

INTELLECTUAL PATHS AND PATHOLOGIES

How Small Events In Scholarly Life Accidentally Grow Big

Path dependence Historical small events Misrepresentation of economic ideas Errors in human thought
Incommensurability of scientific knowledge Discontinuity in the progress of economic ideas The Texas Thruway
Unfortunate accidents of history Contingency Textured inequality Ignorance Unproductivity Intellectual
band Significance tests Ronald Coase Arthur Cecil Pigou George Stigler *Theory of Price* (1953) Aaron
Director *Journal of Economics and Law* Milton Friedman Perfect competition Arnold Harberger John
Mc Dow Chicago School of Economics "The Federal Communications Commission" (1959) "The Problem
of Social Cost" (1960) Arguments of property rights Robert Polak Incommensurable and Walls of Knowledge
Transactions costs in economics Abba Lerner Transactions costs Desirable Transactions costs Coase's theory
Efficient allocation of resources Negative externalities Government intervention Blackboard economics
Oscar Meltzer *Likelihood of Economics* (1965) Ourselves "How much?" Also mentions Aron Klamer Formula
call and conversation Phillip Mirowski *Evolution of scientific knowledge* Piore's formula Human capital
James White *Economic capital in scholarly life* *Examination of the economic and intellectual history* John
Dewey Charles S. Peirce William James Pragmatism Market for ideas Empirical evidence Logical infer-
ences Logical incommensurability Economic innovation Logically consistent Pathology Misrepresentation of
ideas Replication Failure Evolution of scholarly institutions Institutional history of economics Market
failure in academic economics Heidi Weiss Reproduction of old findings Intellectual path dependence
Intellectual pathologies Systematic mistakes Capability of error Self-reproducing Self-correcting Intel-
lectual sink zones Cost-benefit analysis of research programs Epistemic loss Evolutionary economics
Institutional history of economic ideas Searching for the truth Social capital Friedrich Hayek Dialectical
philosophy Socially constructed Economically constructed Karl Popper Critical rationalism Negative

Altuğ YALÇINTAŞ

The initial conditions of certain ways of thinking sometimes lock us in to particular pathways. Such pathways occur when the follow-up of small events catches intellectuals in its complex web irreversibly and grow bigger in the future. The distinctive property of such conditions is that the evolution of ideas does not necessarily lead to any pre-defined end point. Small events trigger shifts in the course of events and this leads to (extra-) positive or (extra-) negative consequences that move the system away from its systematic course. After small events take place, complex webs of scholarly life function in either of two ways: (i) as a short-cut that moves the system to a better state and elevates it to higher levels of order which could only be reached within longer time spans if there had been no interruptions or (ii) as a hindrance that would break the system down and disallow intellectuals to proceed further and achieve intellectual advancement. When historical small events become a hindrance (ii), a little uncorrected error sometimes feeds back a negative cumulative effect on the progress of scientific knowledge. When historical small events operate as a short-cut (i), however, the conditions that turn an event into a starting point of a new pathway can be the breaking point of an old one as such that they unlock the old course of events bearing path dependent properties and perhaps lead to more complex evolutionary pathways. This would mean an upward movement of the system to more coherent and sophisticated levels.

argument Falsifiability Verification Incoherence Lakatos Hard core Cumulative progress of knowledge Opportunity cost of time Positive heuristic Continuous growth Scientific advancement Long-run equilibrium Long-run Linear and non-linearly fitted processes The normal and the pathological Locus Publicus Tharstein Volden 'Why is Economics not an Evolutionary Science?' (1998) Britain's coal wigwag Gunnar Myrdal Cumulative causation John Gungorlo First cause Tipping point Best-of-all-possible-worlds First-best Second-best Attention space Lock-in Lock-out Loss of memory Science wars Paul David 'Clio and the Economics of QWERTY' (1995) QWERTY QWERTY-morities Dvorak Stochasticity Ergodicity Historical narrative Quest for historical economics Brian Arthur 'Competing Technologies, Increasing Returns and Lock-in by Historical Events' (1983) VHS / Beta video systems Silicon Valley Microsoft Trial Decreasing returns Increasing returns Network effects Agglomeration effect Self-reinforcement Palya-Uru process 'History matters' Historically contingent evolution Douglass North Institutions, Institutional Change, and Economic Performance (1990) Belief systems Mental models Uncertainty Ideology Complexity Positive feedback loops Monopolisation Sean Lichowitz Sean Margolis Initial conditions Hereditary interruptions Penetration Colloquialism De Schurck Frictional costs Positive feedback mechanisms *Alle vestjes steemen in het witte* Equilibrium Competition for attention Increasing returns to scientific scale Habits of thought Sub-optimality Path creation Historical specificity Thomas Kuhn Paradigm shift Replaying the tape of life Stephen J. Gould Punctuated equilibrium Carriers of history Irreversibility Inertia Richard Barry Small event-log consequence scheme Op-up Education Domino effect Chain reactions Perfection Mark Blaug Positivism in economics Friedrich Hayek Thomas More Condorcet Perfection Utopia Figures of speech Metaphor Richard Dawkins Repeated perfection

INTELLECTUAL PATHS AND PATHOLOGIES

How Small Events In Scholarly Life Accidentally Grow Big

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How small events in scholarly life accidentally grow big

INTELLECTUELE PADEN EN PATHOLOGIEËN:
Hoe kleine gebeurtenissen in de wetenschap toevallig groot worden

Thesis

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Prof.dr. E. M. SENT

To Zafer Ekin KARABAY and Burak TOLUNAY

Welcome to the world of path dependence, a world governed not by our stars, not by ourselves, but by insignificant accidents of history. In this unpredictable world, small, seemingly inconsequential decisions lead inexorably to uncontrollable consequences. Ingestion of a fly leads an old lady to swallow a spider, a bird, a cat, a dog, a goat, a cow, and then, tragically, a horse. A typewriter keyboard arrangement that solves a temporary mechanical problem on the first typewriter becomes entrenched as the standard for generations to come, even though it is notoriously inefficient. A head start for one computer operating system ensures its persistence, even against superior alternatives. In the world of path dependence, because individual decisions that may seem inconsequential or privately rational lead to large, lingering, and widely felt consequences, our expectations for market outcomes are turned upside down. The Invisible Hand does not work in the world of path dependence. Or so it is claimed.

Liebowitz and Margolis 1995a

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Preface and Acknowledgements

How do ideas evolve actually? Often, there is more than one pathway of advancement in which different ideas emerge and flow in different directions. Does this mean that there is no advancement in intellectual history? Or, are pathways constituents of scholarship?

In this work, I argue that it is possible to understand the course of history as a bunch of overlapping, divergent, and endlessly changing pathways. Such pathways operate in different fashions. They sometimes lead to more coherent and higher levels of understanding. And sometimes they delay or obstruct advancement in intellectual history. In either way, outcomes are unpredictable and multi-directional.

Tangled pathways of intellectual history emerge as consequences of small, seemingly unimportant events of the past. There is a great score of scholarly examples in which small events or objects are argued to have changed the course of history in

dramatic ways. Lynn White argues in his *Medieval Technology and Social Change* (1962) that feudal nobles achieved their status during the Middle Ages by virtue of a small but sudden shift in the methods of warfare. Horses, although domesticated since 4,000 BC, became a serious power in the battlefield only after the rider was equipped with a technological invention in the eighth century: stirrups. A stirrup was a little wooden or iron ring hung under the saddle to support the rider's foot, without which the seat of the rider on the horse was instable. Horses gifted the riders a great advantage of mobility over the footmen in the field longtime before the introduction of stirrups but without stirrups the rider was limited in his methods of fighting: the spear was used with the strength of the shoulders and muscles and there was always the risk of the rider finding himself on the ground after a powerful mode of attack. After stirrups the blow was delivered with the combination of the muscles and charging horse. The rider mounted was thus much more stable and powerful.

William Rosen argues in his *Justinian's Flea: Plague, Empire, and the Birth of Europe* (2007) that in the transformation of the Mediterranean into medieval Europe and proto-nation states, a very little factor, a flea and a bacterium that it carried, *Yersinia Pestis*, played the most significant role and gave rise to very big results in respect to its initial size. This bacterium brought about the plague that caused widespread death throughout Europe. Such transformations in history usually come about as a consequence of big events only but, as a matter of fact, Rosen shows, 'a moment in history' is sometimes sufficient to change everything upside down at catastrophic speeds.

Edward N. Lorenz, the author of *The Essence of Chaos* (1982), presented a paper at the 139th meeting of the American Association for the Advancement of Science in Washington D.C. in 1972 in which he showed how the 'flap of a butterfly's wings in Brazil [may] set off a tornado in Texas.' The paper was the very occasion in which the expression of 'butterfly effect' appeared in the scientific literature for the first time. Butterfly effect, now a 'symbol of the small that can produce the great' (Lorenz 1982: 15), highlights the fact that minuscule disturbances in weather conditions disallow us to accurately predict the occurrences in the atmosphere in distant futures.

'Small matters.' Although it is true in some physical and anatomical sense that cannon balls are bigger than stirrups and fleas and butterflies are smaller than cows and horses, it is not the reason. What is intended is not exactly the size of the objects involved in the stories. Rather it is the specificity of seemingly less significant causes

that give rise to more significant consequences. What matters is the amplification process - not necessarily the objects themselves such as stirrups or fleas or butterflies. The specificity of the occasion in which size matters is the relative relation between inputs and outputs where causes are amplified and give rise to big consequences.

Historical small events point out a difference of size among events in terms of their significance in a specific occasion. The dissertation focuses on this and applies it to the workings of scholarly life in order explain a phenomenon which is not rare and ignorable in the intellectual history of economics. The central theme here is historical small events and the ways in which they accidentally grow big and generate substantial consequences for scholars in the academia and for intellectuals in general.

*

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Parts of this dissertation have been presented in the 2003 Cambridge University Meeting of 'The Future of Economics' (UK), 2005 Annual European Conference on the History of Economics (Austria), 2006 European Association for Evolutionary Political Economy Meeting (Turkey), 2006 and 2007 Conferences of the Association for Heterodox Economics (UK) as well as a number of seminars in the Netherlands, Belgium, and Turkey between 2001 and 2005.

Finally, I would like to acknowledge several sponsors that contributed to this project by way of raising generous funds. The research fellowship from the Higher Education Council of Turkey (YÖK) allowed me to stay and research at Erasmus University Rotterdam between 2001 and 2004. Ankara University has hosted me as a research fellow at the Economics Department of *Mekteb-i Mülkiye* since 1998. The Scientific and Technological Research Council of Turkey (TÜBİTAK), Erasmus Institute for Philosophy and Economics (EIPE), Vereniging Trustfonds, Economic History Association, and American Institute for Economic Research granted me fellowships to attend to a number meetings and conferences between 2002 and 2007.

