily turn against these interferential 'experiments'. Similarly, the interventionist better think twice to associate with the 80-zones that quickly fell from grace[3].

Momentary assessments give little foothold, the interventionist would find out: Accounting neither for regular oscillations nor phase differences between embryonic, blossoming and dying innovations, his map offers mere 'snapshots' of system shifts. By contrast, his attempts to build up in a certain direction meet with a continuously shifting system.

9.1.2 Intervention for synergy and trajectory formation

Seeking to nurture and *combine* system innovative achievements, the interventionist runs up against their non-accumulation. Arguably, his need for orientation would become only more pressing: Instead of resigning into a narrow orientation on singular translation sequences[4], he would seek to grasp the 'bigger picture' - endogenizing the evolutionary sources of non-accumulation and oscillations, the scope for accumulation would be charted more realistically. Refining his strategic map, he would arrive at a more dynamic display like figure 9.2, below. The four translation sequences remain center stage, but the interventionist can see them to evolve amidst other sequences and developments of possible relevance to translators. Distinguishing more or less relevant changes to translators that can lead to either synergetic or interferential co-evolution, he would perceive a manifold of developments to grip on to:

The interventionist could pursue his 'accumulation' attempts by seizing the apparent scope for synergetic co-evolution. Amidst general fragmentation, he could even perceive distinct traces of trajectory formation presenting themselves: Information chain development would come to the fore as a dominant trend, reinforcing and being fed by the network turn and the 'greening' of traffic. Considering these synergies, the interventionist could envision a large proliferation of further system innovation achievements to come: Translators mutually presenting each other with enabling changes, innovation would self-propel to a certain extent. This 'smart' traffic management could yield smoother, safer and more environmentally benign traffic, more customer-friendly information provision, and integrated mobility policy better attuned to network vulnerability.

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[3] In 2010 the centre-right administration decided for speed limit raises on several highway sections. Especially the raises from 120 to 130 km/h featured prominently in the liberals' political campaign.

[4] This focus on separate translation sequences corresponds roughly with what Schot & Geels (2008) indicate as 'niche-internal' dynamics – inadequate to gain understanding of *system* innovation.

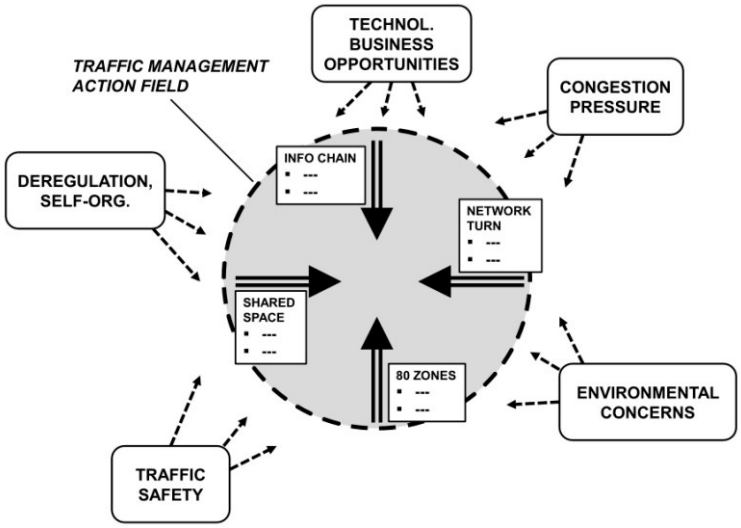

Figure 9.2
Co-evolving system innovation achievements

Considering the apparent opportunities for mutually reinforcing system impacts, the interventionist would consider the synchronizations needed. Within sequences he would encounter translators disputing public and private system responsibilities, for example, but also the administrative struggles involved with boundary-crossing action, and the tradeoffs surrounding the 'greening' of traffic. Without achieving attunement on these issues, the synergies would remain a distant dream. Reflecting on the sequences' constitutions as translation 'clouds' or intertwined clews and further considering the intertwinements between translation sequences, the interventionist could decide upon crucial interferences to confront, and particular synchronization processes to engage in. Similarly, the interventionist could use the map to discern the oscillations likely to affect the synergies: In the worst case scenario these oscillations would combine into even more capricious fluctuations - an evolutionary current pulling loose the synchronization 'anchors'. Understanding how translators are easily driven apart, the interventionist could further consider translators' respective 'relevant environments'. Figure 9.2 would help him to identify key 'selective pressures' to translators across sequences: Congestion pressure for example, as a primary motivation for both network turn and information chain development, and a critical side constraint to the 'greening' of traffic. He could also see environmental pressures, concerns about traffic safety and technological business opportunities. Responsiveness to these 'relevant environments' yielding spontaneous synchronization, it would nicely carry a trajectory towards 'smart' road utilization. The interventionist would thus arrive at the strategic awareness not to be 'steering' co-evolution, but rather to be 'modulating' it (Rip, 2006) – seizing the trends that throw translators together.

9.1.3 Trajectory formation amidst surrounding action fields

Amidst a multitude of oscillating translation sequences headed for different directions, the interventionist may easily get lost: System innovation, as far as it extends beyond management in singular innovation journeys, may be reminiscent of the frogs that refuse to stay in the bucket. On the other hand, the interventionist may find the wide strategic

outlook empowering: Considering system innovation as evolving and co-evolving translation sequences, he can identify a multitude of footholds for *goal-oriented* (Loorbach & Kemp, 2006) modulation. This bending of ongoing co-evolution presents him with the strategic question how to position his synchronization efforts vis-à-vis spontaneous synchronization. Considering the apparent opportunity to accelerate evolution towards an altogether 'smarter' management of traffic, should he devote his energies to keeping the trajectory on course? Yet considering the mixture of synergies and interferences involved, how should he deal with the concomitant tradeoffs and tensions? And considering further how the trajectory may also pose selective pressures to its surroundings in return, what synergies and interferences could he expect on this next-order systems level of co-evolving trajectories?

Having identified the emergent translation-dynamic 'momentum' and wondering how to select upon it, the interventionist could draw a strategic map like figure 9.3(next page). Centre stage are no longer the four translation sequences, but rather the emergent trajectory as a bundled stream of system innovation achievements. Developing amidst adjacent action fields in a wider mobility system[5], the interventionist could envision various intersections between trajectories. There are always other synergies and alternative trajectories to modulate. Observing the 'smart' traffic management trajectory amidst other action fields, the interventionist could consider it highly attractive to reinforce. Its co-evolution with infrastructure supply and road pricing/demand management could yield substantial transformative impact: Critical congestion levels constituting severe systemic problems, curbing demand and providing infrastructure meeting with interferences (being too costly, too environmentally damaging or too intrusive on driving freedom), 'smart' road utilization would be the dearly needed way out. The trajectory would smartly surpass the crude infrastructural strategies[6], and contribute to the tough targets of environmental management as well - an attractive leverage point, combining considerable sustainability gains with comfortable reliance on spontaneous synchronization.

Modulating 'smart' traffic management thus appearing as a textbook example of seizing translation dynamics, the apparent absence of interferences and the moderate need for mitigation might raise the interventionist's suspicion, however: Translation-dynamically, it indicates a 'path of least interference' - the diluted kind of system innovation that is often juxtaposed as mere system *improvement*. Going back to his less aggregated strategic maps, the interventionist would then remember the trajectory to be ridden with internal interferences and tradeoffs, and observe it with different eyes. Understanding that these could be dealt with in various ways, giving rise to various scenarios, the interventionist would be warned not to be blinded by synergy. Naïve modulation of appealing synergies easily strengthening the entangled interferences as well, he would reconsider his synchronization attempts.

[5] See Ch.3 for the 'mobility system' notion, with the traffic management action field as one of its subsystems.

[6] The infrastructural alternative and its concomitant interferences was introduced in section 1.0, and also surfaced in the 80 km/h zones and 'network turn' cases. For elaborate accounts of the emergence and passing of the 'predict & provide' paradigm, see Geels (2007) and Goodwin, (1997, 2011).

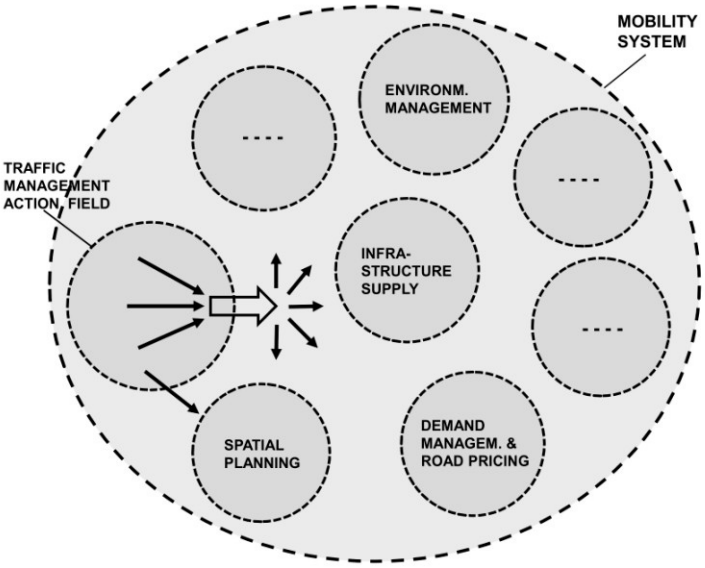

Figure 9.3
Trajectory formation and surrounding action fields

9.1.4 Intervening in an unknown and contested whole

Zooming out from the nurturing of *separate* translation sequences, the interventionist's strategic orientation has widened. Seeking to accumulate system innovation achievements by modulating trajectory formation, the interventionist comes to consider the trajectory's co-evolution with surrounding action fields as well. Envisioning ever further 'cascading' of innovation and projecting ever broader rivers of change, the interventionist has gradually ascended to a helicopter view on the 'mobility system' and its possible transition. He could sharpen his view on this clew of synergies and interferences through an abundant literature on mobility system feedbacks.

Looking down from these social-theoretical helicopters, the interventionist would see an enormous network of translators, and become aware of this super-network's emergent properties: As theorized by Urry (2004), an 'autopoietic', self-reproducing mobility system has emerged, self-propelling into ever increasing mobility needs and car–dependency. The car allows for urban sprawl and is in turn required by it (Garreau (1992), Newman & Kenworthy (1999)), and more generally it is shaped by, and shapes, a wide range of the social, spatial and technical institutions of economically advanced societies. With regard to the Dutch context, Jeekel (2011) indicates how the dependence on cars has even increased ahead of already substantial general mobility growth. Considering how a myriad of societal intersections yields a self-propelling dynamic towards 'hypermobility' (van der Stoep & Kee (1997), Adams (2005)), the interventionist would find himself confronted with an ever flowing tap of mobility, and especially car mobility. In the face of this flowing tap, congestion problems can never be solved (Goodwin (1997), Stopher (2004)). 'Draining' the infrastructure through 'smarter' traffic management could easily lower the threshold for more traffic to pour in (Topp (1995), Noland & Lem (2002)), and gradually reach the point of critical overload and network instability[7] (Traduvem, 2010): While offering temporary solace against

[7] See Ch.5. The very network vulnerability explains the effectiveness of incident management, for example.

immediate overflow, 'draining' would be likely to reinforce the overall dynamic of the 'flowing tap' and its many direct and indirect side-effects - marginalization of alternative transportation modes, environmental degradation and noise, the erosion of social ties, and the advent of ubiquitous monitoring (de Cauter (2004), Cohen (2006), Adams (2005), Jeekel (2011), Zijlstra & Avelino (2012)).

The above helicopter views indicating the serious risk of winding up in 'draining with the tap flowing'[8], the initially appealing synergies thus appear to be partial solutions at best[9]. The interventionist's synchronization efforts appearing of only marginal evolutionary significance, he may find the scope for intervention eclipsed[10]- the great leap in traffic management turning out marginal or even counterproductive on a next-order level. Because of this elusiveness of nested-system solutions, system innovation appears as the pursuit of an ever shifting horizon. Synchronization turns out to be a double-edged sword: Counting synergetic blessings, the interventionist could be happily synchronizing into new systemic problems. *How to handle this double-edged sword?*

9.2 Synchronization for system versatility

9.2.0 Synchronization and its normative implications

Translation-dynamic insight harnesses the interventionist, affording him the lenience to maneuver in a generally not like-minded environment. On the other hand, expanding the strategic orientation towards ever broader translation processes, it also reminds him to be pursuing the shifting horizon of an unknown and contested whole. His joining of forces nurturing some translation sequences and not others, it responds to several but not everybody's relevant environments. Because of this selectivity, deliberate synchronization can be considered a double-edged sword. As discussed in the introduction chapter, this selectivity gives rise to critical questions about the very ambition of system innovation. These concern the transcendentalist temptation to downplay the normative implications of goal-oriented intervention, the related 'shapeshifting' to hide the tensions between reflexivity and direction, and the risk of analysis that sides with particular attempts at systemic change. Having opened up the black box of system innovation, these issues can be confronted in concrete fashion: Investigation has brought forward several transformative efforts, and several ways to conceive of transformed, enlightened or sustainable handling of traffic.

In the following the interventionist's normative disorientation is met by considering three positions to take on synchronization: The first position is to pursue the 'quest for synergy' nevertheless. Synchronization is then primarily a means to make the system targeted less unknown and more agreed upon. This instrumentalist, order-seeking attitude tends to invite a 'transcendental temptation', however. Its drawbacks manifest as inertia on the side of dominant translators, or as ineffective 'loose talk' on the side of challengers **(9.2.1)**. By contrast, its counterpart stance of 'postmodern modesty'

[8] Or 'pseudo-solutions', as known in transition management (Rotmans, 2006).

[9] See Geels et al. (2012) for extensive discussion of the related difficulty to establish whether the 'mobility system' is in transition or not. In other action fields the system failure to be addressed may be more clear, feedbacks may be more easy to control, and intertwinement with surrounding systems may be less.

[10] See Unger (2001) and Pel (2007), addressing in more detail how such structural analysis may inform, but also paralyze, situated intervention.

emphasizes that synchronization can and should not be approached instrumentally; it should primarily serve to question trajectory formation and negotiate relevant environments. The concomitant aversion to committal choices risks to paralyze any attempts to address 'systemic' problems, however **(9.2.2)**. Considering the shortcomings of both aforementioned stances, the quest for system versatility is proposed as the most suitable way to handle synchronization. This normative orientation appreciates the ambivalences of synchronization, yet without lapsing into resignation **(9.2.3)**.

9.2.1 Synchronization as quest for synergy

The signaled ambivalence can be approached as a concomitant circumstance to intervention, to be coped with and managed. Synchronization primarily serves to forge, stabilize and adjust overlaps between system understandings and 'relevant environments'. Focusing actors onto agreed upon system pathologies, translation processes are bolstered against oscillations. Reasoning from a quest for synergy, translation dynamic insights are primarily significant as strategic *tools* to maximize transformative impacts, as 'forecast of interferences' (Luhmann, 1997): Anticipating, signaling, and responding to interferences, the potential could be realized to the full. The gathered synergy should be shielded against doubts about its systemic effects: The interventionist's challenge is to draft allies to work on his envisioned system, and jointly arrive at a system less unknown and more agreed upon. It has to be stabilized, 'closed down', to make it amenable to action (Smith & Stirling, 2007); complexity has to be reduced (Luhmann, 1995). Even when responding to differences between translators, and in that sense acknowledging diversity, this stance towards synchronization can still be considered an extension of order-seeking behavior (Teisman, 2005).