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Ankara, September 2009

PART I

PATHOLOGIES IN SCHOLARLY LIFE

[C]ontingent details do not necessarily wash out over time; rather, they make history forever after, body and soul. If Paul of Tarsus ... had never lived, Christianity might well have sputtered and died aborning, remembered (if at all) as one of many short-lived and immediately forgotten Messianic sects.

Gould 1999

Errors in the finer structure, having attained appreciable size, tend to induce errors in the coarser structure. This result ... implied that after a day or so there will be appreciable errors in the coarser structure, which will thereafter grow just as if they had been present initially. Cutting the observation error in the finer structure in half - a formidable task - would extend the range of acceptable prediction of even the coarser structure only by hours or less. The hopes for predicting two weeks or more in advance are thus greatly diminished

Lorenz 1972: 183

The sociological question is how such an error as the Rule of Two can persist. Or, rather, that is the economic question because sociologists have less trouble than economists do - another trained incapacity - in supposing that people can persist in gross ignorance year after year. Economists are likely to wonder why some smart person doesn't pick up the large-denomination bill lying on the ground and start a new intellectual firm, reaping the profits. If null-hypothesis significance testing is as idiotic as we and its other critics have so long believed, how on earth has it survived?

Ziliak and McCloskey 2008: 240

Life is capable of error. Error is at the root of what makes human thought and its history ... If the history of science is discontinuous, that is, if it can be analyzed only as a series of 'corrections,' as a new distribution of true and false which never finally, once and for all, liberates truth, it is because there, too, 'error' constitutes not overlooking or delaying a truth but the dimension proper to the life of man and to the time of the species.

Foucault 1991: 22

The ‘Coase Theorem’ vs. Coase Theorem Proper

**Or, how an error emerged
and remained uncorrected so long**

George Stigler invited Ronald Coase to Chicago in 1959 to give a speech at a workshop that he organized. Coase accepted the invitation. After the workshop Coase asked the learned audience of Chicago to hold a special meeting to discuss his approach to the ‘rationale of property rights’ which the Chicagoans thought was an error and Coase should delete from his 1959 article, ‘The Federal Communications Commission.’ The meeting was arranged. Big shots of Chicago gathered at the residence of Aaron Director, the founder of the *Journal of Economics and Law*. Milton Friedman, Arnold Harberger, and John McGee were at the meeting. ‘How could such a fine economist like Coase think,’ his fellows at Chicago wondered, ‘that there were costs involved in the operation of price mechanism in the market?’ The discussion took about two hours. It was during this meeting that Coase convinced his Chicago colleagues of his argument. And so was it possible for the next generation of economists to know ‘probably the most widely cited article in the whole of the modern economic literature.’ ‘I persuaded these economists that I was right,’ reported Coase in

his autobiographical Nobel Prize speech in 1991, 'and I was asked to write up my argument for publication in the *Journal of Law and Economics* Had it not been for the fact that these economists at the University of Chicago thought that I had made an error in my article on "The Federal Communications Commission," it is probable that "The Problem of Social Cost [1960]" would never have been written' (Coase 1992a. See also Stigler 1985: 75-80.)

Coase's 1960 article deserves special attention in the history of economic thought. Firstly, the innovative idea that the article developed has spread fast and broad in economics. (See Appendices A, B, and C.) And secondly, the life history of the idea has featured distinguishing properties making the article unique in intellectual history. (For a survey of Coase's contribution to economic analysis see Zerbe 1980, Medema 1994, and Mercurio and Medema 2006.) In this essay, I focus on the following one: that the actual message of Coase has been misrepresented and Coase's main message in the article contradicted the 'Coase Theorem' (Medema 1994, 1999, 2002, McCloskey 1998, Usher 1998, and Fox 2007). My view is that the evolution of the 'Coase Theorem' is an example to intellectual path dependence in economics. I argue that the second-generation models built upon the 'Coase Theorem' have failed to replicate the results of the previous generation (i.e. Stigler 1966 and others) and the controversy in the real message of Coase (1960) has remained unresolved. The contradiction is common: in a survey that I conducted (see below) I found out that of the most cited articles referring to the 'Coase Theorem' 75 percent misrepresented Coase 1960. (See also Buttler and Garnett 2003 for another survey in which the authors reported that of 45 economics textbooks 80 percent misrepresented Coase's main argument.) The evolutionary mechanism that gives rise to such results is 'replication failure.' An economic view of replication failure in science suggest that error and mistakes are a constant aspect of the scientific endeavor ... [T]he continuous presence of faulty research is a by-product of scarce resources being focused on a quest for innovative discoveries' (Wible 1998: 43). The main reason for such contradictions in the history of ideas not to disappear easily (or not at all) is that the history of ideas does not always function so as to fix errors fully. In other words, the market for ideas does not operate like a perfect market and the effects of several small events, such as errors and misrepresentations in analyses, often remain uncorrected for long periods due to high 'epistemic costs' of replicating old findings. This suggests that the scholarly life of economists is rather a *positive transaction costs* world in which negative externalities (e.g. misrepresentations

of ideas) are not always and perfectly self-corrective. Positive feedback loops in the world in which intellectuals live and operate (such as journals, conferences, and other informal meetings) do not allow perfecting solutions to come about so easily. The invisible hand in the market for ideas, so to speak, often operates undesirably and errors frequently remain uncorrected.

Coase Theorem Proper and the 'Coase Theorem' as Economists Know It

The main point in Coase's 1960 article, 'The Problem of Social Cost,' was to provide a criticism of the established theory of negative externalities. According to Coase, accounts of negative externalities were inadequate; the price mechanism was not easily able to solve the problems that arose out of the harmful effects of individual actions on others. Economists, since Arthur Cecil Pigou, have believed that taxes and other kinds of governmental regulations were the best ways of diminishing the negative effects of individual behavior. In view of that, the government should restrain those responsible for the 'harmful effects' of individual action in the market. Although this was not unwise, Coase argued, such a solution would depend on whether the 'gain from preventing the harm is greater than the loss which would be suffered elsewhere as a result of stopping the action which produces the harm' (Coase 1960). There is no single solution to every problem in the market. Economists should be more concerned with the consequences that happen in actual cases - not merely with the consequences that happen on the blackboard only.

For Coase, the problem was to understand the causation between the parties in which one party is supposed to inflict harm upon the other. The problem featured a reciprocal nature: 'To avoid the harm to B would inflict harm on A,' wrote Coase, 'The real question that has to be decided is: should A be allowed to harm B or should B be allowed to harm A? The problem is to avoid the more serious harm.' Carrying out market transactions (such as conducting negotiations with parties, drawing up a contract, reaching an agreement about the terms of the contract, and so on) were costly - 'sufficiently costly at any rate,' wrote Coase, 'to prevent many transactions that would be carried out in a world in which the pricing system worked without cost' (Coase 1960). In other words, the positive transactions cost world in which we live does not always allow parties to conduct negotiations that end up with an efficient (re-)allocation of resources and rights. Under positive transaction costs, 'the initial delimitation of rights does have an effect on the efficiency with which the economic system operates' (Coase

1960). Then, assigning private property rights (no matter to whom) might be a solution to the problem of social cost as negative externalities are not self-corrective. In other words, in the world we live we need a legal system that prevents one party from inflicting harm on another, instead of a ruling state that punishes, by way of introducing taxes, the party responsible for the harm. The problem is, therefore, to decide on the appropriate social arrangement for possible harmful effects. This requires a case-by-case investigation of different ways of handling the problem.

Coase introduced his view in 1960. But the 'Coase Theorem' became established in economic theory only after Stigler's third addition of his *Theory of Price* (1966). (The first edition of the book appeared in 1952. It did not mention any of Coase's works.) According to Stigler, Coase's 1960 article raised important issues about the efficiency of markets, government intervention, and property rights. In a famous passage, Stigler said thus: '[t]he Coase theorem thus asserts that under perfect competition private and social costs will be equal. It is a more remarkable proposition to us older economists who have believed the opposite for a generation, than it will appear to the young reader who was never wrong, here' (Stigler 1966: 113). Having introduced the 'new' conception into economic theory, Stigler, in his later career, did not seriously return to any other original publication of Coase but cited Coase (1960) in his more recent works only twice, in 1983 and in 1989 (see Stigler 1983 and 1989). The 'theorem,' as economists know it, has since become an important topic of investigation. (For a collection of major articles on the 'Coase Theorem' see Volume II of Medema 1995. See also Appendix D for a list of most cited article referring to the 'Coase Theorem'.)

A common misrepresentation regarding Coase's contribution is that the 'Coase Theorem' is elaborated as if Coase himself argued there were no transaction costs in the market. But in fact he did not argue this. Coase instead argued that there are transaction costs in the market; therefore, externalities might cause an inefficient allocation of resources and government intervention may be needed. Transaction costs are not always negligible, Coase claimed, and this is the reason why resources may not move to their highest value and consumers may not be able to direct the resources to where these resources yield the highest value.

The controversy over 'Coase Theorem' is that in a number of important articles and books, that of Stigler (1966) being the first, the 'Coase Theorem' has been analyzed as if Coase argued that the world in which we lived was a world of zero transaction costs.

This 'theorem,' however, was not a proper formulation of Coase's message. Coase did not argue that the pricing system worked without costs. The reason why he used the example of zero transaction costs was (i) heuristic (Zerbe 1980) and (ii) he showed that even under the assumption of zero transaction costs, the Pigouvian system was 'inadequate' and 'incorrect' (Medema 1995). The misunderstanding about the original message of Coase has come out in Coase's Nobel Prize Lecture in 1991. Almost 50 years after Coase first published his 'The Problem of Social Cost,' the consequence of the initial condition under which Coase's contribution was first formulated (Stigler 1966) is not eliminated. The market for ideas, in Coase's own terms (1974b), has failed to correct the error fully even today.

In order to better account for Stigler's misrepresentation of Coase's articulation, I reformulate below the 'Coase Theorem' and Coase Theorem Proper through Propositions I to IV. I conclude that logically true and yet transformed arguments in social sciences do not always yield economically (or theoretically) significant (and true) results when they are applied to the facts of the world. To put it differently, while the propositions below are all logically consistent with each other, they give rise to dissimilar and useless policy implications at pragmatic levels. For instance, Propositions III and IV are useless, even if not wrong, because the theorem stated as such has no 'universally-recognized content' (Usher 1998). In other words, the argument of 'absence of transaction costs' is tautological. The 'core' of the 'Coase Theorem' is empty (Aivazian and Callen 1981). 'I would not wish to conclude,' reports Coase (1981), 'that, while consideration of what would happen in a world of zero transaction costs can give us valuable insights, these insights are, in my view, without value except as steps on the way to the analysis of the real world of positive transaction costs. We do not do well to devote ourselves to a detailed study of the world of zero transaction costs, like augurs divining the future by the minute inspection of the entrails of a goose.'