The quest for synergy implies an emphatically *goal-oriented* kind of modulation. The signaled 'smart' traffic management trajectory illustrates well how the interventionist could hook on to stabilizing system understandings, the emergent public-private system responsibility providing a synchronized 'platform' from which to reap the synergies. Radiant with synergy, the trajectory would be hard to object against, public and private translators voiced. It would forcefully seize the emerging opportunities for more sustainable mobility: Emissions reduced, reliance on infrastructure provision superseded, and current and future generations' needs for comfortable, safe and reliable travel better secured: Only a brief look on costs and benefits should persuade the hesitant translator to adhere.

Challengers seeking more radical system shifts could question whether the 'relevant environment' responded to would be broad *enough*. They could raise other systemic pressures to address, pinpoint system feedbacks neglected, and indicate the trajectory to lack punch for addressing persistent mobility problems[11]. Considering the systemic analyses on 'hypermobility' and car-dependency, they could argue it to be shortsighted to treat the running tap as 'revealed preferences' to be accommodated. Unmasking its

[11] See for example Schot & Geels (2008) and Loorbach (2007b, 1-2):*" Let us consider the mobility issue wherein measures to increase road capacity or to decrease emissions target traffic jams and automotive air pollution. Although such approaches generate incremental short-term improvements, they foster predictable mobility increases that ultimately intensify both congestion and pollution. From this perspective, sustainable development implies breaking with traditional routines and modes of thinking to overcome the inertia that limits innovation. In other words, new expressions of the same policy approaches—whether grounded in government regulations or market incentives—are unable to correct the range of problems that earlier interventions have created."*

false synergy, they would see the trajectory not so much as clever synchronization, but rather as the paradigmatic 'end of pipe' strategy: 'Everything has to change, so that everything can remain the same'[12]. System innovation efforts should dislodge such incremental 'system reproduction' pathway, Geels & Schot (2007) explain. Precisely to counter such apparent 'capture' by incumbent 'regime' actors, transition management recommends not to overrely on spontaneous synchronization, but target synchronization efforts primarily at enlightened 'frontrunners' (Rotmans (2003), Loorbach (2007a)). Less tied to dominant system understandings, these translators would be better positioned to perceive the potential for *truly* sustainable innovation. Reasoning from the root causes underlying persistent problems, they would rather ease the preoccupation with congestion abatement. Mobility management, more thorough greening of traffic, and more priority for public transport and alternative transport modes could be leading orientations (see Geels et al., 2012).

This stylized opposition sketches competing but otherwise symmetrical ways of congealing the system to be changed. Backed by their respective evidence bases and fueled by rhetoric, both quests for synergy persuade the hesitant translator that There Is No Alternative[13]. For the proponents of the 'smart road utilization' trajectory the outsiders' interventions would not be particularly welcome. Their needless politicization could easily add to the internal cleavages, and jeopardize the synchronization so painstakingly achieved. Neither would the ivory tower observations be instructive in containing acute overflow. The pleas for further greening of traffic would seem naïve 'loose talk'[14]; abstracting from network overload, unaware of the intricacies of 'complex weaving sections', and negligent of less interferential options. Moreover, to denounce the emergent trajectory as 'draining with the tap flowing' would underestimate system innovative achievements made. Without those, congestion problems could arguably have led to system break down, or have simply invited more road schemes. Proponents could hold that at least they squeezed system innovation out of limited maneuvering space. Failing to play the highly transferable 'trump' of congestion abatement, critical challengers would thus miss out on spontaneous synchronization. However enlightening their fundamental approach to the rebound effects involved, these would prove remote from translators' daily operations, and therefore hard to implement (see also van Buuren & Loorbach (2009, 389)). Effectively squandering the translation-dynamic agility, they would lack a stepping stone[15] towards the traffic 'tap'. Inversely, dismissing the criticisms as 'loose talk', the 'smart road utilization' advocates could overlook their stabilization efforts turning into inertia and 'group think' (Teisman, 2005, Scheffer & Westley, 2007). Their persistence in smart 'draining' would never receive much applause, its travel time gains remaining invisible under structural overload[16]; the traffic industry could get a bad reputation for its 'undesirable routes'; resistance against traffic externalities could resurge[17]; road pricing arrangements - lucrative for industry,

[12] This phrase became famous through de Lampedusa's novel 'Il gattopardo'.

[13] See Stirling (2009, 2011) in Chapter 1, passionately arguing to think in vectors, not scalars.

[14] See the quotation introducing Ch.2.

[15] Compare Meadowcroft (2009) in Ch.1 on carbon capture & sequestration: It could be denounced as an 'incremental', system-reproducing innovation, but at least the innovation is transferable, and as such a possible stepping stone towards more radical change. See also Loorbach (2007a) on waste management, similarly displaying the theme of draining (efficient waste management) and the tap (consumption patterns).

[16] See Ch.5 on 'GGB', area-oriented traffic management.

[17] See Ch.4: The 80 km/h zone at Overschie was partly a response to civic protest, the more radical citizens even threatening to block the A13 highway.

attractive as congestion abatement policy - might never receive the requisite societal support; and the internal struggle might continue to hamper the potential synergies. Bound to yield little more than shallow 'no regret' collaborations, their quest for synergy would also turn out disappointing in terms of their own ambitions[18].

The instrumental attitude to synchronization risks premature congealment of the system to be changed. Either seeking to shield or to mitigate the emergent trajectory's course, both challengers and 'incumbents' mount the transcendental helicopter. They could easily wind up in airspace congestion, tragically neglecting the mixture of opportunities and threats below. The respective quests for synergy delude them into mutual perceptions of 'resistance to change' – which is odd, considering their respective change ambitions. Moreover, both risk overlooking the entanglement of interferences and synergies. These drawbacks inform a more cautious attitude to synchronization: 'postmodern modesty'.

9.2.2.Synchronization as 'postmodern modesty'

The ambivalence can also be taken as a fundamental condition. The interventionist treats the 'mobility system' as an unknown and contested whole, realizing that any diagnosis of its state, problems and solutions relies on a particular decomposition of it. Further considering the unforeseeable consequences of this selectivity, he assumes a modest attitude (Cilliers, 2005)[19]. From this position, the very idea of 'goal-oriented modulation' merits suspicion: Prone to be blinded by synergy, the interventionist risks neglecting unintended consequences: Synchronization cannot and should not be approached instrumentally. As definitive system understandings will not stand the test of time and tend to represent particular ambitions and not others, translation-dynamic insight should provide sensitivity to present and future interferences - 'opening up' innovation processes instead of closing down on partial solutions (Smith & Stirling, 2007), and aiming for reflection on self-reference (Luhmann, 1995, see section 2.2). Assuming such complexity-acknowledging (Teisman, 2005) attitude, synchronization serves to question trajectory formation, negotiate relevant environments, and maintain diversity – it should serve learning rather than implementation.

Out of 'postmodern' modesty, the interventionist would approach the emergent trajectory with a reserved stance. However promising its forecasted sustainability gains, he would consider it as a particular evolutionary course amongst alternative possibilities. Whose system understandings would it respond to? Whose would be neglected? The apparent absence of interferences would arouse the interventionist's suspicion of selectivity concealed. He could come to an analysis like Hajer (1995), who took similar trajectory formation on 'smart road utilization' as typical manifestation of covert 'subpolitics'. The interventionist would see synchronization confined to government-industry networks[20], at a distance from public deliberation. He would see them downplay the ambivalences of sustainable mobility, depoliticize as a matter of 'realizinging the potential', and home in on solutions particularly 'sustainable' in terms of their own ambitions. Seeing 'too rapid alignment' (Rip, 2006) onto 'technocratic'

[18] Compare Smith (2007).

[19] The critical questions raised against transition management (section 1.3) stem from similar awareness of irreducible complexity.

[20] Chapter 7 gives concrete examples of those public-private networks – also highlighting the tough synchronization challenges involved.

understandings of sustainability, the interventionist would consider arrangements to open up the process. Aiming for synchronization including a broader range of system understandings, he could follow Koppenjan & Klijn (2004) on the importance of network composition and institutional design, or Hendriks & Grin (2007), stressing the importance of 'reflexive arrangements' amidst a sea of everyday politics. Transition management would be promising primarily for its visioning activities (Loorbach, 2007). These arrangements could help negotiate the very understanding of the 'system' to transform, stimulate reflection on the feasibility of trajectory development, and empower excluded translators to assert forgotten 'relevant environments'.

The interventionist would be equally reserved against attempts to mitigate the trajectory towards better selectivity. 'Frontrunners' could usefully stimulate reflection, but their emancipatory 'transition agendas' could easily capture the innovation process: The interventionist would not be blinded by this 'enlightened' synergy either. Being particularly attentive to the manifold of not always conspicuous interferences, he would take to heart Shared Space's historical lesson – the emancipation of vulnerable road users leading to their subjugation. Through 'productive use of interference' he would raise translators' awareness of the difficulty to articulate such interferences; once sedimented into dominant understandings and practices, they become immune to critique. The interventionist would challenge 'smart road utilization' not so much for the debatable effectiveness of 'draining'; such would narrow down the issue. He would rather focus attention onto its primary motor, the information chain, and seek to stimulate reflection on the far-reaching tentacles of this translation-dynamic octopus. Any goal-oriented modulation would reinforce its proliferation of intended and unintended consequences. The phenomena of 'undesirable routes' and 'function creep'[21] should warn enthusiastic translators against unleashing uncontrollable 'innovation cascades': They could entail *undesirable* system transformations as well (Shove & Walker, 2007).

In keeping with the many-sidedness of 'sustainable traffic management', the interventionist would initiate synchronization to keep translators' system understandings 'fluid' (Guy, 2011). Following Leydesdorff (1997), he would refrain from transient fixations of 'sustainability', emphasizing the long-term perspective implied by the term. Synchronization should first and foremost safeguard evolutionary variety, and address an ongoing stream of ever-changing interferences. Sensitive to the attendant ambivalences, the interventionist would thus shake off firm beliefs in 'system pathologies', and quests for synergies to address them. Pursued into the extreme, the modest stance thus advises against targeted attempts to achieve system innovation. The system *remaining* unknown and contested, translators are condemned to situated tinkering or distanced theorizing, however. Without reducing complexity eventually, they cannot translate the gained sensitivity into concrete actions and objects: The interventionist thus failing to guide translators through the 'twilight zone' between old and new system understandings (Teisman & Edelenbos, 2004), he would leave them trapped in a flexibility without anticipatory benefits (Rip, 2006). Translators being bound to lose interest, reflexivity will thus fade away as a passing moment (Teisman, 2005) in daily operations.

[21] For this function creep towards ubiquitous monitoring and surveillance, see Dodge & Kitchin (2007), Monahan (2007), Urry (2008).

To conclude, 'postmodern modesty' can instruct the interventionist into careful handling of the ambivalences of synchronization, but can also lead him to drop the double-edged sword altogether. Schot & Geels (2008) indicate how such overly reflexive attention to system innovation ambivalences risks 'paralysis by analysis'- disempowering, rather than informing, situated action. The challenge is then to avoid this paralysis, while remaining sensitive to the ambivalence involved, and to maintain the systemic approach while steering clear of premature congealment. These requirements can be met by aiming for system versatility.

9.2.3 Synchronization as quest for system versatility

The third position can be considered a synthesis of the previous two. As is generally agreed upon in the debate on reflexive governance, neither of the two preceding attitudes is entirely satisfactory: They form the extreme ends in the 'efficacy paradox of handling complexity' (Voß et al., 2006, 429)[22]. These extreme ends could be handled through alternating stances, by assuming an 'ambidextrous' attitude, or by striking a particular balance. The quest for system versatility opts for the latter. It does tilt towards 'postmodern modesty', as the 'transcendentalist' end of the spectrum appears as the least tenable - not only neglecting interferences, but also remaining ineffective in its own terms. Not allowing for privileged understandings of systemic failures, 'postmodern modesty' delegates normative guidance to the synchronization process itself (Leydesdorff, 1997, Rip, 2006). It may thus seem to leave a normative void, rendering 'system innovation' an empty notion. This conclusion is unwarranted, however: The system understanding of an 'unknown and contested whole' (9.1.4) did not fall from the sky; it resulted from diverse transformations (Stirling, 2011), involving a manifold of efforts to address perceived 'systemic problems'. In the light of those it would not be particularly modest to deny the existence of such problems, Latour (2004) holds: Instead of nonexistent systemic problems, there is rather a *multitude* of concerns for such problems - the question is then how to engage with these concerns, and move beyond a merely procedural approach to synchronization.

Postmodern modesty is not devoid of guidance to action. A fierce postmodern resistance speaks from Adorno's 'negative dialectics' and the later Foucault, for example. Its (meta-) criterion of evolutionary diversity militates against congealed structures that crowd out deviant translations. Determinist path dependencies, dominant designs and hegemonic convictions thus counting as 'systemic problems', they can be approached through active stimulation of diversity where it seems lost - mitigating emergent systemic imbalances, devising translation-dynamic leverage. On this less modest interpretation, the postmodern stance turns into a quest for 'system versatility' (Sartorius, 2006). A similar normative compass is advanced under social-ecological resilience (Folke, 2006, Carpenter et al., 2009), which refers not only to adaptiveness and stability, but also to the active generation of novelty; system 'vitality' (GOCS, 2011). These approaches share the active pursuit of evolutionary diversity, informed by probing system analyses. Navigating towards greater system versatility, the interventionist would use synchronization, albeit not to achieve particular impacts or unleash particular innovation cascades. Guided by this modest compass, the

[22] This paradox or dilemma roughly corresponds with the dilemmas of evolution/development, chaos/order, opening up/closing down, reflection/complexity reduction, steering in/of complexity, planning to avoid/ planning to realize, and process management/project management.

interventionist would appreciate system innovation achievements as dispersed versatility gains that possibly combine. He would see versatility increases in technological, organizational and social dimensions, all with their tendencies towards congealment as well (Pel, 2010):

First of all, he would appreciate the 80 km/h zones as ways to overcome 'infrastructural inertia' (Pel & Boons (2010), Frantzeskaki & Loorbach (2010)), making flexible use of these long-lasting constructions. Recognizing highways as literal expressions of *path*-dependency, he would see how they turned problematic through their obduracy under changing circumstances (rising traffic intensities, growing awareness of traffic-related health hazards). The section control systems would then appear as a flexibility-enhancing software layer; the *technical* dimension to versatility. Beyond this still rather rigid arrangement, dynamic speed arrangements could provide for further versatility. More generally, the interventionist would appreciate information chain development for its drastic increases in technical degrees of freedom. Either next to the road, on-board or handheld, these innovations could increase traffic management responsiveness to changing conditions, and to various goals. Yet considering the unforeseeable consequences and rapid development of this translation 'octopus', the interventionist would seek to prevent it from running out of control. Unless translated by a wide variety of actors, versatility could easily congeal into hardly reversible arrangements creating interferences in their turn.