FIGURE 1: THE 'COASE THEOREM' AND THE COASE THEOREM PROPER

	Coase Theorem Proper	The 'Coase Theorem'	Conditional	Result
Proposition I	•		Positive transaction costs	Contracts are not full, externalities cause inefficient allocation of resources, consumers may not direct their resources to the highest value
Proposition II	•		A	B, C, and D
Proposition III		•	Zero transaction costs	Contracts are full, there is perfect information in markets, assigning property rights does not have any effect on efficient allocation of resources
Proposition IV		•	A'	B', C', and D'

PROPOSITION I: Under conditions of positive transaction costs; externalities cause an inefficient allocation of resources.

Coase asserts that the world we live in is a positive transaction costs world in which economic transactions give rise to a number of significant consequences: contracts are not full, externalities cause an inefficient allocation of resources, and consumers may not direct their resources to where they yield the highest value. In a positive transaction costs world, government intervention is likely and second best solutions often take place. Proposition I states that there is a strong causality between the conditional (positive transactions) and the result (externalities causing an inefficient allocation of resources). The reason why, say, consumers may not direct their resources to the most valued is that economic life is a world of positive transactions cost.

PROPOSITION II: Under conditions of A; B and C and D happen.

Coase Theorem Proper asserts, in abstract terms, that the condition for B, C, and D to take place is A. In other words, if and when A happens, then B, C, and D happen. Coase argued that a 'realistic' assumption for economic science is that the world is A because transaction costs are high and not at all times ignorable. That is, if economists take positive transaction costs into consideration, their models would yield better results.

PROPOSITION III: Under conditions of zero transaction costs; assigning property

rights does not have any effect on efficient resource allocation.

This is what Stigler claims that Coase argues in his 1960 article and is thus the 'Coase Theorem.' At first glance, it may seem that Proposition III is necessarily true if Propositions I and II are also true because (i) both the conditional and the result are negated and (ii) causality is well preserved in Proposition III. This proposition may not be true beyond outside the blackboard, however. In order to prove a proposition that runs in the opposite direction of an original thesis, strong empirical evidence is necessary. Logical inferences do not always yield best practices in the 'real world' and it is not always possible, insofar as economic modeling is concerned, to use blackboard models so as to reach functional policy implications. In other words, logical innovations do not necessarily amount or give rise to economic innovations at all times in the world we live in. The pragmatic content (as well as ideological consequences) of an argument may not be preserved when they are transformed into another argument which is logically true in abstract terms. For instance, one may 'have a say' about financial markets which economists think is plausible. You may have a true proposition about mortgage funds and the turmoil that they may lead to in global markets. Transforming (i.e. negating) the conditionals of your proposition that logically gives rise to the opposite of the result of the proposition does not necessarily yield pragmatic results for financial actors in the economy. Nobody would find it useful to derive the opposite of true economic doctrines and apply them in the economic world unless they enhance our theoretical understanding of the facts of the world.

Logically, the opposite of the original conditional in Propositions I and II (conditions of zero transaction costs) leads to the opposite of the original result (efficient allocation of resources). However, pragmatically, such a transformation does not mean that the conditions we live in are identical to the conditions that the logically transformed arguments amount to. This suggests that logically true arguments may pragmatically be incorrect because they may refer to a world that does not exist beyond outside of the blackboard.

PROPOSITION IV: Under conditions of A'; B' and C' and D' happen

In abstract terms, Stigler claims that conditional A' results in B', C', and D'. This is not incorrect from a logical point of view, as I have already reported. In fact, this reasoning is quite widespread among economists (see the 'Survey' below). It is debatable,

however, whether Propositions III and IV are economically significant and whether they produce any theoretical innovation. What is certain is that Propositions III and IV are not what Coase argued in 1960. It is only what Stigler claimed Coase argued in his 1960 paper.

To sum up: Propositions I to IV are logically consistent but in economic science Propositions III and IV merely create an artificial world in which abstract terms and equations operate on the blackboard only. Such logical inferences are helpful in scientific research. But this does not mean that conditions of the world is A'. As a matter of fact, Coase argued that the world is A; therefore B, C, and D. He did not argue for a world of A'.

In effect, Stigler's interpretation of Coase (1960) (i.e. Propositions III and IV) has made Coase's contribution disappear. The 'Coase Theorem' in actuality had been stated long before Coase, and therefore does not belong to the works of Coase, but of Adam Smith. In other words, the 'Coase Theorem' existed even before Coase (Friedman, *Mimeo*). One would never need the 'Coase Theorem,' as Coase himself reports also, to say that 'people will use resources in the way that produces the most value' (Hazlett 1997). This amounts to saying that we are living in a world without transaction costs. However, Coase believed in the contrary: we live in a world of positive transaction costs. The naming of the 'Coase Theorem' is, therefore, erroneous because the theorem meant the opposite of what Coase wrote in his works. There may be a few exceptional occasions outside the blackboard world in which transaction costs are so low (still positive though) as to be taken into consideration. Coase did not exclude this possibility. Nevertheless, the origin of the theorem is controversial since the message of the 'Coase Theorem' is not what Coase meant in 1960. Implications of the 'Coase Theorem' are not always useful because the assumption of a zero transaction costs world is too restrictive and presupposes a world that does not comply with the facts of the world.

The Error was, in fact, Detected, but...

Coase raised the issue himself in (1988b: 15). He said:

What my argument does suggest is the need to introduce positive transaction costs explicitly into economic analysis so that we can study the world that exists. This has not been the effect of my article. The extensive discussion in the journals has concentrated almost entirely on the 'Coase Theorem,' a proposition about the world of zero transac-

tion costs. This response, although disappointing, is undesirable.

McCloskey pointed out the issue as well (see McCloskey 1993, 1998, and 1996). McCloskey considers Stigler to be one of the worst historians of economic thought. Stigler 'used the history as an ideological tool,' she says, 'and was ruthless in doing so. He read a lot but was defective in paying attention. Thus the Coase Theorem' (McCloskey 1998).

The 'Coase' theorem as understood by George Stigler or Paul Samuelson is actually Adam Smith's theorem (1776). It is wholly explicit in F. Y. Edgeworth (1881, 30ff, 114); and with all the bells and whistles in Arrow and Debreu (1954). Smith, Edgeworth, Arrow, Debreu, with many others, noted that an item gravitates by exchange into the hands of the person who values it the most, if transactions costs (such as the cost of transportation) are not too high. Why a student of economic thought like Stigler would call this old idea in economics 'remarkable' I do not know, though it is not the only strange reading that Stigler gave. Applying it to pollution rights is unremarkable. As Paul Samuelson said sneeringly about the 'Coase' theorem: Where's the theorem? (McCloskey 1998)

This shows that the error has been detected and reported a number of times for more than a decade. Then, quite naturally, one would expect the error to be corrected. The findings show, however, that this has not happened. The invisible hand, so to speak, has not operated desirably in the market for ideas and the error been left uncorrected.

In order to prove this, I have conducted a survey of about 40 articles on the 'Coase Theorem' and economic textbooks referring to the 'Coase Theorem' which are frequently cited in the economic literature. I analyzed them closely in order to see whether (and to what extent) economists have subscribed to the 'Coase Theorem' in their works. Table 4.4 gives a summary of the findings.

Authors of the articles reported in the survey contributed to the economic literature using the central theme in the 'Coase Theorem.' In so doing, they referred to the works of Coase as well as Stigler. The table is organized in four sub-categories in all of which there are four columns showing (i) whether the article has referred to any of the works of Coase and Stigler and (ii) in what sense the article used the findings of Coase (1960). A selection of quotations from the articles is provided below in order for the reviewer to make sure that the works cited are correctly classified. These cited passages are often where the author(s) set(s) out the methodology of their work.

In passing, it is important to note that economists would refer to Coase even if they didn't mention Stigler's 1966 book. Many economists referred to variety of works by Coase, for instance, in order to replicate or at least apply his findings regarding, say, the nature of the firm (Coase 1937) or public goods (Coase 1974b). Economists read the writings of Coase not because Stigler, who is highly regarded, formulated the 'Coase Theorem' and referred to Coase (1960) in his 1966 book. Coase would have been influential in the field of economics even without Stigler. One of his first articles in 1937, 'The Nature of the Firm,' is a seminal work in evolutionary and institutional economics. Had Stigler not read Coase, Coase (1960) would perhaps have been read more or less frequently than today - but, without doubt, more accurately. Stigler directed attention to the 'Coase Theorem' but he could have 'invented' the theorem even if he had not examined Coase (1960).

FIGURE 2: SURVEY SUMMARY, THE 'COASE THEOREM' AND COASE THEOREM PROPER

(A): MOST CITED 10 ARTICLES ON THE 'COASE THEOREM'

	PUBLICATION	NUMBER OF CITATIONS	COASE	STIGLER	The 'Coase Theorem'	The Coase Theorem Proper
1	KAHNEMAN, KNETSCH AND THALER (1990)	559	0	•	•	0
2	JOLLS, SUNSTEIN, AND THALER (1998)	306	•	•	•	0
3	HOFFMAN <i>et al.</i> (1994)	232	0	0	N/A	N/A
4	ELHAUGE (1991)	194	•	•	•	0
5	HOFFMAN AND SPITZER (1982)	121	•	•	•	0
6	KAPLOW AND SHAVELL (1996)	117	•	0	•	0
7	KELMAN (1979)	95	•	•	•	0
8	KOROBKIN (1998b)	83	•	0	•	0
9	KRIER AND SCHWAB (1995)	74	•	0	•	0
10	LEMLEY (1995)	67	•	0	•	0
	TOTAL	1848	8	5	9	0

(B): MOST RECENT 10 ARTICLES ON THE 'COASE THEOREM'

	PUBLICATION	NUMBER OF CITATIONS	COASE	STIGLER	The 'Coase Theorem'	The Coase Theorem Proper
1	MACHADO (2008)	0	•	0	•	0
2	LAI AND HUNG (2008)	0	•	•	•	0
3	ROBSON (2008)	0	•	•	0	•
4	WHITMAN (2008)	0	•	0	0	•
5	PITCHFORD AND SNYDER (2007)	0	•	•	0	•

6	HALPIN (2007)	0	•	•	0	•
7	ROSENKRANZ AND SCHMIT (2007)	0	•	0	•	0
8	CHARNESS <i>et al.</i> (2007)	0	•	0	•	0
9	COHEN AND SANTHAKUMAR (2007)	0	•	0	•	0
10	LEE AND SABOURINA (2007)	0	•	0	•	0
TOTAL		0	10	4	6	4