Second, the interventionist would appreciate the 'network turn' as a means towards greater *organizational* system versatility: Boundary-crossing action and responsiveness to network interdependencies could help prevent local solutions from causing problems 'downstream'. He would appreciate this system-oriented approaches' loose associations between a wide range of problem-solving activities - forceful draining, without forgetting to address the traffic tap. The interventionist would see how the network logic helped mobilize employers and employees as crucial system 'elements', and connect traffic professionals with administrators. While stimulating various boundary-crossing actions, he would steer clear of formalization, however; this could easily reinforce the administrative sclerosis to be resolved. Monocentric 'network authorities' could easily relinquish the versatility gained (see also Termeer et al., 2010). More fundamentally, he would seek to maintain broad and flexible understandings of the network and its changing problems.

Third and finally, the interventionist would appreciate Shared Space's achievements as contributions to *social* system versatility. He would value its revelation of earlier mobility transition having congealed into a stifling structure itself: 'Colonizing' public space, the traffic safety revolution had slowly started to condemn citizens into passivity – sometimes resenting overregulation and uneasy with the loss of the human standard, but hardly able to articulate alternative ways of sharing space. He would be especially struck by this de-activation and the attendant imaginative void. The immediate effects of particular designs would not be his primary concern; these might not stand the test of time. More fundamentally, preoccupation with design would distract from addressing the 'systemic failure' of traffic being organized for, rather than by, its participants.

Aiming for overall versatility, the interventionist would further seek to maintain versatility across dimensions. His synchronization efforts would then typically address translators involved with different dimensions, countering the risk of versatility gains congealing again. In other words, he would seek to *forge intersections* to develop

unexpected synergies – a strategy closely related to the 'coupling of arenas' (Koppenjan & Klijn, 2004). Translators could be entrepreneurs developing new information services, traffic professionals redefining their roles in traffic order, vulnerable road users and Shared Space visionaries, public servants 'switching hats', 'mobility brokers', public transport operators, employers, citizens on and and next to the road, enforcement officers experimenting with monitoring techniques, traffic light programmers knowing how to maintain versatility, and administrators, discovering that traffic management is no mere technical exercise.

9.3 System innovation as synchronization

9.3.0 Intervention in innovation evolution

System innovation involves intervention in the evolution of innovation attempts. Critics having warned not to neglect the attendant ambivalences, the 'immanent approach' has opened the black box of system innovation. Starting from careful recording of two-way innovation traffic and progressively developing more generic translation dynamics, a conceptual framework has been produced through which to *understand* and to *handle* system system innovation in the making. Ultimately relying on synchronization in an unknown and contested whole, solutions are unstable, however; synchronization is a two-edged sword **(9.1)**. Seeking to appreciate the system innovation challenge in its full complexity, the next step was therefore to reflect upon its normative implications: As shown concretely, different normative stances suggest different responses to the signaled trajectory formation. As synchronization is better not deployed with too much or too little sense of direction, an orientation towards system versatility has been argued to be the most appropriate (i.e. the most in line with the adopted two-way approach to system innovation) **(9.2)**. In the following the guidelines for intervention are presented, and discussed as contributions to the ongoing system innovation debate. This also involves formulating recommendations for further research. The synchronization strategy consists of five elements: The cultivation of transferability **(9.3.1)**, interference management **(9.3.2)**, synchronization **(9.3.3)** and management of oscillations **(9.3.4)** are practical implications of the developed translation-dynamic insights. The proposed orientation on system versatility, added to mediate between insight and action, is the fifth element **(9.3.5)**.

9.3.1 Cultivating Transferability & Shapelessness

Taking to heart the developed translation-dynamic insights, the interventionist should realize first and foremost the tentative nature of innovation. His innovation will 'diffuse' neither for its sheer intrinsic value, nor for his good intentions. Instead, it needs to be meaningful and useful to recipient actors in order to be adopted, supported or developed further. The pervasiveness of 'interferences' only underlines this; innovation is easily received as disturbance. Other than trusting naively in the attempted innovation's intrinsic strengths, the interventionist should be minding its *transferability*.

The transferability of an innovation attempt resides on the one hand in its malleable character, which allows it to be embraced in different quarters, and modified in various ways. On the other hand its transfer through a diverse environment is also enhanced if it manages to avoid interferences – as the cases show, this can occur either with translators, between them, or even with the initiators' own organization. Transferability

is, other than the aptitude to meet a certain societal challenge, a chameleonic quality. It responds to the difficulty of surviving in a potentially hostile environment. Reinstating the age-old strategic principle of 'shapelessness', it indicates the need for innovation attempts to immunize against threats by moving along with their surroundings. The case studies show concretely how transferability is not a static quality: It is not possessed forever, but needs to be developed, maintained and exerted through sustained self-translations. This cultivation of transferability can involve reinvention and 'branding' of concepts, redesign and remedial measures, or renegotiation of action plans. Like the ice-rubbing efforts of curling players, it reduces the friction ahead -facilitating the 'flow through the network', as Latour expressed it.

The observed importance of transferability confirms insights from both the sociology of translation and the theory of self-referential systems; innovation needs to be interesting and *relevant* to recipient actors and systems. It helps articulate the workable substance of 'adaptive networks' (Nooteboom, 2006), maneuvering in the shadow of power, and of the 'organic' innovations indicated by Goldman & Gorham (2006): A multitude of these inconspicuous ventures could outperform the grand yet vulnerable attempts. Transferability also coincides with the rationale behind Strategic Niche Management, taking the unfavorable selection environment as central challenge to radical innovation (Kemp et al., 1998). Yet as a complement to these studies into innovative niches' survival, 'gelling together' (Schot & Geels, 2007) and ascendance to regime formation (Geels, 2010, see Ch.2), transferability elicits the directionality (Stirling, 2009, 2011) of 'system innovation in the making'. Its pertinence to system innovation research and practice resides in highlighting the various 'domestications' of novelty[23]. When aiming to diffuse, roll out or 'mainstream' innovation, hybridization may seem anomalous, yet the studied cases suggest it is to be expected: Similar to the observations of Smith (2007), some innovative elements prove more transferable than others; miscellaneous sets of practices emerge, bearing the marks of both initiator and translators. The case studies and their translation-dynamic commonalities unpack how to play into hybridization, or even to use it in a self-translation strategy (see also Raven, 2006).

The observed importance of transferability reinstates what is easily forgotten when reasoning from a need for systemic transformation: The circumstance of innovating in a polycentric society. It suggests innovators and analysts to reason not only from the systemically desirable, but also from the translation-dynamically possible – the question why translators would bother to join in (section 2.1). In this regard it is worthwhile to investigate further the 'transition experiment' repertoire of deliberate variation and diffusion (Kemp & van den Bosch (2006), van den Bosch (2010)): Societal experimentation can be 'deepened' to maximize situated learning, 'broadened' to other contexts, and 'scaled up' to turn deviant into mainstream practices. As a systematic approach to finding out what works where, and how, the repertoire offers excellent possibilities to deepen the understanding and anticipation of hybridization. As yet its sensitivity to context and diversity is overshadowed by the focus on aggregation and diffusion, however. For further research it can therefore be recommended to combine this systemic experimentation with more differentiated translations analysis – be it through the translations categories applied and developed in this study, or through others. More generally, system innovation research would benefit from a lessened

[23] Compare (STRN, 2010, 17): *"How are new technologies/attitudes/values/ideas incorporated or 'domesticated' into existing routines and systems of practice?"*

preoccupation with evolutionary survival and death, and greater attention to directionality. This could be done through targeted investigations into ambiguous system innovation achievements[24].

9.3.2 Interference management

The interventionist needs to be aware that cultivating transferability is important, but not sufficient. Sheer maximization of transferability will yield not only shapeless, but also *toothless* innovation attempts. Beyond mere avoidance of interference, system innovation achievement depends on how it is resolved, coped with, or even cultivated. The 'productive use of interference', 'capture', 'dilution dilemma' and 'self-interference' each eliciting aspects of this interference management, the case studies provide concrete manifestations.

The interventionist should take specific notice of the counterintuitive dynamics of 'self-interference' and 'productive use of interference': System innovation achievement can very well be served by *seeking* disturbance, raising the reflective question of what disturbs what. Especially when appealing to common sense, translators can be persuaded into accepting such reversal-of-logic. That interference-seeking tends to confer disturbance onto the initiators' own organization is the other side of the coin; the cliché 'no pain, no gain' does apply here, and the attendant self-interference needs to be coped with. Beyond the understanding that interference not always needs to be avoided, another instructive observation is that it *cannot* always be avoided either: As an immediate consequence of transferability, modifications and hybrids come into being that can themselves evoke interferences: The easily transferable is prone to be 'captured' in not always satisfactory ways. In this regard the 'dilution dilemma' expresses how interference-avoidance needs to be balanced with the wish to achieve more than shallow innovation. Diluted through concessions, the attempted innovation could end up like a meteorite, hitting earth eventually as relatively innocuous pebbles.

The observed importance of interference management is a typical yield from the 'immanent' approach taken. It confirms the relevance of Luhmann's sobering view on system innovation: Actors and institutions are bound to receive innovation attempts as meaningless 'noise', or even as disturbance. Idealistic calls for 'out of the box thinking' tend to forget why these self-referential 'boxes' have emerged in the first place; as ways to cope with complexity (Luhmann (1995), Scheffer & Westley (2007)). The observed normality of interference adds to the discussed studies into system innovation 'in the making', confirming these processes to be contested and political (Voß et al (2009), Meadowcroft (2009), Avelino (2009, 2011), Kern & Howlett (2009)), played out through, rather than in the shadow of, power. 'Interference management' helps unpack these contested processes, affording concrete understanding of what it means to engage in 'constructive disequilibrium' (Rip, 2006). Having treated interference as two-way traffic, interference management enriches conventional understandings of system innovation tensions: First, it warns how the very perceptions of 'resistance' and 'barriers' to change can thwart quests for synergy by failing to respond to receivers' system understandings and ambitions. The inadequacy of such unidirectional framings has also been pinpointed in organizational change literature (Diamond (1986), Waddell & Sohal (1998), Piderit (2000), Ford et al., (2002)). Second, interference management

[24] Cases featuring 'rebound effects' will be particularly interesting, but it is also a matter of applying analytical frameworks that allow the ambiguity to surface in the first place.

helps to deal with the dilemmas of system innovation in the making. These have been addressed in insufficiently practical terms hitherto (de Bruijne et al., 2010). Comprising both interference avoidance and the inverse 'productive use of interference', it approaches the 'dilution dilemma' as integral to system innovation. The diluting domestication of novelty is receiving much criticism as 'incremental' system reproduction (Geels & Schot, 2007), 'capture' by incumbent actors (Kern, 2010, Avelino, 2011), or simplified and selective appropriation (Heiskanen et al., 2009). Yet as also stressed by Smith (2007), a bidirectional approach to this 'absorption of deviance' also acknowledges that the relatively shallow translations are at least likely to survive. At least engaging translators and preventing the translation sequence from running dry, it then remains to be seen how they co-evolve with other changes, and whether they could be evolutionary stepping stones (Meadowcroft, 2009) towards broader transformations: Translators may eventually turn out to have 'captured' a Trojan horse.

Interference management highlights that interference affects system innovation achievement *in various ways*; it is not a clear-cut inhibiting factor or 'mechanism', nor is it a phenomenon only occurring between dominant and dominated actors. The various empirical faces of interference suggest the fruitfulness of further bidirectional analyses, so as to enrich the understanding of 'resistance' and 'barriers' to change. In this regard it will be particularly promising to address the 'evolutionary bases of rigidity' i.e. the grounds for inertia and self-reference (Scheffer & Westley, 2007, Miller, 1993). This would elicit the related scope for innovation to 'slot in' with stable structures and mindsets. As regards the 'functionality' of interference, a salient research topic would be the relation between interference seeking and systemic 'backlash'. Especially the politicized debate over the 80 km/h zones points out the risks of playing with interference: It offers the chance to politicize, mobilize, and articulate systemic problems, but can also evoke resentment. Such *counter*productive interference (frustrated drivers, for example) eroding translators' support for system innovation, it could trigger an evolutionary backlash. This evolutionary dilemma featured implicitly in Rotmans (2003), indicating the importance of high-risk experimentation on the one hand, and the risk of 'backlash' on the other. Detailed investigations into interference-seeking are promising: They could inform system innovation strategies targeting not only the enlightened 'frontrunners', but also the 'peloton' and especially the 'laggards' interfered with.

9.3.3 Synchronization of uncontrolled transferability

The interventionist should realize that beyond the cultivation of transferability and management of interference, the attunement between translations is essential: The translators are at least as important as the initiators. The more prolific translation sequences typically displayed synchronization between their various 'segments' - reducing or resolving interferences between translators, preventing the innovation process from lapsing into fragmentation, and enhancing sustained translation. Synchronization is especially promising when cast in a growth model, to anticipate self-propelling and assembled translation.

The observed importance of synchronization underlines that system innovation is a *collective* attainment. These broad and organization-transcending innovation processes are not only about the production of novelty, but at least as much about assembly,

coordination and negotiation. System innovation resulting from evolving and co-evolving translation sequences, it can only partly be controlled: The innovative seeds may blossom or die out, but they can breed rampant or even carnivorous species too - this speaks from the 'alien' modifications so embarrassing to initiators. High transferability poses serious synchronization challenges, the 'function creep' in the information chain exemplifies. Similarly, the tragic pattern of 'backfiring replication' shows how planned rollout can be thwarted by unexpected evolutionary dynamics. Furthermore, interferences between translators prove hardly exceptional. Especially once politicized they can reverberate through the sequence as a whole; hence the Shared Space protagonists' turn to synchronization on sharing space. The synchronized translations of the network logic and the incessant attempts to weld a coherent information chain are exemplar cases: Through sustained synchronization the various modifications were assembled, instead of yielding a cacophony of translations. More than nurturing particular innovation attempts, the guidance of system innovation is chiefly a matter of minding the subsequent translation processes of renewed attempts, translators' attempts to bend innovation their ways, and the ensuing emergent dynamics.

In a society in which network connectivity and mutual updating is all-important, the importance of synchronization may seem underwhelming news. As a translation-dynamic concept its meaning is more specific, however. It indicates the challenge to coordinate and attune a multiplicity of *diverse* and not always compatible translations, which is essentially more complicated than the mechanical clockwork-metaphor may suggest. This is why Star & Griesemer (1989) raised the importance of mediating 'boundary objects', and why Kern & Howlett (2009) suggested the emergent incoherence in 'transitioning' attempts to require considerable fine-tuning. Leydesdorff (1997) and Rammert (2000) indicated similarly how the multitude of translations by systems 'ticking at their own frequencies' would yield synchronization challenges on a next-order systems level: Uncoordinated yet simultaneous translations could easily co-evolve into problematic incoherence. In this regard Teisman et al. (2009) specify how the co-evolution of interconnected but self-organized steering attempts tends to produce erratically developing governance processes. More important than confirming its theorized importance, this study has offered detailed accounts of the expected complexity: Synchronization comes to life through actors' various encounters with the evolution and co-evolution of translation sequences, and their strategies through which to coordinate nevertheless.

The importance of synchronization upsets common beliefs about 'niche' innovations needing to fight their way into the dominant rules of the 'regime' (Berkhout et al., 2004). Translators, dispersed over a variety of 'transition contexts', come in shades of grey: Were the information service providers niche players upsetting the traffic management regime, or were they regime players, following and reinforcing the preoccupation with congestion abatement? More than assisting the marginal player to diffuse radical innovations and anticipate the system-reproductive actions of dominant players, it is thus essential to intervene in the interplay between diverse translators (see also Smith (2007), van der Brugge (2009), Dijk (2010) for similar observations). This can involve mild dilution of radical attempts or radicalization of the shallow ones - synchronization involves both. In response to Geels (2010), the observed importance of synchronization confirms that translation analysis is of limited pertinence to system innovation as long as it focuses on local processes of stabilization. Beyond the 'micro' attention to situated translations, translations analysis can very well be tailored to system

innovation research, however. As regards the desired micro-macro linkage, it can be recommended to direct translations analysis towards widely branched innovation processes, and investigate larger-scale synchronization processes. Another suggestion for empirical research would be to investigate different forms of synchronization, and develop systematic knowledge in the form of a synchronization typology. Apart from the empirical strategies, synchronization could also be researched formally along the lines of Leydesdorff (2010), modeling translation dynamics in relation to higher-order discourse formation. Shifting emphasis in the division of labor between the theory of self-referential systems and translations analysis, system innovation can be researched on various levels of meaning construction.

9.3.4 Managing oscillations

The interventionist should take into account that translations occur under changing circumstances: Translators often shift between more and less affirmative translations, and interferences may disappear and resurge. Under these pervasive oscillations, synchronization is of only transient effect. Amidst mutual interference and fragmentation, system transformative trajectories can still emerge, however, through either spontaneous or deliberate synchronization. The management of oscillations consists in understanding and responding to the sources of oscillation, and in seizing spontaneous synchronization to realize synergies.

The interventionist attempting to manage oscillations should realize that translators, beside their engagements with a particular innovation, are occupied with a range of other issues too. Translators respond not so much to 'environmental pressures' as observed from a helicopter, but rather to changes relevant to *them*. These could stem from their own translation sequence, from other translation sequences, and from their wider environments. Considering the general lack of overlap between translators' 'relevant environments', it becomes more understandable why translation sequences 'oscillate' between interference and affirmative translation. These shifts better not be mistaken for incidental hiccups; they are inherent to translators' immersion in co-evolution. Because of translators' only partly overlapping 'relevant environments', deliberate synchronization offers only transient anchors. In order to achieve synergetic co-evolution and coherence rather than mutual interferences and fragmentation, the interventionist will therefore have to ensure that translations *remain* synchronized, in spite of oscillations: He should consider whether targeted translation sequences evolve as unstructured translation 'clouds' or as intertwined subsequences, but also observe their parts in broader co-evolutionary processes. Observing translators' divergent and convergent responses to their respective relevant environments, the interventionist could then decide on synchronization efforts to reinforce, mitigate, or reconsider ongoing trajectory formation.

The observed importance of managing oscillations indicates the added value of intersections analysis. The emergent properties of compounded systems being well-known, this analysis elicits their implications for situated actors who seek to change these systems. Particularly salient is the observed mixture of interferential and synergetic co-evolution. Adding nuance to mechanistic assessments of 'system feedbacks', it shows concretely why the 'transcendental temptation' in management and analysis of system innovation is that unfortunate. The observed intertwinement of intereferences and synergies underlines recent calls to mind the directionality and

plurality of system innovation (Stirling, 2009, 2011), and to take complexity seriously (Vasileiadou & Safarzynska, 2010).

Intersections analysis fruitfully unearthing the evolutionary mixture of coherence and fragmentation, Schot & Geels' (2008) suggestion to study multiple and interacting 'innovation journeys' can be wholeheartedly recommended for further research. As also indicated by Byrne (2005), nested-case research designs are attractive in allowing the complexity of compounded systems to surface. This study gives several indications for methodological alternatives and improvements: Depth could be increased by zooming in onto the intertwinements within translation sequences (the information chain 'octopus', for example), or onto the multiple intersections between adjacent translation sequences. Width could be enhanced as well, even when it would generally detract from fine-grained empirical analysis. The idea to study intersections can be acted upon through various case demarcations – figure 3.1 offers a basic diagram for fine-tuned case designs. Such 'intersections research' could yield a more systematic understanding of the sources of oscillation, and the ways interventionists could deal with those. With regard to translators' fluctuating receptiveness to novelty, Callon (1998) made the useful distinction between 'hot' and 'cold' situations: 'Hot' situations involving greater controversy and ambiguity, synchronization will be more fragile and all the more needed. Regarding the 'temperature changes' affecting translations, the notion of 'process systems' is promising (Teisman et al., 2009, Pel et al., 2012). Singling out populations of translators with partly overlapping relevant environments, it describes translations under changing states of inertia, chaos, dynamism, and stability. Awareness of these system shifts could help interventionists to synchronize with a sense of timing.

9.3.5 Synchronizing for system versatility

Above the cultivation of transferability and interference management, synchronization is the central element for immanent guidance of system innovation. As it provides only transient anchors against pervasive oscillation, the interventionist is advised to 'surf' translation-dynamic waves rather than swim against the current: Seizing spontaneous synchronization makes strategies for systemic leverage more robust. However comforting this perspective on joining of forces, the interventionist should also take to heart its less reassuring implication: Nurturing some translation sequences and not others, responding to several but not all 'relevant environments', deliberate synchronization is a double-edged sword that can both alleviate and reinforce systemic problems. As discussed in sections 9.1 and 9.2, it is handled best when aiming for system versatility.

Different normative stances lead to different deployments of the strategic elements discussed thusfar. Out of a quest for synergy, the signaled ambivalence is a concomitant complication, to be coped with and resolved. Synchronization is then instrumental to making the system targeted less unknown and more agreed upon. This attitude easily loses the translation-sensitive lenience, however. Blinded by synergy and insufficiently flexible in his system understanding, the interventionist will miss out on synergies, and neglect interferences. To the second position of 'postmodern modesty', by contrast, the signaled ambivalence is fundamental. Synchronization serves to question trajectory formation, negotiate system understandings, and maintain evolutionary diversity. This attitude sensitizes towards the typical mixture of synergies and interferences, and to the real possibility of synchronizing into undesirable trajectories. Excessive modesty stifles

action, however. Leaving the interventionist without clear systemic problems to target, he will fail to engage translators. The third stance, the quest for system versatility, is the most appropriate. It tilts towards postmodern modesty, yet without resigning into distanced and insufficiently transferable embrace of diversity. This active pursuit of diversity amounts to forging intersections between translation sequences, maintaining diversity, and helping to develop unexpected synergies.

The compass of 'system versatility' marks a synthesis in the longstanding dilemma between direction and reflexivity. This study shows how the dilemma plays out concretely, and how different stances towards ambivalence yield different 'cross-sections of co-evolution' (Rip, 2006, 92) that either focus on synergies to pursue, or on interferences to avoid. Having considered different normative positions, it can be felt why system innovation in the making involves 'shapeshifting' between transcendentalist objectification and polycentric commitments (Shove & Walker, 2008, see Ch.1). Not excessively modest[25], the orientation towards system versatility reflects that shapeshifting has to be dealt with - over and over again. This ambivalence is well acknowledged in transition management thinking, but easily gets lost in practice: The instrumental, transcendentalist elements of transition management appear to be more transferable than its reflexivity (Heiskanen et al., 2009, see also Bruggink, 2009 and Avelino, 2011 on transition management in the Dutch mobility sector). Also the efforts for more 'sustainable' traffic management show how perceived synergies are hard to withstand, and blind the interventionist to the entangled interferences. Against the sirens' song of synergies, the interventionist better tie himself to the mast: It is recommended to relax strong claims about 'systemic failures' and 'pseudo-solutions', and refrain from rigid 'transition agendas' and overarching sustainability visions. Instead vision*ing* should be reinvigorated as a crucial transition management activity, to develop the multiple-source visions intended to be generated in 'transition arenas' (Berkhout, 2006). The notion of the 'system failure' would then be used more reflexively, igniting rather than channeling translators' innovative capacities. Critical Systems Thinking (Ulrich, 1983, 2003), (Pel & Boons, 2010), (Pel, 2012)) seems promising to turn this notion into a powerful boundary concept. Similarly, critical theory could be given a new life beyond ranting about monolithically understood Systems (Adorno & Horkheimer (1946), (Luhmann, 2002)).

The aim for versatility thus stresses that the 'system' in 'system innovation' is a composite to be unraveled. The introductory metaphor to this chapter can now be explained. Intervention in intertwined networks is often described as 'playing simultaneous chess games'. Considering the manifold of translation sequences to synchronize, it is certainly an elegant description. Yet with regard to the pursuit of system innovation and its shifting horizon, the game of Go offers a more appropriate metaphor. It is in principle a boundless game. Just like synchronization efforts, the space-gaining enclosures are always transient feats. They can be enclosed in their turn. The challenge is to handle this shifting horizon, and connect the parallel battles in the corners.

[25] As expressed especially through the 'productive use of interference', aiming for system innovation requires the art of not *too* gentle modulation of co-evolution – to paraphrase Gerrits (2008).

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Samenvatting

Naarmate de maatschappij zich ontwikkelt en de mogelijkheden om menselijke behoeftes te bevredigen toenemen, wordt ook de keerzijde van ontwikkeling duidelijk. Die uit zich vooral in toegenomen afhankelijkheden tussen allerlei processen van behoeftebevrediging, groeiende coördinatieproblemen en ongewenste neveneffecten.

Dit inzicht bestond al in de jaren '30 van de vorige eeuw. Toenmalige wetenschappers meenden dat zonder doordachte interventie in haar structurele 'weeffouten' de maatschappelijke ontwikkeling in chaos zou eindigen. Orde en Vooruitgang werd het devies om de maatschappij van zijn irrationele en gevaarlijke tendensen te redden. De opbrengsten van die wetenschappelijk veiliggestelde vooruitgang, planning, zijn in de naoorlogse decennia van de vorige eeuw echter tegengevallen. De samenleving van toegenomen afhankelijkheden riep wel coördinatieproblemen op, maar frustreerde tegelijkertijd de planmatige coördinatie die deze problemen zou moeten oplossen. De maatschappelijke ontwikkeling bleek niet voorspelbaar, planbaar en 'maakbaar'.

Tegelijkertijd kunnen velen niet berusten in de niet-maakbaarheid van de samenleving. Het bewustzijn van haar kwetsbaarheid blijft ook onverminderd groot; de groeiende erkenning van vele urgente milieuproblemen heeft die hernieuwd onder de aandacht gebracht. Daarbij is het besef gegroeid van de tragiek van sturing, namelijk dat deels daaruit nieuwe problemen kunnen voortvloeien. Er zijn vele voorbeelden van deze tragische omslag, waarin oplossingen tot problemen worden: De vernuftig ontworpen woonwijken van de vorige eeuw die probleemwijken van nu werden, de rationalisatie van de landbouw die op het tweede gezicht veel minder rationeel bleek, en de vrijheid die de auto bood maar stilaan ook tot een autoafhankelijke maatschappij leidde. Een nieuwe generatie wetenschappers buigt zich over dit vraagstuk van 'systemische' problemen en het ontwikkelen van passende oplossingsstrategieën. Het Kennisprogramma voor Systeeminnovaties en Transities (KSI) waar dit onderzoek deel van uitmaakte is daarvan een voorbeeld. De onderzochte persistente problemen zijn diepgeworteld in de samenleving, en ze overschrijden de grenzen van functionele subsystemen en schalen van overheidshandelen. Ondanks de vele inspanningen en besluitvormingsprocessen in de subsystemen blijven de problemen echter terugkeren. De vermeende oplossingen blijken achteraf regelmatig het symptoom te bestrijden, zonder de wortels te raken. Het kernidee achter voornoemd kennisprogramma is dan ook dat de systeemproblemen een overeenkomstig systemische aanpak vergen: Systeeminnovaties, als typisch organisatieoverstijgende maatschappelijke innovaties, en transities, als uit meerdere systeeminnovaties voortkomende structurele maatschappelijke omwentelingen. Die transformaties kunnen systemen als mobiliteit, energievoorziening, landbouw en gezondheidszorg een duurzaam karakter verlenen.

Inzichten uit de geschiedkunde, sociologie, complexiteitstheorie, evolutionaire economie, innovatietheorie en de bestuurskunde hebben geleid tot een zich ontwikkelende theorie over de dynamiek van maatschappelijke transities en systeeminnovaties, en tot 'transitiemanagement' als daardoor geïnformeerd handelingsrepertoire voor doelbewuste interventies. Hiermee is een geraffineerde historische synthese ontwikkeld, die enerzijds de gebleken moeilijkheden van planning in een gedifferentieerde samenleving erkent, en anderzijds blijft streven naar een holistische, systemische aanpak van systemische problemen.

Toch heeft ook deze nieuwe benadering van systemische problemen kritische vragen opgeroepen. Wil de theorie over en praktijk van transitiemanagement niet opnieuw, net als de eerdere planningsbenaderingen, het onmogelijke verenigen: Enerzijds de erkenning van niet-maakbaarheid en de fundamentele omstredenheid van maatschappelijke innovatie, anderzijds de niet geringe ambitie om systeemfouten en ingeslagen paden middels een brede en lange-termijn georiënteerde strategie gericht bij te buigen. Sociaalwetenschappelijke critici hebben er al op gewezen dat de ontwikkelde kennis over transitiedynamiek en het evolutionaire perspectief op maatschappelijke verandering weliswaar helpen om overspannen maakbaarheidambities te bezweren, maar dat zelfs dit verlichte perspectief de haken en ogen van systeeminnovatie nog onvoldoende onderkent. Enerzijds zijn er de kritieken op het transitietheoretische 'vogelvluchtperspectief' op systeemfouten en maatschappelijke evolutie, die aangeven hoe dit de diversiteit aan perspectieven en ambities van gesitueerd handelende actoren dreigt te miskennen. In een netwerkmaatschappij is de identificatie van 'systeemfouten' omstreden, benadrukken deze kritieken: De theorie over transities erkent dit wel, maar wil zich ook niet neerleggen bij de gedachte dat systeemproblemen louter 'subjectief' van aard zouden zijn. Naast de meer theoretische kritieken, die soms blijven steken in abstracte kritiek vanaf de zijlijn, zijn er echter ook belangwekkende recente inzichten over 'systeeminnovatie in actie'. Deze brengen naar voren dat de praktijk van systeeminnovatie bepaald weerbarstig is, en dat bij het inbedden van die transformerende initiatieven weer blijkt hoezeer actoren er verschillende systeembegrippen op na houden.

Dit proefschrift adresseert de gesignaleerde spanningen van systeeminnovatie. Het richt zich vooral op de thematiek van het 'inbedden'; de vraag hoe innovatie- en transitiepogingen in de praktijk worden ingezet door enkelen, vanuit een eigen opvatting over wat het systeemprobleem is dat oplossing verdient, en hoe deze inzet in wisselwerking met reacties vanuit andere opvattingen daarover evolueert. Het onderzoeksdoel is om een empirisch geïnformeerde theorie te ontwikkelen die de spanning, als 'transcendente verleiding' ingebakken in de ambitie tot systeeminnovatie, zowel inzichtelijker als hanteerbaarder maakt. De gekozen 'immanente' benadering zoekt de in dit onderzoeksveld nog weinig onderzochte spanning op tussen innovatie als poging en innovatie als resultaat in een groter systeem. Voortbouwend op het inzicht dat het overbrengen van systeeminnovatie geen 'eenrichtingsverkeer' is (Voß et al., 2009), wordt daarbij een open benadering gevolgd, waarbij de onderzoeker er voor waakt niet stilaan het perspectief van de innovatie-'zender' aan te nemen. De 'zwarte doos' van systeeminnovatie wordt geopend vanuit ontvankelijkheid voor de diverse ambities en systeembegrippen van betrokkenen, zoals aanbevolen door Stirling (2009, 2011). Gezien de ambitie om de gesignaleerde spanningen kritisch te analyseren maar wel handelingsperspectief te bieden, zullen de gewonnen inzichten uit de geopende 'zwarte doos' bewerkt worden tot een strategisch repertoire. De centrale onderzoeksvraag is dan ook tweeledig:

Hoe kunnen innovatiepogingen tot systeeminnovaties evolueren, en hoe kunnen in de betreffende systemen handelende actoren in dat evolutieproces interveniëren?