(C): FIRST 10 ARTICLES ON THE 'COASE THEOREM'

PUBLICATION	NUMBER OF CITATIONS	COASE	STIGLER	The 'Coase Theorem'	The Coase Theorem Proper
1 NUTTER (1968)	18	•	•	•	0
2 MUMEY (1971)	17	•	•	•	0
3 GIFFORD AND STONE (1973)	14	•	0	•	0
4 DARGE (1973)	4	•	0	•	0
5 BUCHANAN (1973)	21	•	0	•	0
6 INADA AND KUGAK (1973)	8	•	0	•	0
7 FRECH (1973)	7	•	0	•	0
8 GIFFORD (1974)	1	•	0	•	0
9 SAMUELS (1974)	27	•	0	•	0
10 SHAPIRO (1974)	8	0	0	•	0
TOTAL	125	9	2	10	0

(D): MOST CITED 10 ARTICLES ON THE 'COASE THEOREM' AFTER 1991

	PUBLICATION	NUMBER OF CITATIONS	COASE	STIGLER	The 'Coase Theorem'	The Coase Theorem Proper
1	JOLLS AND SUNSTEIN (1998)	306	•	•	•	0
	HOFFMAN, MCCABE, SHACHAT, AND SMITH					
2	(1994)	233	0	0	N/A	N/A
3	ELHAUGE (1991)	194	•	•	•	0
4	KAPLOW AND SHAVELL (1996)	117	•	0	•	0
5	KOROBKIN (1998a)	83	•	0	•	0
6	KRIER AND SCHWAB (1995)	74	•	0	•	0
7	LEMLEY (1995)	67	•	0	•	0
8	GROSS (2003)	59	0	0	N/A	N/A
9	KOROBKIN (1998a)	48	•	0	•	0
10	HOVENKAMP (1991)	47	0	•	N/A	N/A
TOTAL		1228	7	3	7	0
TOTAL (GENERAL)		3201	34	14	32	4

SOURCE: Scientific - Thomson Reuters © ISI Web of Knowledge <http://www.isiknowledge.com>
[Accessed in December 2008]

* Works considered for column 'Coase': Coase (1937, 1960, and 1966)

* Works considered for column 'Stigler': Stigler (1966, 1971, 1974, and 1975)

The findings are parallel to the results of a survey conducted by Buttler and Garnett (2003) in which they examined textbook representations of the 'Coase Theorem' only: 'A few get it right.' The survey conducted here relies on the most frequently cited articles on the 'Coase Theorem' since 1968 and suggests the following:

1. 75% of the articles listed subscribe to the 'Coase Theorem.' Stigler's interpretation of Coase (1960) has dominated the history of economic ideas for five decades.
2. None of the articles in Category A and Category C (20 articles in total) subscribe to the Coase Theorem Proper. Publications right after Stigler's *Theory of Price* (1966) as well as the most frequently cited articles on transaction costs and other related fields fully adopted Stigler's interpretation.
3. Not much has changed after Coase's Nobel Prize speech: none of the ten most cited articles after 1991 subscribe to the Coase Theorem Proper.
4. The most cited article on the 'Coase Theorem' (Kahneman, Knetsch, and Thaler 1990) did not cite any works of Coase. Additionally, almost half of the articles citing one (or more) of Coase's works also cited one (or more) of Stigler's works. Stigler has a visible impact on the literature.
5. In more recent years, the market for ideas seems to have started to correct the error and replicate Coase's original findings (1960). In the past three years, half of the articles on transaction costs and other related fields subscribed to the Coase Theorem Proper. The powerful effect of Stigler's 1966 book still exists after 50 years and the 'Coase Theorem' is still widespread among economists even after several publications reporting Stigler's misrepresentation.

Evidence

I picked the first ten articles from Categories (A) to (D) (see below) using the database of the ISI Web of Knowledge. Citation figures of the articles in Category A rank the highest in the database. I have found that nine articles in Category (A) fully subscribed to the 'Coase Theorem.' Two articles (Kelman 1979 and Lemley 1995) reported the controversy about the 'Coase Theorem' but nevertheless did not adapt the correct interpretation in their works. Kahneman, Knetsch, and Thaler (1990) rank first in the list and their work refers to none of Coase's works. Italics below are added to the original quotations by the present author.

CATEGORY (A): Most cited 10 articles on the 'Coase Theorem'

Jolls, Sunstein and Thaler (1998): 'When combined with the notion that opportunity and out-of-pocket costs are equated (see fundamental principle two), this yields the Coase theorem - the idea that initial assignments of entitlements will not affect the ultimate allocation of resources so long as transaction costs are zero.'

Korobkin (1998a): 'The Coase theorem is generally understood to predict that contracting parties will bargain to the efficient allocation of rights and responsibilities, irrespective of initial entitlements if and only if transaction costs are low. Consequently, in a Coasean world, parties will agree on efficient contract terms if transaction costs are low, irrespective of the substance of default rules. The corollary to this application of the Coase theorem is that when transaction costs are high, contracting parties will not contract around inefficient defaults.'

Krier and Schwab (1995): 'Absent any impediments to bargaining, an initial mistaken (inefficient) assignment of an entitlement can (will) always be corrected by subsequent transactions between the parties.'

Elhauge (1991): 'The Coase Theorem provides that, no matter how the legal rule assigns initial rights or liabilities, the efficient outcome will always result if private bargaining is unimpeded by transaction costs or other obstacles.'

Kaplow and Shavell (1996): 'As Coase emphasized, if there are no obstacles to the consummation of mutually beneficial bargains, it will make no difference what the legal regime is: thus, it will be irrelevant whether property rules or liability rules apply.'

CATEGORY (B): Most recent 10 articles on the 'Coase Theorem'

Halpin (2007) and Lai and Hung (2008) report the controversy about the 'Coase Theorem' but stick to the erroneous misrepresentation of the theorem in their works.

Charness et al. (2007): '... with well-defined property rights, no transaction costs, and fully symmetric information, efficiency is neutral to the assignment of responsibilities for damages; this result has come to be called the Coase theorem.'

Halpin (2007): 'A well known statement of the Coase Theorem within the legal literature is that provided by Jules Coleman (1988: 69) in the following terms: Given traditional assumptions of substantial knowledge, perfect rationality and the absence

of both transaction costs and income effects, the assignment of legal entitlements in cases of two-party incompatible land uses will be neutral as to the goal of allocative efficiency. In simple terms, the counterintuitive thrust of the theorem is that it does not matter whether the law imposes liability on an activity or not: the market value of the activity to A as against the market value of its absence to B will determine whether the activity goes ahead or not purely as a matter of efficiency.'

Lee and Sabourina (2007): 'This paper, by introducing complexity considerations, explores the extent of the validity of the Coase theorem. In particular, we highlight the role of "transaction costs" in explaining why individuals may not fully exploit mutual gains from trade via bargaining and negotiation. The central message of the paper is that, when each player has a preference for less complex strategies (at the margin), only efficient equilibria arise in complete information models of bargaining/negotiation without transaction costs while, in sharp contrast, perpetual disagreement, and inefficiency, are the only possible features of an equilibrium outcome with arbitrarily small transaction costs. Thus, in what follows the Coase theorem is valid if and only if there are no transaction costs.'

Rosenkranz and Schmit (2007): 'According to the celebrated Coase Theorem, rational parties always exploit all possible gains from trade, provided there are no frictions (specifically, if there is symmetric information). They will hence write a contract that induces party A to choose the efficient activity level and divide the gains from trade by appropriate transfer payments. Thus, if one does not make the assumption that the government has better information than the parties themselves (which many economists consider to be unrealistic), Coasean bargaining makes Pigouvian taxation unnecessary.'

CATEGORY (C): First 10 articles on the 'Coase Theorem'

Nutter (1968): '[Coase] showed that, whenever the costs of market transactions can be neglected, the 'damaging agent' will make the same calculation of marginal cost whether charged with responsibility for damages or not.'

Mumey (1971): 'Coase contends that with no transaction costs, victims of social costs will, in the absence of liability placement by law, offers bribes for abstention to inflictors of the costs.'

CATEGORY (D): Most cited 10 articles on the 'Coase Theorem' after 1991

Korobkin (1998b): 'In The Problem of Social Cost, the foundational article of the law and economics movement, Ronald Coase suggested that when transaction costs are zero, the initial allocation of a legal entitlement is irrelevant to its eventual ownership. Assuming no transaction costs, the Coase Theorem predicts that if part A values an entitlement more than does party B, A will keep the entitlement if it is initially allocated to him, and he will buy it if it is originally allocated to B. This powerful insight depends on the behavioral assumption that an individual's valuation of entitlements does not depend on ownership; that is, A values an entitlement neither more nor less if he is initially allocated that entitlement than if it is initially given to B.'

How about economics textbooks? Economics textbooks, to a great extent, have also subscribed to Stigler's interpretation of Coase (1960). For instance, Richard Allan Posner, senior lecturer at the University of Chicago Law School, wrote (1986: 7): 'if transactions are costless, the initial assignment of a property right will not determine the ultimate use of the property.' Coase responded to Posner in the following lines: 'after having read Posner's paper I felt I could not remain silent ... The trouble with Posner ... is not with what he doesn't know but with what he knows things that 'ain't so' (Coase 1993 quoted by Nicita and Panago, Mimeo).

In a similar fashion, Hal R. Varian argued that 'the result that under certain circumstances the efficient amount of the good involved in the externality is independent of the distribution of property rights is sometimes known as the Coase Theorem' (Varian 2002: 542-543). The point hasn't been correctly elaborated by the following generation of textbooks on economics and law (See also: Jeffrey L. Harrison (1995: 56-60) and Robert Cooter and Thomas Ulen (1995: 79-84).) Not even at the web site of the University of Chicago Law School: <http://www.law.uchicago.edu/socrates/coase.html>.

A final case to investigate closely is raised by Gary North, a Christian Reconstructionist activist and president of the Institute for Christian Economics. North (1991) argues that the 'Coase Theorem' raises a number of moral issues: the 'Coase Theorem,' North argues, 'assigns zero economic value - and therefore zero relevance - to the sense of moral and legal right associated with a willful violation of private ownership. The theorem ignores the economic relevance of the public's sense of moral outrage when there is no enforcement by the civil government of owners' legal immunities from in-

vasion, even if this invasion is done in the name of some 'more efficient' social good or social goal' (North 1991: 27). The victims of, say, pollution, claims North, in other words, wouldn't sue the polluter in civil courts. Or, restrictions on kidnappers would be impossible. North thus considers the 'Coase Theorem' 'one of the most morally insidious pieces of academic nonsense ever to hit the economics profession' (North 1991: 27). According to North the epistemological problem of social costs becomes an ethical one and economics happen to be 'wicked.' He poses an important question:

Who should make the initial distribution of an ownership right to whomever 'values it the most'? How does this sovereign agent know scientifically which potential owners 'are likely to value them [ownership rights] the most'? In short: By what standard of value does he make the initial distribution? (North 1991: 30).

North falls into the same trap as Stigler. Coase didn't say this. He didn't assume individuals would have no commitment to any sense of justice. He pointed out 'the impossibility of a world without transaction costs.' If Coase were asked the questions in the above quote, he would argue that judges should certainly intervene in the types of disputes mentioned above to find fair solutions. He would argue that there are reasons for governments to enter markets to protect the rights of different parties. Some economists - certainly, the followers of Stigler - might be considered 'wicked,' if one subscribes to North's vocabulary. Economics, however, cannot be considered wicked. Coase doesn't suggest economists should be value-free and morally neutral. Many economists, like Coase himself, and unlike Stigler and his followers, care about justice, equity etc. The problem of social cost means also the problem of ethics and justice. It is the problem of caring about the social consequences of individual doings. Externalities can be morally significant, too, especially when one's action harms the utility of another and violates the others' rights (Anomaly 2006). North, likewise, states that 'the issue of economic efficiency therefore cannot be separated from the issue of judicial equity' (North 1991: 45). But he, just like the followers of Stigler, fails to see that Coase never intended the 'Coase Theorem.' Coase argued in his 1960 essay that

There is no reason why, on occasion, ... governmental administrative regulation should not lead to an improvement in economic efficiency. This would seem particularly likely when, as is normally the case with the smoke nuisance, a large number of people is involved and when therefore the costs of handling the problem through the market or the firm may be high (Coase 1960).

In order to prove the popularity of the 'Coase Theorem,' I also ran a trendy Google search on the Internet. In return, I had the following hits:

'... so long as property rights are clearly established, externalities will not cause an inefficient allocation of resources' (The Economist, February 17th 1996, p.67).

'... bargaining will lead to efficient employment of resources independently of who owns them initially, when there are no transaction costs.' [<http://yetanothersheep.blogspot.com/2006/12/anti-coase-theorem.html>]

'... when information and transaction costs are low, the market will produce an efficient solution to the problem of nuisances without regard to where the law places the liability for the nuisance' (Encyclopedia online: <http://www.britannica.com/eb/article-9024510/Ronald-Coase>).

'According to the Coase Theorem (named for the economist who developed it, Professor Theorem), if property rights are well-defined and well-enforced, and if transaction costs are low (less than the expected gains from the transaction), then resources will move to their most highly valued use and no government intervention would be needed and the market is efficient, that consumers are going to direct the resources to where these resources yield the highest value' (<http://www.electecon.com/posts/1174129605.shtml>).

'Coase Theorem asserts that as long as there are well-defined property rights (and no transaction costs), externalities will not cause a breakdown in the allocation of resources' (<http://www.economyprofessor.com/economictheories/coase-theorem.php>).

To summarize: Coase published an article in 1960 which has become one of the most cited articles in (evolutionary) economics. He owes a great deal to Stigler's 1966 book for being so popular in economic science for almost 50 years. Stigler, in his *Theory of Price* (1966), formulated Coase's contribution for the first time in the history of economics and coined the phrase the 'Coase Theorem' which has become one of the most well-known theorems in economic theory. However, it has taken too long for Coase and other economists such as McCloskey and Buttler and Garnett, among others, to notice and comment upon the fact that the 'Coase Theorem' was not a proper formulation of Coase's message in his 'The Problem of Social Cost.' Coase reported in 1988(see Coase 1988b) that his message had been misunderstood ever since Stigler's 1966 book. In

1991, Coase was awarded the Nobel Prize and repeated his denunciation of Stigler's interpretation in his speech. Also, McCloskey has published two articles explaining that the 'Coase Theorem' did not reflect what Coase had actually intended back in 1960.

The Lesson to be Drawn

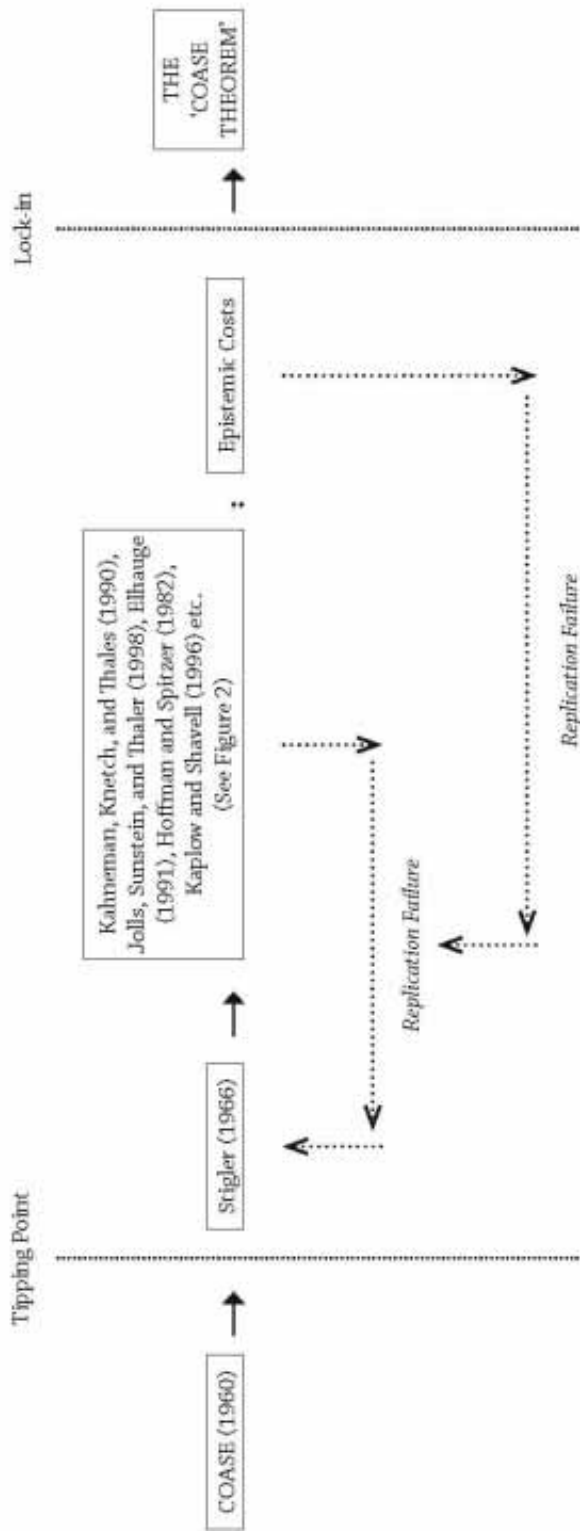
The mechanism that has given rise to this result is 'replication failure': economists thinking that Coase's contribution was important could and should have re-checked the theorem from the 1960 article instead of simply reproducing the conclusions of Stigler's 1966 book but they never did so until recently. Today, the 'Coase Theorem' has turned into a *typical phenomenon in intellectual path dependence* in which a small event - a mis-interpretation of an original contribution - grew so big - the 'Coase Theorem' - that it has dominated the entire economic literature.

While a theory or research program spreads among scholars due to its intellectual merit, there is also an economic side to the progress of every research program. This economic side has to do with the costs arising out of the time that must be allowed to replicate the results in the scope of other scholarly works. Economic development of a theory examines the dynamic relations among scholars as well as their products (i.e. publications, conference meetings etc.) that positively feed back upon each other in mutual support with further evidence and further argumentation. Financing a research program - the allocation of resources for a particular project instead of an alternative, is also important. But the qualitative resonance among scholars is unique and deserves special attention: scholarly life has such a particularity that a little achievement or a little error may spread fast and wide when certain circumstances are materialized. Figure 3 demonstrates the 'Coase Theorem' as a typical phenomenon of intellectual path dependence in the field of the history of economic ideas.

The case shows that the 'Coase Theorem' is reproduced, but the main findings of the economist Coase have only been recently replicated. The market for ideas had failed for a long time as Stigler's followers did not go to the trouble of looking up Coase himself. They contented themselves with the main findings of Stigler.

James Wible argues that '[a]n economic view of replication failure in science suggest that error and mistakes are a constant aspect of the scientific endeavor ... [T]he continuous presence of faulty research is a by-product of scarce resources being focused on a quest for innovative discoveries' (Wible 1998: 43). Indeed, among the reasons the

FIGURE 3: ELEMENTS OF THE FORMATION OF THE 'COASE THEOREM'



The figure, by way of using symbols representing sequential stages and mechanisms between stages in the most simplistic form, depicts the transmission mechanism in the 'market for economic ideas' in which scholarly processes of decision-giving authors after Stigler's 1966 article transform into an intellectual pathology. Boxes represent different stages in this unique process. Arrows with dots (...) correspond to replication failure in which second generation models (Kahneman, Knetch, and Thales (1990), Jolls, Sunstein, and Thaler (1998) etc.) do not test the findings of the first generation model (Stigler 1966) and principally rely on (i.e. reproduce) available results in the market. Column (:) signifies the costs generated during the transaction between second generation models and Stigler (1966). In the case of the 'Coase Theorem,' epistemic costs are the opportunity costs of allowing time to replicate the results of Coase (1960). Such costs disallow intellectuals to re-test the result of Stigler (1966) and lock them into a particular research program - the 'Coase Theorem.' Bold arrows between stages (→) show the direction of the working mechanism. Tipping point is where the erroneous interpretation of Stigler was published in 1966. Lock-in is the stage in which the 'Coase Theorem' is accepted as the established message of Coase (1960). The figure indicates that inputs in the 'market of economic ideas' such as errors in interpretation, via the mechanism of replication failure, lead to a particular result - such as the 'Coase Theorem.'

'Coase Theorem' remained uncorrected for so long, scarcity of resources has played the most important role: Researchers' limited time did not allow them to re-test the results of the models in previous generations. In general, replication is costly. But it is not impossible. The problem is therefore an economic one, not a technicality. In other words, correction of the 'Coase Theorem' has been a matter of cost but not a matter of impossibility. If the researches had (economic) incentives to replicate Coase (1960), the 'Coase Theorem' could have been corrected long ago.