De vragen drukken al uit dat naar empirisch geïnformeerde antwoorden wordt gezocht. Met erkenning van de beperkingen van een transcendent perspectief op innovatie-evolutie, ontwikkelt hoofdstuk twee een bruikbaar immanent perspectief; een

theoretische benadering die helpt systeeminnovatie als tweerichtingsverkeer te analyseren.

Een belangrijke theoretische bijdrage daaraan is geleverd door de socioloog Niklas Luhmann. Met zijn theorie van 'zelfreferentiële' systemen biedt hij een conceptueel raamwerk dat helpt om de spanning in innovatie-evolutie 'van binnenuit' te begrijpen. Uitgangspunt daarin is de complexiteit van de maatschappij, en de noodzaak tot complexiteitsreductie om die hanteerbaar te maken. Te midden van alle elementen van de wereld is het onmogelijk ze allemaal, in al hun onderlinge relaties, in acht te nemen: Complexiteitsreductie, selectieve waarneming, is noodzakelijk. Uit complexiteitsreducerende 'relevant'/ 'irrelevant' onderscheidingen vormen zich dan sociale betekenissystemen, die deze hanteren als onderscheidingen tussen 'systeem' en 'omgeving'. Zo onstaat een zelfreferentiële verhouding tot de omgeving; deze is slechts betekenisvol onder voortdurende betrekking op het eigen betekenissysteem. Selectief kanaliseren van informatie uit de omgeving maakt systemen tegelijkertijd open en gesloten; gesloten in het selectieve waarnemen, maar door de daarmee verworven stabiliteit juist weer open voor de signalen van de omgeving. De complexiteit van een veranderende omgeving zet zelfreferentiële systemen dus enerzijds aan tot het ontwikkelen van een stabiele betekenisgevingsstructuur, en anderzijds tot het voortdurend raffineren van die structuur – dat wil zeggen, tot innoveren.

Deze even eenvoudige als abstracte theorie maakt het begrijpelijk waarom van innovatie*pogingen* wordt gesproken. Initiatieven tot systeeminnovatie worden ondernomen vanuit, en worden ontvangen door, selectieve betekenissystemen. Vanwege verschillen in selecteren is een zinvolle innovatiepoging voor de één dus niet noodzakelijkerwijs zinvol voor de ander; innoveren is altijd een poging om verschillen in betekenisgeving te overwinnen. De theorie biedt zo een spanningsvolle, tweezijdige kijk op innovatie. Enerzijds wordt begrijpelijk hoe innovatiepogingen worden ontvangen als verstoring van het streven naar stabiliteit en complexiteitsreductie. Anderzijds blijft het begrijpelijk hoe innovatie toch mogelijk is - de betekenissystemen moeten zich voortdurend vernieuwen om de veranderende omgeving bij te houden. Vanuit de 'dynamische instabiliteit' van zelfreferentiële systemen kunnen drie basispatronen worden onderscheiden als globale verwachtingen over innovatiepogingen: 1. Eigenstandige systeemdifferentiatie, als permanent proces van vernieuwend onderhoud; 2. 'Ruis' en 'resonantie', waarbij de zelfreferentieel gekanaliseerde innovatiepoging van buiten als irrelevante ruis zal worden genegeerd, of juist als relevant signaal bewerkt en verspreid; 3. Reflectie, waarbij een betekenissysteem wordt gedwongen zich op zijn betekenisgevingsstructuur te bezinnen. Belangrijker nog dan de afzonderlijke patronen is hun wisselwerking: Aangezien de veranderingen in het ene systeem als relevante veranderingen in de omgeving van het andere kunnen optreden, kunnen hele series van veranderingen ontstaan. De betekenissystemen co-evolueren, met emergente uitkomsten. Zo bezien is systeeminnovatie een mogelijke, moeilijk voorspelbare en niet zeer waarschijnlijke uitkomst van innovatieprocessen. En aangezien de afzonderlijke veranderingen voortkomen uit selectieve waarneming, – en dus niet vanuit een 'transcendente' kijk op objectieve fouten en vereisten van het overkoepelende maatschappelijke systeem -, zijn de 'filterende' processen van zelfreferentiële systemen cruciale aandachtspunten voor empirisch onderzoek.

Luhmann's kader biedt een eerste theoretische plaatsbepaling. De patronen van zelfreferentiële innovatie bieden solide 'bouwstenen', maar roepen in hun abstractie ook

empirische vragen op. Ze bieden een ruw idee van hoe innovatiepogingen tot systeeminnovatie kunnen evolueren, maar wat typisch buiten beeld blijft, is het concrete handelen in en bijsturen van die evolutie door actoren. De aanwijzing daarvoor is dat actoren de juiste snaar moeten zien te raken bij de betekenissystemen die ze willen meekrijgen in hun innovatie, en deze te laten 'resoneren'. Deze fysische metaforen verraden echter een mechanische, afstandelijke zienswijze: Ook Luhmann's 'immanente' theorie stijgt ongemerkt weer op tot vogelvluchtperspectief.

Met de theorie van zelfreferentiële systemen als voorlopige plaatsbepaling kan dan het immanente theoretisch kader gericht aangescherpt worden. Het zelfreferentiële 'filteren', hoe ziet dat er uit in termen van het handelen van actoren? Hoe hun gesitueerde ingrijpen in de innovatie-evolutie in beeld te krijgen? Op dit punt zijn innovatiesociologische inzichten van grote waarde. Specifieker gaat het om de notie van 'translaties', zoals ontwikkeld bij het Franse Centre de Sociologie de l' Innovation. Net als het voornoemde 'filteren', geeft dit begrip aan hoe innovatiepogingen in een diverse maatschappij niet zozeer worden geaccepteerd of verworpen, maar vooral ook op uiteenlopende wijzen worden *vertaald* door ontvangers. In dit geval heeft 'vertalen' een bredere dan slechts talige strekking. Het gaat ook om het bewerken van een innovatie, of het er naar handelen. In vele gevalsstudies naar innovatieprocessen is met de 'translatiesociologie' beschreven hoe de initiatiefnemers van een innovatiepoging beoogde gebruikers, ondanks verschillen, toch voor hun project proberen te winnen. Een centraal inzicht uit die studies is dat niet de vermeende intrinsieke waarde van een innovatie haar uiteindelijke succes bepaalt – een verleidelijke gedachte, zeker voor ideaalgedreven pogingen tot systeeminnovatie. Het welslagen hangt daarentegen vooral af van een afstemmingsproces in het netwerk van initiatiefnemers, de innovatie zelf, en de (beoogde) gebruikers. Vanwege de bewerkingen onderweg leidt zo'n proces niet tot diffusie, een gebruikelijk kennisvraag in dit verband, maar tot hybridisering van de innovatie. Ten opzichte van de theorie van zelfreferentiële systemen biedt deze benadering essentiële aanvullingen: Ten eerste de aandacht voor het handelen van initiatiefnemers en 'vertalers', ten tweede de aandacht voor de transformaties van de innovatie zelf. Dat de translatiesociologie ondertussen weinig helpt om het macrofenomeen maatschappelijke evolutie te begrijpen, maakt dat een theoretische arbeidsdeling met de theorie van zelfreferentiële systemen het overwegen waard is. Geels (2010) en Termeer & Dewulf (2009) geven aan dat een dergelijke verrijking van perspectief juist in onderzoek naar de zo veelzijdige processen van systeeminnovatie meerwaarde belooft te hebben. Gezien de 'immanente' inzet van dit onderzoek is de methodische nadruk gelegd op de concreet waarneembare en theoretisch meer behoedzame 'translaties'. Gezien de behoefte aan een wat ruimere focus dan gebruikelijk in dergelijke analyse, zijn de theoretische congruenties met de theorie van zelreferentiële systemen daarom benut op het translatiekader wat 'op te rekken':

Translatieanalyse biedt de gewenste 'immanente' betrokkenheid en diepte. Wel moet de methodische breedte in de inrichting van het onderzoek versterkt worden om *systeem*innovatie in beeld te krijgen. Die breedte wordt in eerste instantie verschaft door de translatieanalyse toe te passen op innovaties van enige omvang: De operatie maanlanding, bij wijze van voorbeeld, en niet het ontwikkelingsproces van een daarvoor benodigd onderdeel. Daarnaast is een typologie van translaties opgesteld om systematische vergelijking te vergemakkelijken, en inzichten in patronen van translatie (translatiedynamiek) te verstevigen: Belangrijker nog dan de verbreding van afzonderlijke 'translatiesequenties', dwz. series van translaties, is de keuze voor een

meervoudige gevalsstudie naar meerdere van die sequenties. Een specifieke keuze daarbij is het streven om de onderlinge beïnvloeding van deze innovatietrajecten in beeld te krijgen, en dus innovatiepogingen te volgen die enigermate overeenkomen in plaats, tijd en maatschappelijk domein ('action field'). Het voordeel van de laatste keuze is dat deze in beeld belooft te brengen wat zowel volgens Luhmann als de transitietheorie een essentiële dynamiek is in systeeminnovatie: co-evolutie. Om een dergelijke omvangrijke omwenteling teweeg te brengen, zullen de uiteenlopende en verspreide translaties tot enige samenhang moeten komen. Luhmann benadrukte hier hoezeer onderlinge interferenties en fragmentatie op de loer liggen, en voortbouwend op zijn polycentrische wereldbeschouwing schetsten Leydesdorff (1997) en Rammert (2000) de uitdaging om de diverse en verspreide translaties met elkaar af te stemmen, te 'synchroniseren'. Door onderzoek naar parallelle en mogelijk elkaar kruisende translatiesequenties wordt synchronisatie in beeld gebracht zoals deze zich concreet voordoet – *binnen* en *tussen* translatiesequenties. Zo worden de inzichten over zelfreferentiële verandering ingebracht om de translatieanalyse beter toe te rusten voor analyse van systeeminnovatie – een vorm van innovatie die de doorgaans lokale oriëntatie van translatieanalyse overstijgt.

Het ontwikkelde theoretische perspectief wordt in het derde hoofdstuk methodologisch uitgewerkt. De uitdaging is daarbij om het tweerichtingsverkeer tussen innovatie 'zenders' en 'ontvangers' adequaat te beschrijven en te analyseren. Eerder onderzoek in de traditie van translatieanalyse biedt enkele belangrijke richtsnoeren:

1. Analyse van deze processen vraagt van de onderzoeker dat deze de initiatiefnemers en gebruikers poogt te begrijpen in hun handelen.
2. De onderzoeker moet daarbij afzien van voorbarig theoretisch duiden, verklaren en beoordelen.

Voor studie van 'innovatie in actie' is doorleefd beschrijven van de ervaringen en perspectieven van betrokkenen essentieel. Daarbij moet de onderzoeker de belangrijkste 'protagonisten' van een innovatiepoging in het drama van transitie identificeren, hun ambities, en wat daar van terecht komt. Translaties zijn bewerkingen van een innovatiepoging. Door die bewerkingen ondergaan innovatiepogingen transformaties, die de gedaanten aannemen van ideeën, objecten en handelingen. Om aanvullend op een nauwgezette beschrijving ook tot verklaring van innovatieprocessen te komen is verder een typologie van translaties ontworpen. Deze stelt in staat tot systematische vergelijking. Het ontwikkelen van generieke translatiedynamische inzichten kan echter niet gereduceerd worden tot het 'tellen' van translatietypen – dit zou onvoldoende recht doen aan de veelvormigheid van translatieprocessen, en zou miskennen hoezeer het reconstrueren ervan interpretatie vergt. In lijn met beginselen van constructivistische 'grounded theory' wordt de typologie slechts gebruikt om de aandacht van de onderzoeker te richten op bepaalde uitdagingen, problemen en kwesties waar initiatiefnemers en 'vertalers' naar verwachting mee geconfronteerd zullen worden. De typologie helpt op die manier om middels voortschrijdende analyse en begripsvorming meer generieke translatiedynamische inzichten te ontwikkelen.

De onderscheiden translatietypen zijn:

a) **Non-translatie.** De innovatiepoging wordt niet relevant geacht.
b) **Interferentie.** De innovatiepoging wordt, in lijn met Luhmann's verwachtingen hieromtrent, als verstorend ontvangen, en wordt beantwoord met verzet.

c) **Omarming**. De innovatiepoging wordt positief ontvangen, en zonder noemenswaardige bewerking geaccepteerd.
d) **Modificatie.** De innovatiepoging wordt positief ontvangen, doch met een eigen draai er aan. De innovatie *hybridiseert*, zoals de translatiesociologen voor waarschijnlijk houden.
e) **'Wezensvreemde' bewerking.** De innovatiepoging wordt bewerkt, maar zo dat de initiatiefnemers zich er niet meer in herkennen. Dit kan alsnog tot interferenties leiden tussen initiatiefnemers en ontvangers.
f) **Zelftranslatie.** De initiatiefnemers geven zelf een nadere draai aan hun aanvankelijke innovatiepoging. Ze interveniëren daarmee in de translatiesequentie.

De translaties kunnen gevolgd worden door de initiatiefnemers van een innovatiepoging en relevante 'vertalers' te interviewen, documenten en internetbronnen te raadplegen, en in het veld observaties te doen. Het belang van directe observatie wordt benadrukt door innovatiesociologen. Het is in de praktijk van systeeminnovaties echter maar begrensd uitvoerbaar, gezien de omvang van systeeminnovatieprocessen, het grote aantal actoren en de lange reeks van pogingen en translaties die betrekking hebben op deze innovatieprocessen: Het combineren van methodologische breedte en diepte gaat nooit zonder concessies en afwegingen. Ondanks deze praktische beperking in menskracht, biedt de gerichtheid op translaties scherp zicht op het complexe vraagstuk van systeeminnovatie: Het volgen van translatiesporen komt neer op een continue wisselwerking tussen het interpreteren van verworven data, het nagaan van de aanwijzingen en verbindingen die deze levert, en het vergelijken tussen en binnen cases. Daarbij wordt een innovatiepoging gevolgd langs vele vertalers, totdat de poging door de vele perspectieven daarop 'verzadigd' raakt. De theoretische en methodologische balans moet voortdurend worden gevonden in de praktijk van het onderzoek. In het herhaald antwoord geven op de vragen 'Welke elementen uit translatiesequenties te kiezen, hoe ze af te bakenen, welke bronnen dieper aan te boren, en hoe de interviews te voeren' wordt een balans gevonden tussen openheid voor onverwachte translaties en gerichte vraagstelling naar wat voor een specifieke innovatiepoging relevant is. Ondersteunende onderzoekstechnieken en strategieën hierbij zijn 'kritisch systeemdenken' en 'voortschrijdende contextualisering'. De overkoepelende notie van 'empirisch gegrond systeemonderzoek' drukt goed uit hoe de onderzoeksactiviteiten verricht worden vanuit onbevangenheid, met tegelijkertijd, op de achtergrond, theoretische ankerpunten.

Generieke translatiedynamische inzichten worden nadrukkelijk geleidelijk en stapsgewijs ontwikkeld: In eerste instantie beginnend bij nauwgezette beschrijving, interpretatie, verder vergelijkend tussen cases, en uiteindelijk vanuit een co-evolutionair perspectief op de kruisingen tussen translatiesequenties. Die geleidelijke theorieontwikkeling komt terug in het analysekader, consequent toegepast op vier gevalsstudies: Eerst een beschrijving van de innovatiepoging, de initiatiefnemers en hun ambities, vervolgens een uitgebreide 'kale' beschrijving van de ervaringen van initiatiefnemers en 'vertalers', afgesloten met een tijdlijn van gebeurtenissen. Analyse vindt pas daarna plaats, in twee stappen: Eerst een inventaris van uitkomsten, namelijk 'innovatiesucces' zoals waargenomen door betrokkenen, een inschatting van systeeminnovatie opbrengsten, en identificatie van in het oog springende basale patronen. Vervolgens biedt deze inventaris de aanknopingspunten voor analyse aan de

hand van de onderscheiden translatietypen. De casus-specifieke translatiedynamieken tonen de casus in zijn meest gecondenseerde vorm.

De vier gevalsstudies zijn gekozen in het (ruim gedefinieerde) veld van verkeersmanagement, te beschouwen als subsysteem van een meer omvattend mobiliteitssysteem. De respectievelijke innovatiepogingen vonden allen plaats in Nederland, en zijn in de afgelopen 15 jaar ondernomen. Zo is het redelijk waarschijnlijk dat hun translatiesequenties elkaar kruisen. De innovatiepogingen zijn geselecteerd als 'diverse transformaties' (Stirling, 2011), in plaats van als onderdelen van een geprojecteerde transitie. Ze verschillen in de aard van systeemverandering die de initiatiefnemers voor ogen hadden. Gezien hun verschillende manieren van afwijken van het gangbare, konden op voorhand al verwachtingen geformuleerd worden over het optreden van interferenties. De gevalsspecifieke conclusies over translatiedynamiek vormen het startpunt voor de concluderende analyse van translatiedynamiek in het achtste hoofdstuk, dat ingaat op overeenkomsten, verschillen en kruisingen tussen de translatiesequenties. In de hoofdstukken 4 tot en met 7 worden de casus volgens hetzelfde stramien onderzocht. Hieronder worden ze beknopt beschreven:

De eerste casus betreft de '80-kilometerzones'. De minister van Verkeer en Waterstaat introduceerde deze op enkele snelwegtrajecten als oplossing voor de ter plaatse optredende knelpunten met luchtkwaliteit en geluidsoverlast. Juist waar snelwegen zich dichtbij woongebieden bevinden, leiden emissies van autoverkeer tot schadelijke gezondheidseffecten, werd aan het eind van de vorige eeuw steeds duidelijker. De ontwikkeling van milieuwetgeving en de luide roep om maatregelen van de plaatselijke bevolking brachten de minister tot het instellen van een verlaagde snelheidslimiet op de A13 ter hoogte van Overschie. Bij verlaagde snelheid verwachtten verkeersexperts een schoner verkeer. Aangezien de 80 km/h limiet afwijkt van de 'ontwerpsnelheid' van de weg, werd strikte controle onontbeerlijk geacht. Snelheidshandhaving werd bekrachtigd middels het nieuwe 'trajectcontrole' systeem, met 100% pakkans. In mei 2002 werd de zone geopend. Dat drie jaar later vier nieuwe zones werden ingesteld, de minister reeds in voorjaar 2006 tot heroverweging van de maatregel werd gebracht en haar opvolger verder inzette op een flexibeler regime van dynamische snelheden, schetst reeds het turbulente verloop van het innovatietraject. Het kreeg zijn verloop door een grote groep 'vertalers': Een projectleider die vele hindernissen moest nemen om het trajectcontrolesysteem snel geïnstalleerd en operationeel te krijgen, bewoners die maatregelen tegen hun gezondheidsrisico's wilden zien, boze automobilisten die de auto andermaal als melkkoe zagen fungeren, lokale politici die naast de milieukwestie toch ook ruimte zochten voor bouwprogramma's, actievoerders die grootschaliger 'gezondheidscordons' uitgerold wilden zien, onderzoekers die wezen op vele complicerende omgevingsfactoren en onzekerheidsmarges, juridische officials die wezen op rechtmatigheids- en administratieve aspecten, milieudeskundigen die de maatregel tegen alternatieve maatregelen afwogen, verkeerskundigen en psychologen die verkeer- en gedragseffecten analyseerden, vele mediareportages, een parlement met uitgesproken voor- en tegenstanders, en een minister die ondervond hoe de eerder genomen maatregelen moeilijk terug te draaien waren vanwege milieurichtlijnen en de procedures van dien.

De tweede casus betreft de aanbevelingen van de 'Commissie Luteijn' en de wending naar netwerkgeoriënteerd mobiliteitsbeleid. De commissie was ingesteld door de minister van Verkeer en Waterstaat om oplossingen voor de bereikbaarheidsproblemen

op de A4 te vinden, en in het bijzonder om het eerder voorgestelde idee van een 'mobiliteitsmarkt' verder uit te werken. De publiek-private commissie concludeerde dat de bereikbaarheidsproblemen niet zozeer de A4 zelf betroffen, maar vooral het geheel van vervoersstromen in de omliggende regio Groot-Haaglanden – geen 'corridor'probleem, maar een *netwerk*probleem. Overwegend dat de oplossing van het netwerkprobleem werd gehinderd door vele bestuurlijke grenzen en 'bestuurlijke drukte', achtte de commissie grensoverschrijdende samenwerking cruciaal. De commissie formuleerde een groeimodel voor samenwerking, waarin de successen met relatief eenvoudige 'netwerkacties' een vertrouwensbasis voor de meer uitdagende initiatieven zouden vormen. Het model zou als eerste beproefd worden in de Groot-Haaglanden regio, met de bedoeling dat andere regio's zouden volgen. Het aanbevelingsrapport werd gepubliceerd in 2003, waarna het aan de regionale publieke en private 'probleemeigenaars' was om te handelen naar het simpele devies dat 'voor de weggebruiker bestuurlijke grenzen niet ter zake doen'. Dat dit een mantra in mobiliteitsbeleid geworden is en de Luteijn-principes zijn terug te vinden in vele vernieuwingen in mobiliteitsbeleid, geeft al aan dat de innovatiepoging een rijke translatiesequentie kende. Belangrijke 'vertalers' waren de 'mobiliteitsmanagers' als speciaal aangestelde aanjagers van grensoverschrijdende initiatieven, de medewerkers van hun netwerkorganisaties die bemiddelden tussen hun thuisorganisatie en de netwerkorganisatie, de verschillende bestuurders die het belang van netwerkactie tegen hun onmiddellijke eigen belangen moesten afwegen, de vele professionals in o.a. verkeersmanagement, wegbeheer en incidentmanagement, de bedrijven die hun probleemeigenaarschap begonnen te erkennen en hun arbeid reorganiseerden met mobiliteitsmanagement, en de ondernemers die innovatieve diensten ontwikkelden. Deze vertalingen vonden verspreid plaats, over een grote verzameling van minder of meer geformaliseerde netwerkinitiatieven.

De derde casus betreft een benadering van verkeer die bekend is geworden onder de naam Shared Space. Volgens deze inrichtingsfilosofie is het managen van verkeer doorgeschoten, ten koste van de leefbaarheid en aantrekkelijkheid van de openbare ruimte, en van gezond verstand en fatsoen. In plaats van een met verkeersborden, stoplichten, belijningen en rijbaanscheidingen 'dichtgetimmerde' ruimte zou het verkeer best wat meer aan zelforganisatie overgelaten kunnen worden, is daarbij de gedachte: Shared Space vertrouwt op sociaal gedrag. De casus beschrijft hoe uit enkele aanvankelijk marginale en weinig spectaculaire verkeersoplossingen het internationaal bekende Shared Space concept ontstond, zowel geroemd als verguisd om het omarmen van 'verkeerschaos' en spontane orde. Beschreven vanuit een lokaal herinrichtingsproces, het opstarten van een Europees project en de bredere verspreiding van het Shared Space concept, komt een translatiesequentie naar voren niet alleen van controverse, maar ook van diverse pogingen om het concept te kneden tot een aanvaardbare innovatiepoging. Behalve door de charismatische vaandeldrager die het concept wereldwijd uitventte, werd de translatiesequentie vormgegeven door enthousiaste gemeenteambtenaren, burgers die als werkgroepleden tot een verfraaid dorpscentrum probeerden te komen, bezorgde ouderen, voorvechters van vrije fietsbanen, een wethouder die de vernieuwing door de ontstane commotie poogde te loodsen, onderzoekers die grip probeerden te krijgen op de onvoorziene gevolgen voor visueel gehandicapten, activisten die ten strijde trokken tegen overregulering door stoplichten, kritische verkeersveiligheidexperts, architecten en adviesbureaus die hun repertoire verrijkt zagen, bestuurlijke vernieuwers die een verfrissende kijk op

maatschappelijke orde zagen ontstaan, politiemensen die met de verkeersborden ook de grond voor handhaving zagen verdwijnen, burgers die tegen de verkeerschaos protesteerden of wijzigingen voorstelden, reporters die in de buitenissige verkeersinrichting een opzienbarend nieuwsitem zagen, en Shared Space ambassadeurs die het gedachtegoed probeerden onder te brengen in opleidingen, handboeken en verkeersgerelateerde beleidsvelden.

De vierde casus betreft de pogingen te komen tot een geïntegreerde organisatie van reis- en verkeersinformatie. In 1996 lanceerde een groep beleidsmakers van het Ministerie van Verkeer en Waterstaat daartoe de Beleidsnota Reisinformatie. Signalerend dat de snelle ontwikkelingen in ICT vele nieuwe kansen bieden voor zowel verkeersmanagement als informatiediensten voor gebruikers, streefden de initiatiefnemers naar een geïntegreerde 'informatieketen'. Door data-inwinning, bewerking en distributie te coördineren zou uiteindelijk in 2010 een 'bewuste keuze' voor de reiziger mogelijk worden. Vanuit de gedacht dat optimalisering van de informatieketen gediend zou zijn met de innovatieve kracht van ondernemerschap, was het laten ontstaan van een markt voor informatiediensten een speerpunt van het initiatief. Inmiddels aangeland bij de geprojecteerde horizon van 2010 zijn de ambities deels bewaarheid, worden andere plannen nieuw leven ingeblazen, en telt de informatieketen een diverse en groeiende groep commerciële partijen. Dat recent mobiliteitsbeleid inmiddels uit gaat van door publieke en private partijen gedeelde 'systeemverantwoordelijkheid' wijst daarbij al op een significante systeeminnovatieve verschuiving. De innovatiepoging kende, in wisselwerking met andere, de rijke translatiesequentie zoals voorzien. De translatiesequentie werd gevormd door de initiërende beleidsmakers die met aanhoudende inspanningen de voorwaarden voor een informatiemarkt probeerden te scheppen, hun collega's van Rijkswaterstaat die met de ingrijpende gevolgen voor hun verkeersmanagement probeerden om te gaan, een pionier in commerciële verkeersinformatie die worstelde met de marktverstorende invloed van een nooit volledig terugtredende overheid, verkeersprofessionals die nieuwe technologische kansen zagen voor een meer dynamisch verkeersmanagement, overheden die hun burgers zichtbare inspanningen tegen fileleed probeerden te tonen, technologische bedrijven die zich, aanvankelijk met weinig loon naar werken, op de informatiemarkt waagden, kaartenmakers met evenzeer onzekere investeringen in het digitaliseren en actualiseren van kaarten, bezorgde bewoners over navigatie-geleid 'sluipverkeer', automobilisten die de diverse navigatie-en informatiediensten de uitgave waard vonden, openbaar vervoer bedrijven die het belang van geïntegreerde informatievoorziening poogden te verenigen met controle over bedrijfsgevoelige informatie, maatschappelijke organisaties die het reizigersbelang bij betrouwbare informatie onderstreepten, en verschillende intermediairs die de uiteenlopende vertalingen zinvol probeerden te verknopen.

De vier translatiesequenties bieden ieder een blik in de zwarte doos van systeeminnovatie. In hoofdstuk 8 worden de inzichten uit de afzonderlijke gevallen boven het specifieke uit getild. De vraag naar het evolueren van innovatiepogingen tot systeeminnovatie wordt beantwoord middels stapsgewijze analyse van translatiedynamiek: Allereerst wordt kort vergeleken wat de vier translatiesequenties aan systeeminnovatie hebben voortgebracht. Dit geeft een eerste indruk van welke gevallen vooral als lichtende voorbeelden, of juist als demonstraties van valkuilen instructief zullen zijn. De vergelijking biedt echter vooral ook een gemengd beeld; ook in de relatief 'succesvolle' cases (d.w.z. rijk aan systeeminnovatie-opbrengsten;

innovatiesucces is omstreden) zijn minder geslaagde translatiedynamieken aan te treffen. Na de vergelijking van uitkomsten worden de gevalsspecifieke translatiedynamieken geïnventariseerd. Iedere gevalsstudie bracht zes opvallende patronen in translaties naar voren, en juist door deze patronen zijn de gevallen direct vergelijkbaar. Daarbij wordt theoretisch gegeneraliseerd: Moeten de gevalsspecifieke translatiedynamieken als incidentele manifestaties worden gezien, of zijn er redenen om aan te nemen dat ze meer algemeen geldig zijn? Vanwege overeenkomsten en gemene delers kunnen de 4x6 patronen als 10 afzonderlijke 'translatiedynamieken' worden geanalyseerd:

- 'Diepe interferentie'
- 'Inlijving'
- 'Wijdverbreide omhelzing'
- 'Oscillatie tussen interferentie en modificatie'
- 'Gesynchroniseerde translatie'
- 'Productief gebruik van interferentie'
- 'Het verwateringsdilemma'
- 'Zelf-interferentie'
- 'Onderling interfererende bewerkingen'
- 'Leunen op andere translatiesequenties'

Op basis van gevalsspecifieke en vergelijkende analyse kunnen al generieke conclusies worden getrokken ten aanzien van translatiedynamiek. Gezien de kennelijke relevantie van diverse 'omgevingsfactoren' kan pas na analyse van de kruisingen tussen translatiesequenties definitief geconcludeerd worden – dit is de derde stap in de analyse. Bij de analyse van kruisingen komt bij uitstek de *co*-evolutionaire dimensie van translatiedynamiek in beeld. Zoals Luhmann's kader al aangaf, kunnen veranderingen uit de ene translatiesequentie relevante ontwikkelingen zijn voor de vertalende actoren in de andere. Wanneer dit wederzijds optreedt co-evolueren de sequenties, in plaats van zich geïsoleerd en parallel te ontwikkelen. Er ontstaan dan translatiepatronen die zich deels achter de rug van de actoren om voltrekken. Analyse van de kruisingen start vanuit een 4x4 matrix die de 12 theoretisch mogelijke kruisingen aangeeft. Gerichte analyse betreft verder de aangetroffen onderlinge kruisingen, en de kruisingen die zich niet voordeden. De analyse van de kruisingen wordt besloten met een korte reflectie op 'omgevingsfactoren' in hun volle breedte.