Some ideas in history exist in such institutionalized environments that we cannot easily eliminate their consequences: consequences linger and they give rise to further, sometimes erroneous, ideas. The course of events feeds itself endlessly in such a way that early events in the course generate intellectual paths that last into the future. Had such ideas not been invented or argued for initially, the entire history of ideas would have been completely different. The case of the 'Coase Theorem' is an example of the development of intellectual paths in the history of economic ideas in which a unique event - i.e., Stigler's misreading (or manipulation) of the writings of Coase - generates an unusual pathway in the evolution of economic thought - a pathway in which the message of the idea was dissimilar to Coase's argument in the 1960s, and onwards. Stigler's 'Coase Theorem' was not in Coase's "The Nature of the Firm" (1937). Neither was it in "The Problem of Social Cost" (1960). A chance element - namely, Stigler - that was in no way part of Coase's intellectual contribution influenced the way his contribution is construed by economists today.

Consequences of such events in similar courses of history can even result in 'fraud.' 'Fraud in this context,' writes Wible, 'is the deliberate violation of scientific principle for personal material gain and professional advancement' (Wible 1998: 44). Whether the 'Coase Theorem' could be called a 'fraud' in the above sense is a different matter. What is certain in this case, however, is that a small event - Stigler's misinterpretation of Coase's contribution - was an error that lasted until today without being corrected and has generated an intellectual pathology in history. The problem of the social cost of Stigler's misunderstanding of Coase's writings to the community of intellectuals has been the failure of markets to correct an error that has lasted for decades.

"Truths" in philosophy are in fact only systematized mistakes and prejudices of our ancestors. Many of them originated in accident; many in class interest and bias, perpetuated by authority for this very reason' (Dewey 1950: 50). In a similar fashion,

many philosophical problems are products of the unconscious adoption of assumptions built into the vocabulary in which the problems were stated. We inherit philosophical problems; in other words, we think erroneous thoughts without questioning the assumptions that caused the problems. These assumptions are mainly due to the unfortunate mistakes and confusions that are jammed into us after the writings of Descartes, Locke, and Kant. Just as the patient needs to relive her past to answer her question, philosophy needs to relive its past in order to resolve those obsessions (Rorty 1979: 357).

An important issue here is nevertheless that although such errors abound in intellectual history, there are a great many important achievements from the past. For instance, it is not *wise* today to look up Adam Smith to read the best theory of division of labor. Sophisticated versions of the theories of the eighteenth and nineteenth centuries are printed in many contemporary economics textbooks. The idea of government today is much sophisticated than it was when Plato first wrote about it. In other words, there has been considerable progress in the sciences, philosophy, and the arts. Boulding's question, in this sense, is very intriguing: after Paul Samuelson who needs Adam Smith? (Boulding 1971).

It is a *vice*, however, to ignore the historical past of economic science as if there were a single path of institutional evolution headed toward perfection (of theorems). Economists have incorrectly assumed that whatever knowledge economics departments produced would immediately add positively to the body of economic science. Good ideas are sometimes completely ignored initially. Some texts, which were not considered important at the time they were first published, come to the forefront of economic theory only years after their publication. And sometimes, an error remains uncorrected for long times. This shows us at least one thing: progress of scientific knowledge does not at all times follow a single path headed at a predefined end point. Progress is often halted by small events. The 'Coase Theorem' is just an example to the condition in which economic ideas have been trapped into the consequences of a small event which in the end turned into a pathology. There are perhaps more instances in the past. This requires economists to be more interested in the history of ideas.

Historical Small Events as Historical Pathologies

**Or, what conventional histories of
ideas can often not explain**

Is there not any place in the history of economic ideas for the imperfect character of human doings (i.e. capability of error) that is repeated for so long until we lately start to think that it had long been wrong? The answer is: In the conventional histories of ideas there is almost no account of imperfection in analytical thinking. The importance of the phenomenon, however, is immense. The history of economic ideas is full of errors. Such errors are among the factors that generate intellectual pathways in which consequences of historical small events feed back up on each other positively and give rise to historical pathologies in the end. The economic literature is often held dependent upon such pathways.

Errors, and other types of irregularities alike, have always existed in intellectual history. No philosophical or scientific inquiry since the ancient Greeks has been separated from the reflections on error. The issue here is not to argue or show whether or not errors played any role in the course of events in our pasts. Rather, it is to develop an answer to whether they had any significance, either by way of self-reproducing or self-

correcting themselves, so as to generate pathways in the life's history. I here ask whether they are significant in the evolutionary course of events, and, if so, how much.

Philosophers have long elaborated on irregularities caused by erroneousness in scholarly life. According to Hegel, history was governed by a similar mechanism. Dialectics constituted the principle according to which history (of philosophy) progressed from contradiction to logic. 'Dialectical philosophy,' Terry Pinkard argues (1988: 19), 'explains the possibility of apparently incompatible categorical beliefs by trying to show that the apparent incompatibility is only apparent, that the contradiction is avoided once one expands one's framework of discourse in the appropriate way.' History was self-determined to true knowledge. It ran through negativity: a proposition (thesis) was to be negated (that is, passed over into its opposite) by another proposition that was dialectically in contradiction with the former proposition and transformed into a new beginning (synthesis) which, in turn, was the thesis of a new generation of dialectical course. 'What propels the dialectic is the emergence of new contradictions in the explanation that avoided the old ones, and the dialectic continues until no more contradictions emerge' (Pinkard 1988: 19). This general 'process of change' was the pathway from 'abstract' to 'concrete,' from 'possibility' to 'actuality,' from 'falsehood' to 'truth.' Upon the path, contradictions and confusions were all negated one after another. Accidents and contingencies were not part of the big story. The 'process' featured necessity. It was completely teleological.

The only requisite for the acquisition of the Scientific progression - and the very simple insight into this is what essentially concerns us - is the cognition of the logical proposition that the negative is equally positive, or that that which contradicts itself does not dissolve into Zero [Null] but essentially only into the negation of its particular content, or that such a negation is not all negation but the negation of the determinate subject-matter [Sache] which dissolves and is thus determinate negation, so that that from which is results is essentially contained in the result - which actually is a tautology, for otherwise it would be something immediate and not a result (*Hegel Science of Logic* (1812), quoted by Rosen 1982: 31).

Karl Popper's view on critical rationalism was based on the understanding that errors and mistakes were an essential part of scientific research. According to Popper, there was no way to avoid errors in the explanation of the unknown but science was nevertheless capable of correcting them. In order for this to happen, scientific knowledge should be able to be falsified by further evidence and testing. Scientific activity was

based on 'negative argument,' that is, criticism and propositions that put things right (or better, truer). If a proposition was not criticizeable (i.e. falsifiable), it was not scientific. By way of criticism, more errors and mistakes in the scientific discourse could be singled out and we could pass on to new theories that featured more truth-value. What mattered was the cure - not the prevention of error (Miller 1985: 9-14). According to Popper, critical rationalism was the only way for science to grow. Verification, say, couldn't be the way of attaining truth because it didn't have critical rationalist basis and it was flawed with the problem of induction: no matter how many times one observed an event, one could not provide any proof as to whether the same happening would take place next time. By way of falsification, Popper argued, that is, choosing theories that had higher empirical content or verisimilitude, one could 'move forward' as false theories were thus eliminated from the intellectual sphere. Truth was an endless inquiry, requiring a critical rationalist view on new theories. (See Popper (1945) and (1958) in Miller (1985) and Keuth 2005: 151-165.)

Imre Lakatos has provided one of the most insightful reflections on the development of scientific knowledge since Popper's *Logic of Scientific Discovery* (1959). Lakatos argues, too, that there is rational basis for progression in science. 'Research programs,' according to Lakatos, are progressive if and when a new theorem is an attempt to discover novel facts and provide more precise predictions about novel facts. Growth of knowledge is not necessarily a matter of accepting or refuting single theorems according to a scientific criterion. In other words, Popperian problem of demarcation - distinguishing science from pseudoscience - is not the only problem. (It is not even an important one.) What matters is assessment of research programs in which a scientific community operates with a number of very general hypotheses - 'hard core' - in terms of their ability to provide explanation about new facts. The key issue here is that new theorems must help develop new experimental techniques and provide insights about new facts. In a progressive research program, theorems do not need to pass the test of falsification (or comply with any other abstract rule). Neither do theorems need to displace another theorem. The problem is to lessen the amount (or significance) of inconsistent observations that newly accepted theorems point at. In the Popperian methodology, inconsistencies would end up with abandoning the theorem. Abandoning a research program, however, is not necessarily the only option for a forward-looking scientist who is confronted with theoretical challenges that come about as a result of the observance of new facts. In fact, it is a moral duty for scientists to face negative

'crucial experiments.' Solving the problems that crucial experiments give rise to, scientists are more able to achieve 'problem shifts,' which eventually results in cumulative progress of knowledge. When negative experiments lead to more inconsistencies - or what Thomas Kuhn once called 'anomalies' - 'positive heuristic' helps scientists to overcome these difficulties. Positive heuristic consists of the principles instructing scientists the path to follow in order to get them 'closer to truth.' Requirement for 'continuous growth' in science is the following:

There are no such things as crucial experiments, at least not if these are meant to be experiments which can instantly overthrow a research programme. In fact, when one research programme suffers defeat and is superseded by another one, we may - with long hindsight - call an experiment crucial if it turns out to have provided a spectacular corroborating instance for the victorious programme and the failure for the defeated one ... if a scientist in the 'defeated' camp puts forward a few years later a scientific explanation of the allegedly 'crucial experiment' within (or consistent with) the allegedly defeated programme, the honorific title may be withdrawn and the crucial experiment may turn from a defeat into a new victory for the programme. (Lakatos and Musgrave 1970: 173, *italics* in the original are omitted.)

To put it simply, both Popper and Hegel, among many others, such as Lakatos, supposed that big systematic forces of history, such as rationalism and dialectics, would eventually dominate the course of natural and social events in such a way that the consequences of 'historical small events' (Arthur 1989), usually in the form of small errors and contradictions in analysis, would cancel out the effects of each other. Historical small events existed, according to Popper and Hegel, but their role was only temporal and such events could not have long-lasting causal influences. At best, they could be side effects which would be canceled out one way or the other over the course of time.

As a matter of fact, a large number of events fit into their philosophical outlook. However, evolutionary theory of institutional change in general (Nelson and Winter 1982), and the theory of path dependence in particular (David 1985, Arthur 1994d, Pierson 2000), points out a small difference, an appendix that should be annexed to their world-view: that is, there are such occasions in history that there could never be an objective reason for the consequences of small events to disappear so easily because specificities of each circumstance might have featured feedback properties which would cause the effects of small errors to last long and grow big. As a result, 'scientific advancement' is often interrupted or at least forced to follow a non-linear pathway. As

Prigogine and Stengers (1984: xxviii) maintain, 'the history of science is far from being a linear unfolding that corresponds to a series of successive approximations toward some intrinsic truth. It is full of contradictions, of unexpected turning points.' In other words, under the conditions of path dependence, a system may lock itself into a number of evolutionary pathways in which the smoothing out of irregularities is not possible. In order to uncover the mechanisms that cause such results, one should examine every little detail. Such details are the small events, i.e. errors and contradictions, which historians have ignored and long considered irrelevant for the history of ideas.