Op basis van afzonderlijke gevalsstudies, vergelijkende analyse en analyse van de kruisingen tussen de translatiesequenties is uiteindelijk het volgende geconcludeerd:

1. Overdraagbaarheid. Allereerst wordt duidelijk waarom het zinvol is te spreken van innovatiepogingen. De initiatieven verspreidden zich niet louter op grond van hun intrinsieke waarde of de goede bedoelingen van de initiatiefnemer. Ze moesten zinvol en nuttig zijn voor de ontvangers om aanvaard, gesteund of verder ontwikkeld te worden door ontvangende partijen. Ook tonen de gevalsstudies dat innovatiepogingen verstoringen met zich meebrengen. De vele 'interferenties' onderstreepten het pogende karakter van innovatie. Om tot systeeminnovaties te kunnen uitgroeien moeten de pogingen overdraagbaar en vertaalbaar zijn. De overdraagbaarheid bestaat uit het kneedbare karakter, dat bewerkingen toelaat. Transfers worden ook bevorderd wanneer de gepoogde innovatie interferenties weet te vermijden; zowel met ontvangers, tussen ontvangers, als met de organisatiedoelstellingen van de initiatiefnemer zelf.

Overdraagbaarheid is, anders dan de intrinsieke kwaliteit om een bepaalde maatschappelijke uitdaging het hoofd te bieden, een kameleontische kwaliteit. Het principe van survival of the fittest gaat ook voor innovaties op. 'Fit' is passendheid in diverse omgevingen. Het belang ervan voor innovatie te midden van een diverse en mogelijk vijandige omgeving bevestigt de verwachtingen ten aanzien van 'modificatie' en de totstandkoming van zogenaamde 'boundary objects'. Overdraagbaarheid brengt ook een eeuwenoud strategisch principe in herinnering: 'Vormloosheid' als immunisering tegen bedreigingen, door mee te bewegen met de omgeving. De gevalsstudies tonen meer in het bijzonder dat overdraagbaarheid geen statische, gegeven kwaliteit is, maar vooral een kwaliteit is die ontwikkeld, onderhouden en uitgeoefend moet worden door aanhoudende zelftranslaties.

2. Interferentievermijding volstaat niet. Ten tweede kan geconcludeerd worden dat overdraagbaarheid alleen niet volstaat. Niettegenstaande de empirie die het belang ervan aangeeft en theoretische verwachtingen in deze richting bevestigt, waren er ook verschillende translatiedynamieken die anomalieën en complicaties opwierpen. Deze leiden tot het inzicht dat alleen overdraagbaarheid de systeeminnovatie-opbrengsten niet kan verklaren, en dat dit algemene beeld moet worden bijgesteld en verfijnd: Het louter maximaliseren van overdraagbaarheid zal niet alleen tot vormloze, maar ook tot tandeloze, verwaterde innovatiepogingen leiden. Het teweeg brengen van systeeminnovatie hangt niet alleen af van het vermijden van interferentie, maar vooral ook van de manier waarop deze wordt opgelost, gehanteerd, of zelfs wordt gecultiveerd. De verschillende aspecten van dit algemene inzicht werden belicht onder bespreking van 'het productieve gebruik van interferentie', 'inlijving', het dilemma van de 'verwatering', en de 'zelf-interferentie'. Wel heel merkwaardig zijn de dynamieken van 'zelf-interferentie' en het 'productieve gebruik van interferentie'. Deze tonen hoe systeeminnovatie juist gediend kan zijn bij het *opzoeken* van verstoring. Dat zulk interferentiezoekend gedrag gewoonlijk ook verstoring voor de eigen organisatie met zich meebrengt is de andere kant van de medaille; het cliché 'no pain, no gain' is hier van toepassing. Interferentie hoeft en kan niet altijd worden vermeden om innovatiepogingen verder te brengen. 'Inlijving' en 'verwatering' waren belangrijke dynamieken door te tonen hoe, als een onmiddellijke consequentie van overdraagbaarheid, er modificaties en hybrides ontstaan die zelf bron van interferentie kunnen zijn. Het verwateringsdilemma drukt de spanning uit tussen het vermijden van interferentie, en het vermijden van de schaduwzijde daarvan – het berusten in verwaterde, vervlakte overdraagbaarheid. Dat wat overdraagbaar is, zal ook al gauw ingelijfd worden op niet altijd bevredigende wijze.

3. Synchronisatie als doorslaggevende factor. Ten derde bracht vergelijkende analyse naar voren dat boven de overdraagbaarheid van de gepoogde innovatie en het omgaan met (en niet slechts vermijden van) interferentie, de doorslaggevende en overheersende dynamiek die is van synchronisatie. Het belang van dit afstemmen van translaties was wel verwacht, maar pas in de loop van het empirisch onderzoek werd duidelijk dat de meest geslaagde innovatiepogingen evolueerden dankzij synchronisatie – gezamenlijk vorm geven aan de 'netwerkgedachte', bijvoorbeeld. Bespreking van 'synchronisatie', het 'leunen op andere translatiesequenties' en 'onderling interfererende modificaties' hielp te begrijpen waarom dit niet toevallig was: Deze dynamieken onderstreepten dat in alle vier de sequenties de 'vertalers' minstens zo belangrijk waren als de initiatiefnemers. De systeeminnovatie opbrengsten in de meest geslaagde gevallen konden vooral zo indrukwekkend zijn doordat de vele translaties gesynchroniseerd

waren. Dit verminderde onderlinge interferenties of loste deze op, voorkwam dat het innovatieproces in fragmentatie verviel, en bevorderde voortgaande translatie. En zoals duidelijk werd uit het 'leunen op andere translatiesequenties', berustte de synchronisatie in de meer geslaagde gevallen op groeimodellen, die anticipeerden op voortdurende, zelfaandrijvende en geassembleerde translatie.

4. Synchronisatie heeft een tijdelijke werkingskracht; te midden van onderling uitdoving en fragmentatie kan door al of niet bewuste synchronisatie een traject richting systeemverandering ontstaan. De systeeminnovatie opbrengsten van translatiesequenties hangen niet alleen af van initiatiefnemers. Vele 'vertalers' en hun meer of minder succesvolle pogingen tot synchronisatie spelen eveneens een belangrijke rol, alsmede een reeks contextfactoren die op het evolutieproces ingrijpen. Deze komen naar voren in de gevalsstudies en in vergelijkende analyse. Pas na analyse van de kruisingen tussen de sequenties werd duidelijk hoezeer context ertoe doet: De translaties van actoren bleken door de tijd aan verandering onderhevig onder invloed van relevante ontwikkelingen in hun eigen translatiesequentie, in andere translatiesequenties, en in hun bredere als relevant aangemerkte omgevingen. Onder vergelijkende analyse bleek al dat oscillatie tussen ervaren interferentie en meer affirmatieve vertaling een gebruikelijk patroon is. Analyse van de kruisingen toont dat oscillatie onvermijdelijk optreedt - actoren reageren verschillend op een verschillende verzameling van relevant geachte ontwikkelingen. Op die manier ontstaan volatiliteit, fragmentatie, uitdoving en onderlinge versterking, zowel binnen translatiesequenties als tussen translatiesequenties. (Aangezien translatiesequenties zelf ook al een samengesteld karakter hebben, is de translatiedynamiek binnen en tussen translatiesequenties niet essentieel verschillend). Gezien de onvermijdelijke oscillaties hebben bewuste synchronisatiepogingen tot onderlinge versterking altijd een tijdelijke werkingskracht. Niettegenstaande deze beperkte werkingskracht toont de mengeling van co-evolutie en parallelle ontwikkeling dat er, behalve fragmentatie, ook verrassend coherente 'trajecten' ontstaan. De geslaagde synchronisatiepogingen in de 'informatieketen' en onder de 'netwerkwending' sprongen eerder al in het oog, maar uit hun kruisingen lijkt zich een traject te vormen. Dat traject, waar ook het vergroenen van verkeer zijdelings deel van uitmaakt, blijkt niet alleen het product van doelbewuste synchronisatiepogingen, maar ook van overeenkomende reacties op gelijkelijk gevoelde 'omgevingsdruk': Een stijgend verkeersvolume dat noopt tot filebestrijding, erkenning van netwerksamenhang die aanzet tot integrale toepassingen, milieuproblematiek (en wetgeving) die een premie zet op bijdragen aan emissiereducties, het beschikbaar komen van en vragen naar technologische opties om de doelstellingen mee te verwezenlijken, en het garanderen van verkeersveiligheid. De gesignaleerde trajectvorming (richting efficiënt en 'slim' verkeersmanagement) is deels spontaan, deels doelbewust gesynchroniseerd. De doelbewuste synchronisatie kan dus ondernomen worden zowel ten faveure als ter doorbreking van spontane trajectformatie en dominante translatiesequenties.

Hoofdstuk 9 geeft antwoord op de vraag naar interventie in innovatie-evolutie. Pas na grondige analyse van translatiedynamiek kan de uitdaging in zijn volle complexiteit aangegaan worden. Dat de stap van systeeminzicht naar systeeminterventie verre van triviaal is, is in het eerste hoofdstuk reeds gesteld; deze brengt de transcendentale verleiding met zich mee om 'vanuit de helicopter' transitiepaden te gaan projecteren. Nagaand hoe een actor met systeeminnovatieve ambities de translatiedynamische inzichten zou kunnen inzetten blijkt dit concreter. Uitzoomend vanuit het ingrijpen in enkele translatiesequenties, ervaart deze de complexiteit van samengestelde systemen

uiteindelijk als een ongekend en omstreden geheel: Synchronisatie daarbinnen blijkt dan een tweesnijdend zwaard. Het kan de totstandkoming van systeeminnovatie bevorderen, maar kan ook trajecten helpen vormen die tot nieuwe of zelfs verergerde systemische problemen leiden - zoals de trajectvorming richting 'slim verkeersmanagement' illustreert. Deze ambivalentie leidt aanvankelijk tot desoriëntatie. Deze kan op verschillende manieren tegemoet getreden worden:

Als bijkomstige complicatie bij het realiseren van synergie, waarbij synchronisatie stabilisatie van systeemopvattingen dient, of juist als fundamentele conditie, waarbij synchronisatie vooral de reflectie op systeemopvattingen dient. Waar de eerste ordezoekende houding zich richt op het benutten van het waargenomen potentieel voor synergie, benadrukt de tweede complexiteit-erkennende houding juist het risico om daardoor verblind te raken, en interferenties te veronachtzamen. De relatieve sterktes en zwaktes van voornoemde posities leiden in tot een derde houding, die de diverse vertalingen van duurzaamheid erkent maar de interventionist nog wel een globaal richtsnoer biedt: Systemische wendbaarheid, vergelijkbaar met de huidige aandacht voor 'veerkracht'. Ten aanzien van de gesignaleerde trajectvorming blijkt dit een krachtige heuristiek, die helpt de verschillende, niet altijd compatibele 'verduurzamingen' op waarde te schatten en actief te verbinden. Gericht en actief diversiteit nastrevend, poogt de interventionist juist nieuwe kruisingen tussen translatiesequenties aan te brengen. Na deze strategisch- normatieve bezinning kan het gewonnen translatiedynamische inzicht voor een interventierepertoire ingezet worden. Deze synchronisatiestrategie bestaat uit vijf elementen. Daarbij wordt voor ieder element kort uiteengezet hoe dit zich verhoudt tot reeds bestaande inzichten- en in welke richting verder onderzoek aanbevelenswaardig is.

1. Cultiveren van overdraagbaarheid. Zoals uiteengezet onder translatiedynamiek 1, kan de interventionist niet teveel vertrouwen op de vermeende intrinsieke waarde van de gepoogde innovatie; het gaat erom dat deze overdraagbaar is, en relevant voor vertalers. Dit principe is op zichzelf geen nieuw inzicht. Het belang ervan werd ontdekt door de translatiesociologie (en ruim daarvoor al als het principe van de vormloosheid), en is ook herkenbaar in recente pleidooien voor 'adaptieve', 'organische' innovatie. Opgevat als evolutionaire aangepastheid komt het overeen met het basisidee van 'strategisch niche management'. Maar behalve het overleven en aggregeren van niches, wijst het belang van overdraagbaarheid ook op hybridisering, het ontstaan van mengvormen. Dit laatste verdient meer aandacht in verder onderzoek naar 'transitie-experimenten'. De evolutionaire preoccupatie met overleven en sneuvelen moet worden afgezworen ten gunste van aandacht voor hybridisering, en de 'gerichtheid' van systeeminnovatie (Stirling, 2009, 2011). Meer dan de veelbelovende niche-initiatieven verdienen juist gevallen van *ambigu* 'innovatiesucces' dan nader onderzoek.

2. Interferentiemanagement. Zoals uiteengezet onder translatiedynamiek 2, is het cultiveren van overdraagbaarheid en vormloosheid belangrijk maar onvoldoende. Systeeminnovatie is niet gebaat bij tactieken om interferentie vermijden. Een blijvende vormloosheid kan gemakkelijk tot *tandeloze* innovaties leiden; het laaghangend fruit in de netwerk-wending, bijvoorbeeld. De interventionist zal interferentie als inherent aan systeeminnovatie moeten erkennen, waarbij interferentie opgelost, het hoofd geboden, maar soms ook bewust opgezocht zal moeten worden. Het belang van interferentiemanagement is bij uitstek een opbrengst van de immanente methode. In de literatuur over systeeminnovatie en transities wordt het nog te weinig als inherent aan

systeeminnovatie onderkend, zoals de preoccupatie met 'inlijving' door 'regime-actoren' en het negatief duiden van 'weerstand tegen verandering' aangeven. Het omstreden karakter van systeeminnovatie wordt recentelijk meer en meer erkend. De manifestaties en onderscheiden facetten van interferentiemanagement bieden hier een verrijking, doordat ze interferentie als tweezijdig fenomeen uitwerken – zoals in organisatiestudies al veelvuldig is bepleit. Verder onderzoek in deze richting zou de gronden van 'weerstand tegen verandering' verder kunnen uitzoeken. Een andere aanbeveling is om na te gaan hoe het opzoeken van interferentie en het ondernemen van 'risicovolle experimenten' zich verhoudt tot juist contraproductieve interferentie, ressentiment en de dooruit volgende terugslag in transitie. Dit zou tot een transitiemanagement-repertoire kunnen leiden dat zich niet zozeer op koplopers maar juist op de 'achterblijvers' richt.

3. Het synchroniseren van ongecontroleerde overdraagbaarheid. Zoals uiteengezet onder translatiedynamiek 3, zal de interventionist moeten beseffen dat de afstemming tussen vertalingen de doorslaggevende dynamiek is. In het systeeminnovatieproces zijn de vertalers minstens zo belangrijk als de initiatiefnemer. Dat synchronisatie belangrijk is, wordt in een tijd van netwerkconnectiviteit en veelvuldig wederzijds 'updaten' wel erkend in technische zin; dat synchronisatie ook gaat om het verbinden van de veelheid aan *diverse* en niet altijd compatibele vertalingen, wordt echter nog onvoldoende onderkend. De systeemtheoretische uitdaging hiervan is wel veelvuldig uiteengezet; de empirische bevindingen in deze studie zijn van belang om het begrip verder te vormen, en te tonen hoe synchroniseren zich manifesteert in de worstelingen met de samengesteldheid van vertalingssequenties; de wijdvertakte informatieketen bijvoorbeeld. Synchronisatie benadrukt hoezeer het geleiden van systeeminnovatie niet primair om het voeden van specifieke innovatiepogingen gaat, maar om de verdere interacties van hernieuwde pogingen, bewerkingen en andere innovatiepogingen en de emergente dynamieken van dien. Dat daarbij het transitietheoretische onderscheid tussen 'niches' en 'regimes' vervalt als secundair t.o.v. de synchronisatie tussen meer of minder stevig gepositioneerde actoren is een nevenresultaat: Zeker in praktische zin belangrijker is hoe synchronisatie aangeeft dat ambities tot systeeminnovatie maar ten dele van innovatiepogingen afhangen. Zoals aangegeven door Geels (2010), is vertalinganalyse van beperkte relevantie voor systeeminnovatieonderzoek zolang deze zich op de stabilisatie en ontogenese van enkele objecten richt. De analysemethode is zelf echter ook kneedbaar, en kan aangepast worden om juist de gewenste micro-macro verbinding in beeld te brengen – op verschillende niveaus van betekenisgevingsdynamiek.

4. Oscillatiemanagement. Zoals uiteengezet onder translatiedynamiek 4, zal de interventionist er rekening mee moeten houden dat translaties onder wisselende omstandigheden plaatsvinden. Interferenties en affirmatieve vertalingen blijven elkaar afwisselen, en vertalingssequenties 'oscilleren' aanhoudend. Synchronisatie heeft dan dus een tijdelijke werkingskracht. Te midden van fragmentatie kunnen nog steeds translatietrajecten ontstaan, door hetzij spontane, hetzij doelbewuste synchronisatie, maar deze vallen evenwel gauw stil als er geen nieuwe synchronisaties blijven ontstaan. Oscillatiemanagement gaat dan over het verbinden van spontane en doelbewuste synchronisatie, en om het begrijpen van de bronnen van oscillatie. Het gaat erom oscillatie als theoretisch bekende uitkomst van samengestelde processen ook in de praktijk serieus te nemen (Vasileiadou & Safarzynska, 2010). De omgevingsdynamiek blijkt bepalend voor de effecten van innovatiepogingen. De analyse van kruisingen

tussen vertalingssequenties is waardevol gebleken in het tonen van de opvallende mengeling van interfererende en synergetische co-evolutie. De aanbeveling van Schot & Geels (2008), het analyseren van *meervoudige* en wederzijdse beïnvloedende innovatieprocessen, kan dan ook van harte worden overgenomen. De hier gevolgde methode van 'geneste' meervoudige gevalsstudie kan op vele manieren aangepast worden om zicht op de kruisingen te krijgen, en op de bronnen van oscillaties. Interessante aanknopingspunten daarvoor zijn verder het onderscheid tussen 'hete' en 'koude' configuraties (Callon, 1998), en de verschuivingen tussen 'inerte', 'chaotische', 'stabiele' en 'dynamische' procestoestanden (Teisman et al. (2009), Pel et al. (2012)). Dit kan oscillatiemanagement informeren, en synchroniserende actoren aan een gevoel voor timing helpen.

5. Synchronisatie voor systemische wendbaarheid. Zoals uitgewerkt in hoofdstuk 9, berust interventie in systeeminnovatie uiteindelijk op synchronisatie. Gezien de voortdurende oscillatie in complexe innovatieomgevingen zal innovatie alleen slagen als deze kan leunen op spontane synchronisatie. Ten aanzien van trajectformatie is synchronisatie echter een tweesnijdend zwaard, moet beseft worden. Het kan het beste gehanteerd worden vanuit een streven naar 'systemische wendbaarheid', een concept dat overeenkomt met aanbevolen posities in het debat over 'reflexieve governance'. Deze studie is belangwekkend in het tonen hoe 'transcendente' en meer polycentrisch gerichte benaderingen concreet uitpakken in 'systeeminnovatie in actie': Afhankelijk van de aangenomen positie concentreert de interventionist zich op de synergieën of juist op de interferenties, op de beloofde duurzaamheids-impacts of op de onvoorziene neveneffecten. Het streven naar systeemwendbaarheid neigt echter wel naar 'postmoderne bescheidenheid': Het ziet de ambivalentie van systeeminnovatie als fundamenteel. Deze ambivalentie wordt in het denken over transitiemanagement ook wel erkend – maar de meer transcendente, instrumentele elementen van deze benadering blijken de meest overdraagbare. Het verduurzamen van verkeersmanagement toont hoe moeilijk de lonkende synergie te weerstaan is, en hoe het nastreven daarvan tot onproductieve tegenstellingen leidt en interferenties veronachtzaamt. Het lijkt daarom verstandig om de notie van 'systeemfalen' meer reflexief en interactief te hanteren: Kritisch systeemdenken kan dan een rol vervullen bij het gezamenlijk uiteenleggen van 'systeemfalen', als krachtig 'boundary concept'. Ook voor de 'kritische maatschappijtheorie' is dan een rol weggelegd, voorbij het aanklagen van een monolithisch voorgesteld Systeem.

Appendix: List of respondents

Reference nr.	Date	Affiliation
***1**	23/04/09	Rijkswaterstaat
***2**	11/02/08	Rijkswaterstaat/DVS
***3**	14/10/08	Rijkswaterstaat/DVS
***4**	26/06/08	Gezond Overschie
***5**	05/12/08	GGD Rotterdam
***6**	26/09/08	Min. VROM
***7**	01/12/08	Deelgemeente Overschie
***8**	19/02/08	Milieudefensie
-	22/02/08	Stadsregio Rotterdam
-	31/10/08	CROW
-	25/11/08	DIVV Amsterdam
-	07/11/08	DCMR Schiedam
-	11/12/08	CROW
***9**	28/01/08	DHV, SWINGH
***10**	23/09/09	Incidentmanagement IPO
***11**	09/06/09	BEREIK afstemming wegbeheer
***12**	20/08/09	Twynstra Gudde, NEXUS/BEREIK
***13**	23/04/09	BEREIK Den Haag
***14**	10/12/09	Provincie Zuid-Holland
***15**	16/06/09	Gebiedsuitwerkingen BEREIK
***16**	09/04/09	DVM Zuidvleugel/BEREIK
***17**	18/09/09	MARCEL traffic consultancy
***18**	13/11/08	Verkeersonderneming Rotterdam
***19**	20/03/08	Verkeersmarinier Rotterdam
***20**	21/11/07	Rijkswaterstaat, Groene Golf team
***21**	27/02/08	Gemeente Haren
***22**	20/02/08	Gemeente Haren
***23**	10/03/08	Gemeente Haren
***24**	22/06/09	Gemeente Haren
***25**	26/02/08	Fietsersbond
***26**	10/03/08	VISIO Haren

-	11/01/08	Baluw.nl
***27**	19/02/08	Rijkswaterstaat
***28**	28/02/08	Prov. Fryslan
***29**	07/07/09	Shared Space institute
***30**	21/09/09	Min. V&W
***31**	04/02/08	DS+V Rotterdam
***32**	02/11/07	NDW/VCNL
***33**	17/06/09	Connekt
***34**	23/10/09	VID
***35**	12/08/09	Rijkswaterstaat/AGI
***36**	10/06/09	Provincie Brabant
***37**	08/07/09	Provincie Zuid-Holland
***38**	03/12/08	TomTom
***39**	03/12/08	Railforum
***40**	08/12/09	Min. V & W
-	11/01/08	Min. V&W
-	12/03/08	TNO Human Factors

Acknowledgements

I am happy to present you this dissertation. Hopefully it provides you with new insights into processes of societal change, and into ways to intervene in those. I also hope it conveys some of the fascination I developed for the complexity of tinkering with traffic, and that it inspires to reconsider this seemingly self-evident aspect of public life. Many routes can be taken.

Of course also this scholarly innovation attempt should be considered a moment in an ongoing translation process. Having reached the happy stage of sending it to print, the painstaking self-translations that shaped it are still very vivid memories. Starting with a rough focus on the 'consolidation' of system innovation achievements, an innovation journey started that took me along a variety of theoretical perspectives, a multitude of empirical leads to follow, and a respectable pile of discarded prototypes. Considering myself a social philosopher at the start, somehow along the way I became an avid empirical researcher. Yet although the contents of this book should be entirely attributed to its author (for better or for worse), it is important to highlight the contributions of helpful translators, and to thank others who formed most relevant parts of my environment.

First of all I owe much to my respondents. Not only were you so kind to arrange time for a meeting with at best unclear benefits, you also did your best to provide me with elaborate answers to sometimes confusing questions. Your comments on an earlier draft version are also highly appreciated. Your voices bring this book to life, and they energized my investigations. It was hard to close down my searchings, but I am also comforted by knowing that your translation sequences go on.

This research was conducted as part of the (never really ending) KSI program on system innovations and transitions, subproject 'Multi-level Governance of Transitions'. I still feel proud to have been part of this KSI II.3 'dream team', featuring the brilliant minds of Geert Teisman, Jan Rotmans, Frank Boons, Derk Loorbach and Roel van Raak. I congratulate us on not having arrived at a unified model; let the dialectics go on.

Specific thanks go out to Geert and Frank. Although there must have been quicker routes to get from A to B, the synchronization between the three of us has generally been solid. Geert, your supervision as a promotor demonstrated deep insight into the limits to steering. Through genuine interest in my particular 'historical complexity development' you knew how to build on my self-referential operations - and when to interrupt them. Frank, you have been a most devoted supervisor and a true guardian of scientific rigor, always seeking to make the best of my spiraling thoughts. Very soon I learnt to take your assessments very seriously (me being a northerner, your Brabant accent put you at a slight initial disadvantage ;)).

More generally I enjoyed the luxury of being embedded in two research groups. Left aside the gains from moving between paradigms, it brought me only more colleagues to inspire me and make me enjoy my stay at Erasmus University. The Governance of Complex Systems (GOCS) group has been a great habitat for my innovation attempts; an exciting group in the otherwise rather dull world of public administration. You made me feel appreciated and included (It's not you; at times I manage to be an outsider even in my own living room). I have especially good memories of our joint sessions for the 'blue book'. I hope GOCS will continue to thrive with a capital C, despite knowledge

market incentives towards more transferable commodities. I also propose to have Arthur's and Vicky's bursts of laughter recorded, for the benefit of future workers. The Dutch Research Institute for Transitions (DRIFT) has always felt like a second home. Your enthusiasm and optimism - quite amazing for people delving into current and future sustainability challenges - is contagious. Also special mention deserve the little class on interviewing techniques and grounded research by Henk Wagenaar, and the 2008 Lugano class on systems design by Werner Ulrich and Peter Checkland. Both helped me to untangle what all these 'systems' are made of, together with fellow researchers equally passionate but heading for different directions.

The above thanks going out to 'whomever the shoe fits', a few more specific thanks are in place: Jasper Eshuis, for being a great roommate at EUR; I cherish our rainy evenings at Locus and other places. Flor Avelino, for friendship and shared bewilderment over the fate of the three P's, Nienke van Schie for encouraging talks at the doorstep, Sibout Nooteboom for adventures in hyperincursion, Derk Loorbach for talking loud and saying a lot, Lasse Gerrits for his craving for complexity, Peter Marks, Arthur Edwards and Bram Steijn for seducing me into chess-related talks under working hours, Hans Jeekel for personal 'travel information', Ig Snellen for his 'shifting structures of relevance', Niki Frantzeskaki for kindness and genuine interest in my '99 steps from theory to policy', Wouter Spekkink and Stefan Verweij for trying to make headway while having me on board, and Karen van Mullem for making the administrative hassle into pleasant intermezzos.

For my friends I need few words; as you know, much has been said and will be said. Thanks for all: Coenraad (setting me on the right track), Attila (talking about plants & drinking beer), Annemiek (because you're worth it), Ayi (have we really been study mates?), Fred (take care with that pine!), Anne (der Räuber und der Prinz), John (seems Tiger forgot to mention that one..), Lambertus (always hoping for that double Novotny), Laszlo & Klara (knock out in the first round), Leonie (could you repeat that, a bit more slowly?) and Erno (the midget from Minneapolis was grand).

A lot of reductionist nonsense has been written about genes and brains (forgetting that it is all about television…). Speaking for myself, I do have to admit that any ingenuity in this book can be easily traced back to my wonderful family. I thank my parents for unconditional support, and lifelong education. I also wish to thank my sisters: First for who you are, second for the considerable bonus I got in the persons of Pietro and Michal, Jan, and Dana & Eva. To the latter three: Welcome, enjoy your stay on spaceship Earth. Meanwhile, my grandparents have always been beacons of humanity and decency in a world that can be disappointing.

Finalmente, Paula, a minha linda namorada. Como começávamos falar, mesmo entender, e apaixonar, é inacreditável. Poderia ser um bom exemplo de 'sincronização', enquanto sei que não esta exatamente facil. Ainda deixam alguns desafios a superar. Mas como eu estou feliz todos os dias com o seu amor, quero te agradecer por a sua dedicação, a sua paciência e a sua perseverança…e por que pode imaginar muito ;)!

About the author

Bonno Pel started his academic training at the University of Amsterdam. In the course of his studies in spatial planning, he specialized in environmental and transportation planning. His specific interests involved planning theory and the challenges of governing current mobility problems. The insights into these challenges he deepened through his studies in socio-political philosophy at the same university, graduating (with distinction) in 2004. In 2006 he joined the Public Administration department at the Erasmus University of Rotterdam, to conduct his dissertation research on the governance of system innovations and transitions. This research, funded by the KSI program on system innovations and transitions, focused on 'system innovation in the making'. Inspired by insights from the sociology of innovation and various theories on governance in polycentric societies, he approached system innovation immanently - as a process in which it emerges from innovation attempts, actors' translations of those, and their efforts to synchronize between translations. Having conducted the research as a member of the Governance of Complex Systems (GOCS) research group, he has grown a fascination for the complex interplay and emergent outcomes of actors' behaviors in compounded governance systems.

Currently, Bonno works as a postdoctoral researcher at GOCS. This involves mainly the interdisciplinary NWO/NICIS research project on ‘Integral Planning and Design in the southwest Delta’ (IPDD), which confronts synchronization challenges as they occur in the Dutch Southwest delta area. This cooperation between spatial designers, governance researchers and experts in Geographical Information Systems aims to develop a complexity-sensitive methodic for spatial planning and design in delta areas. As such, it provides research on system innovations and transitions with geographical concreteness, and allows to test translation-dynamic insight in the domains of water management and spatial planning.

Intertwined with his scientific explorations he has a longstanding passion for chess. In this game of decision-making under uncertainty he obtained the title of FIDE-master in 2003. Another source of curiosity, insight and pleasure are his sustained efforts to master languages: Next to a good to reasonable command of Dutch, English, German and French, Bonno currently seeks to make himself understandable in Portuguese.