In the history of economic ideas, we detect numerous instances of error in the ways economists analyze the phenomena they live by. Errors often cause the evolution of the economic literature to 'change tracks.' Stanley Jevons once argued that 'that able but wrong-headed man, David Ricardo, shunted the car of Economic science on to a wrong line, a line, however, on which it was further urged towards confusion by his equally able and wrong-headed admirer, John Stuart Mill' (Jevons 1871: 45). Jevons thought that Malthus and Senior had a better understanding of 'true doctrines.' But the influence of Ricardo and Mill was powerful. 'It will be a work of labor,' Jevons claimed, 'to pick up the fragments of a shattered science and to start anew.' It is a hard task, he argued, though a must for those who would like to see the advance of economic science.

William Coleman correctly points at the consequences of the issue. 'Instead of moving further away ('ahead') from the past,' he argues, 'economic thought has sometimes moved "forward into the past" as old problems recur[red], and older theories live[d] again. Thus in the 1970s, slow growth of the UK economy promoted Roger Bacon and Walter Eltis to advance classical growth like diagnoses of this sluggishness: too few producers. Similarly, the war between post-Keynesians and Monetarists in the same period was reminiscent of the 1840s controversy between the Banking School and the Currency School' (Coleman 2005). Likewise, the South Sea Bubble was repeated when Wall Street crashed in 1929. Families were torn apart at the time. People turned into beggars (Mackay 1995: 46-88; Colbert 2001: 13-14).

Alchemists and fortunetellers are still alive at present. They keep occupied the minds of many people who read astrology magazines. We have so long forgotten the business of witchcraft, but witchcraft remains (at least conceptually) in our daily lives. Charles Mackay's *Extraordinary Popular Delusions and the Madness of Crowds* (1852) focuses on manias, follies, and delusions in human history. He covers such issues as "The South-

Sea Bubble,' 'The Witch Mania,' and 'The Slow Poisoners,' about which he wrote in 1852: 'We find that whole communities suddenly fix their minds upon one object, and go mad in its pursuit; that millions of people become simultaneously impressed with one delusion, and run after it, till their attention is caught by some new folly more captivating than the first' (Mackay 1852: xv). Many have not noticed the stories of madness in the past, but we live by the consequences of idiocy, insanity, and irony such as those that Mackay mentions in his book.

And finally, Matthias van Boxsel (2004) provides numerous examples of ironies in history. He argues that stupidity is the foundation of our civilization. The best way to get rid of the terrible feeling after a stupid act, according to Boxsel, is to repeat it. This turns stupidity into a joke and makes it funny. Thus, stupidity turns into a conscious act. It is institutionalized and has become a condition for intelligence.

From Path Dependence into Intellectual Pathologies

'In all cases, error since the seventeenth century has been understood as a case of pathological belief, of credit extended recklessly or lazily or slavishly' (Daston 2005). Our question, likewise, is the following: are errors ignorable or are they among the factors that give rise to intellectual paths and pathologies? How do errors in analyses turn into intellectual pathologies?

Path dependence, in general terms, is regarded as *blind* processes that do not culminate with a certain end-point. In epidemiology, blindness is usually considered to be a pathological situation that causes a person to lack visual perceptions (see the WHO Fact Sheet No 282, November 2004). In fact, blind processes, from a philosophical point of view, can be considered pathological, too, in the sense that, in nature and society, they lead to path dependent circumstances in which individuals practice their capability of error and capability to repeat it in the general course of events.

The manner in which 'the normal' and 'the pathological' are constructed in such disciplines as medicine, psychology, and sociology is crucially important in uncovering the significance of historical small events and mechanisms related to evolution (of ideas), consequences of which dominate various fields of intellectual life. Pathologies in the history of medicine and psychology often show us the central role of historical small events, usually in the form of errors and contradictions, in the making of social and economic institutions: initial conditions (errors), self-reinforcing themselves, often

turn into bigger occurrences (pathologies). An error is considered to be any factor that generates formal flaws featuring hereditary interruptions and suspensions in social processes (Canguilhem 1991: 278). Under such conditions, harm can be truly large and radical. Errors transform into pathologies within the relation between the organism and its environment. An error is now not defined as a simplistic phenomenon, taking place only once, with predictable results. Instead, it is considered to feature complexity in the sense that linear causal relations lead the system into non-linear states generating substantial outcomes randomly.

The notion of pathologies, though, should not necessarily be imbued with a negative meaning or circumstance. The distinctive element in the notion of pathology is the positive feedback loops inherent in the evolutionary history of a specific epidemic. Intellectual paths in the institutional evolution of human ideas are pathologies in the sense that numerous self-reinforcing mechanisms magnify the effects of small causes in such a way that consequences of initial conditions are much greater for the intellectual community in the end. Whether the outcome is desirable or not is another issue.

What Types of Error?

It is possible to elaborate on the term 'error' in a number of various ways. According to Aristotle, Canguilhem argues, a monster could be an error because it intervened unfavorably in the ways in which plants and animals behaved so as to achieve harmony in nature. Error could be attributed to an objective criterion, too. For a calculator, it is a substantial error to calculate 9 as the square root of 64. Some errors are not harmful such as (some of) those made by children (Gigerenzer 2005). When a child who has just started to speak uses 'gived' instead of 'gave' she is usually recognized as following a normal and necessary developmental path. Such errors are 'good errors.' Sometimes, experts make good errors as well. 'After the invention of the telephone,' Gerd Gigerenzer reports, 'a group of British experts concluded that this invention had no practical value, at least in their country: The telephone may be appropriate for our American cousins, but not here, because we have an adequate supply of messenger boys' (Gigerenzer 2005).

We can choose from a multitude of examples from history to illustrate this point. For instance, blackness (the so-called Negro Problem) or homosexuality have for a long time been (and even still are by some) regarded as (neurotic) pathologies. What must

strike the inquirer here is that cultural factors influence the way biological and mental pathologies are defined. The opposite is also true: how we define pathology influences the way the culture is constructed. In other words, there is a feedback relation between the two. Under such conditions, pathologies re-express and re-constitute the values of the society in which those pathologies are defined. In the case of homosexuality, social culture's horror of homosexuality has given rise to the efforts to 'cure' the condition. All homosexuals were thought to have a common dysfunctioning. Such 'pathology' caused societies to see it as the root of a number of problems, such as cultural degeneration. And this has made the examination of the pathology a more critical issue. A number of serious measures were taken in the social and cultural sphere. This intensified society's horror of sexuality and the circular logic was thus constructed.

Another illustrative example of this phenomenon is the case of defining Blackness as pathology. The result was the widespread sharing of a descriptive norm as a social norm. Benjamin Rush (1785), although a strong ally of the black-skinned population in America in the eighteenth century, claimed to have discovered a pathology that he called 'negroism' or 'negritude,' which, Lawrie Reznek reports, was a mild form of congenital leprosy whose only symptom was the darkness of the skin (Reznek 1987: 18). Rush argued that being a 'negro' or black was a hereditary pathology. Whites shouldn't intermarry with the blacks, Rush declared, as it 'would infect posterity with the 'disorder'.'

In a similar fashion, Samuel Cartwright (1851) named two diseases peculiar to black-skinned peoples - 'drapetomania' and 'rascality.' Drapetomania was a disease causing the slaves to run away. And dysaesthesia aethiopica was a disease that caused rascality, writes Cartwright,

peculiar to negroes, affecting both mind and body in a manner as well expressed by dysaesthesia, the name I have given it, as could be by a single term. There is both mind and sensibility, but both seem to be difficult to reach by impressions from without. There is a partial insensibility of the skin, and so great a hebetude of the intellectual faculties, as to be like a person half asleep, that is with difficulty aroused and kept awake. It differs from every other species of mental disease, as it is accompanied with physical signs or lesions of the body discoverable to the medical observer, which is always present and sufficient to account for the symptoms. It is much more prevalent among free Negroes living in clusters by themselves, than among slaves on our plantations, and attacks only such slaves as live like free Negroes in regard to diet, drinks, exercise, etc.

When pathologies are at stake, 'cumulative causation' operates in disfavor of numerous disenfranchised and minority groups. Cumulative causation, in the works of such writers as Thorstein Veblen (Veblen 1898 and 1961), Gunnar Myrdal (1997), and others (for a general account of cumulative causation see Toner 1999), accounts for how the final effects of greater magnitude can come into existence as causes of the initial efforts. In such causal mechanisms, components and variables respond to a change of any cause in the same direction with a follow-up effect upon the first components and variables. The causal system is dynamic in the sense that the system moves as a consequence of the cumulative effects of initial and consecutive pushes as well as the interaction between them. Variables are causally interconnected, leaving no place for the 'first cause'; 'everything is cause to everything else' so that the system is interlocked. Myrdal assumes interdependence between all the factors in 'the Negro Problem.'

White prejudice and discrimination keep the Negro low in standards of living, health, education, manners and morals. This, in its turn, gives support to white prejudice. White prejudice and Negro standards thus mutually 'cause' each other. If things remain about as they are and have been, this means that the two forces happen to balance each other. Such a static 'accommodation' is, however, entirely accidental. If either of the factors changes, this will cause a change in the other factor, too, and start a process of interaction where the change in one factor will continuously be supported by the reaction of the other factor. The whole system will be moving in the direction of the primary change, but much further. This is what we mean by cumulative causation (Myrdal 1997: 76).

Gladwell (2000) makes a similar analogy and likens the spread of social behavioral patterns to the epidemics of contagious diseases. Ideas diffuse among different social circles, Gladwell argues, just like viruses do. Epidemics 'tip' - that is, the spread of virus reaches critical mass and its graph shoots straight upwards. This happens very rapidly because the virus carriers are (or at least can be) socialized into different groups among which there are powerful ties. In the 1990s it was thought that crack cocaine was the cause of the spread of HIV in New York because it led to risky sexual behavior. 'It brings far more people into poor areas to buy drugs,' Gladwell reports, 'which then increases the likelihood that they will take an infection home with them to their own neighborhood. It changes the patterns of social connections between neighborhoods' (Gladwell 2000: 15). Social and intellectual pathologies (or epidemics) work in the same way. The emergence of fashion trends, the ebb and flow of crime rates, and the phenomena of word of mouth are examples in which a social pattern crosses a threshold and

its expansion takes the form of 'exponential overdrive' (Gladwell 2000: 7). This may seem like a strange thought, Gladwell claims, because we are intellectually born into a conception of approximation among causes and consequences. Changes we render in social life take place steadily and slowly. 'We are trained to think that what goes into any transaction or relationship or system must be directly related, in intensity and dimension, to what comes out' (Gladwell 2000: 11). This is not necessarily the case 'in the real world.' Consequences are often far out of proportion to initial causes when evolution takes the form of 'geometrical progression.' Under such conditions, what matters are little things, like small events.

Crime is always considered to be a consequence of social injustice, structural economic inequities, unemployment, racism, and so forth and so on. If policy makers want to reduce the crime rate, they have to solve the big social problems; they have to deal with big causes. Indeed, this was what the New York Police Department and many criminologists had said was done in the 1990s when the crime rate in New York fell more than 60 percent within a decade. Policing strategies improved noticeably, they claimed. The crack trade was stopped. Employment opportunities increased.

Such changes are certainly important in increasing the quality of life of a community - but only in the long run. As a matter of fact, New York's economy didn't improve significantly between 1980 and 1990. Crack cocaine was an influential factor in the increase of crime rates, Gladwell reports, but it had already been in steady decline by the time the crime rate dipped. The reason why the crime rates declined in New York was more complicated. Big social factors couldn't account for why the rates did not fall so sharply in other cities that implemented the same social policies and why it took place in such a short time only in New York.

Gladwell argues that the 'broken window theory' of two criminologists, James Wilson and George Kelling, provides the best explanation. 'If a window is broken and left unrepaired,' writes Gladwell, 'people walking by will conclude that no one cares and no one is in charge. Soon, more windows will be broken and the sense of anarchy will spread from the building to the street on which it faces, sending a signal that anything goes' (Gladwell 2000: 141). This is an epidemic theory of crime, saying that crime is contagious and it can start with a broken window and spread to the whole community. Gladwell shows that the problem in New York was solved by way of changing specific and relatively small elements that served as tipping points. The authorities decided to

remove all the graffiti in the subway system. This would show New Yorkers, authorities thought, that they were taking the problem seriously. The graffiti problem was considered the symbol of the collapse of the system. The authorities considered that at the heart of the problem laid the winning of the battle against graffiti in the trains. And just as they thought, such minor changes had dramatic effects on how people behaved. Authorities fixed the broken windows, cleaned up the graffiti, and removed any other signals in public places that would invite people to commit crime. The crime rate fell dramatically. After the tipping point people started to behave differently. The New York subway experiment showed, according to Gladwell, that it was 'possible to be a better person on a clean street or in a clean subway than in one littered with trash and graffiti' (Gladwell 2000: 168).

Epidemics are, at the root, about this very process of transformation. When we are trying to make an idea or attitude or product tip, we're trying to change our audience in some small yet critical respect: we're trying to infect them, sweep them up in our epidemic, convert them from hostility to acceptance. That can be done through the influence of special kinds of people, people of extraordinary personal connection ... It can be done by changing the content of communication, by making a message so memorable that it sticks in someone's mind and compels them to action ... [S]mall changes in context can be just as important in tipping epidemics, even though that fact appears to violate some of our most deeply held assumptions about human nature (Gladwell 2000: 166).

Errors are Often Trivial and Self-corrective, but Sometimes Self-reproducing, too

Darren Oldridge reports a remarkable trial that was held in Rothenbach in 1485 (Oldridge 2005: 1-19). The trial was about a woman who was suspected of witchcraft. The Court of Fürstenberg decided to try the woman with a method called 'trial by red iron.' The method required the person to hold a piece of hot iron and carry it for three paces. The person's hand would then be bound for three days. After three days, the wound would be inspected. If the wound was healed completely, the person would be declared innocent. But if it was still weeping and discolored, the person would be condemned. The trial ended with an impressive result. The woman took the iron from the furnace, walked more than three paces, and asked if she was required to walk further. After all that, she was acquitted and freed.

The story tells that the woman was accused of a crime (witchcraft) that would seem

to be 'strange' to a reasonable mind. She was then set free on the basis of a completely arbitrary reason (i.e. passing the test of red iron). The cause of the strange event was cancelled out not because of some systematic cause and yet by another cause that was no less absurd: that she seemed unaffected by the red iron. Oldridge writes that such trials stopped not because people started to think them illogical but, rather, because the Church Father thought that they were against the Christian Doctrine. Such instances suggest to us that many absurd, strange, erroneous events could have conceivably existed in history, lasted for long periods, and disappeared after some time not because of some systematic tendency inherent in the course of history but, rather, by further absurdities, strangeness, and erroneousness.

Many errors in the history of human ideas are usually trivial or, as the above example shows, self-corrective. Such 'errors' do not always cause intellectual pathologies. Jevons, for instance, thought there was a connection between sunspots and business cycles, but it was soon corrected. 'The Earth [was] at rest,' Ptolemy thought, 'it [was] in the centre of the Universe, and that fixed stars move[d] together as a sphere' (Field 1981: 349). His astronomy was wrong but it nevertheless worked well and helped navigators produce land and sea maps using measurement and observatory techniques. It was then corrected, too. Sungook Hong reports that Guglielmo Marconi's invention of the transmission of wireless signals across the Atlantic Ocean was based upon a small error. We now know that he was wrong. Marconi was a fortunate man, though, because:

A number of notable scientists and engineers joined Marconi in believing it possible for electromagnetic waves to travel over a wall of ocean, based on the current theories of the electron and ether, in which the electron was regarded as a 'knot' of the electric strain in the ether. In this theoretical framework, the earth itself functioned as a sort of huge waveguide. However, it was not long before Marconi's idea of surface transmission was shown to be in error, for the electron was soon identified with real particles, and it was also shown that the earth could not guide waves as Marconi believed. We now know the electromagnetic waves that Marconi received in St. John's in 1901 did not get there by traveling along the surface of the earth, but by reflecting off the upper ionosphere (now known as the Heaviside-Kennelly layer). Marconi's achievement, based on the science of his time, was based upon a 'big mistake' (Hong 2005).

While some errors in history are harmless or even temporarily fruitful, others generate enduring paths of evolution. Many errors in history are either left uncorrected or their

significant consequences linger on through time (although, occasionally, at decreasing scales). In such cases, we keep repeating the same errors. Uncorrected errors of the past sometimes generate disappointments about concrete situations in the future. Life then starts to get more complicated and more tragic. Kenneth Prewitt (2005) argues that there are many instances in the history of social science 'truths' that have lasted for centuries without being touched upon. The example he gives is a 'mistake whose origin is to be found in the assumptions, preferences, and prejudices brought to the research question' (Prewitt 2005). Samuel George Morton, a nineteenth century anthropologist and zoologist, Prewitt reports, thought to have proved a hierarchy of races in which Caucasians were blessed with the most capacious array of skills and Negroes as well as a number of aboriginal groups with the smallest. Morton's categorization was used to formulate the 1850 census that was introduced to determine whether or not the cross-race reproduction caused mentally defective offspring. Merton's 'race science' - as well as Herbert Spencer's survival-of-the-fittest argument - resulted in many unhappy stories in the United States and Europe in the twentieth and, even, twenty-first centuries. "The social science mistake was an elementary one," writes Prewitt, "[a]s noted by Stephan Jay Gould, it was "the claim that worth can be assigned to individuals and groups by measuring intelligence as a single quantity" (Gould 1981)' (Prewitt 2005).

Our issue is how to characterize this social mistake. It is obvious that neither the formulation of race-science nor its subsequent rejection can be understood solely in scientific terms - that is, by simply considering hypotheses, data, theory construction, better data, new hypotheses, theory modification, *ad infinitum*. Both its formulation and its rejection have to be understood as part of a larger political project: its formulation on behalf of defending slavery and sustaining racial separation; its rejection on behalf of educational programs to discredit racist thinking and government policies to compensate for past racial injustice. In this example, the inseparability of a social science theory and its political uses indicated how a science project and a political project were unfolding in tandem, resulting in a social science 'mistake' (Prewitt 2005).

Such examples suggest that some errors are significant but nevertheless temporal. That is, the consequences of errors sometimes fade away in time, causing less and less damage as time goes by. Some other errors, however, take more time for the intellectuals to realize that they have basically been locked into a pathway that was inaccurate. Such errors are reinforced by further errors and they linger on and on. The consequences are copied by themselves multiple times. In such occasions, errors are difficult to cope

with. They generate significant intellectual pathologies in history. An example of this is statistical significance tests in economics. Steve Ziliak and Deirdre McCloskey report that of the 182 papers published in *American Economic Review* during the 1980s, 70 percent did not distinguish statistical significance from economic significance and 96 percent misused statistical significance tests (Ziliak and McCloskey 1996). Ziliak and McCloskey have conducted the same survey for the empirical papers of the next decade, and concluded that the case had not improved. Economists have, since the 1980s, not ceased in making the same error. 'Of the 137 relevant papers in the 1990s,' write Ziliak and McCloskey (2004), '82 percent mistook statistically significant coefficients for economically significant coefficients (as compared to 70 percent in the earlier decade). In the 1980s, 53 percent had relied exclusively on statistical significance as a criterion of importance at its first use; in the 1990s, 64 percent did.' The statistical significance tests are one of the examples of important intellectual paths in our scholarly life of economics for which setting a new path in motion has long been impossible:

The current practice statistical significance represents a market failure in the sense that the market for published and refereed articles has failed to drive out a substandard product: the use of tests statistical significance for wrong (unscientific) reasons. Moreover, the persistence of this sub-optimal practice is path dependent, a product of the type of market which exists for journal articles and the economic and psychological costs of producing the product. The current structure of incentives is such that one cannot expect that the current wrong practices will be easily abandoned or significantly modified. We are locked in to a path of empirical practice which yields unscientific results with regards to analytical significance (Altman 2004).

The study of intellectual paths matters because these paths help us explain the mechanisms which disallow thinkers to diverge from pathologies in history. Had there been only a single path of modern civilization or intellectual advancement since thinkers started to ask questions about nature and society; that is, if the best-of-all-possible-worlds argument were true and we lived in such a world, we would have never been interested in the roles that small events have played in the course of history. There have been many. There have been numerous spatial and temporal paths in history, in which particularities and specificities played important roles in the course of events. Irregularities come about in such 'processes' in response to assorted variables in the direction indicated by the first push. Investigations into such pathologies require more effort than deriving abstract generalizations or doing blackboard economics.

PART II

ECONOMICS OF INTELLECTUAL PATHOLOGIES

In our fractal world, big becomes an entirely relative concept, and surely not intrinsically superior to small or short ... Who dares say that the little and the particular don't matter? Wouldn't the world be much better off if Beethoven had lived to write a 10th or 11th symphony, or Mozart had composed, in his mature 50s, tragic operas about Hamlet and King Lear? We will never know such pieces, and we are thus all the poorer. But thank God that the sperm for J. S. Bach won the great impregnation lottery instead of the adjacent competitor that would have made a tin-eared brother or sister.

Gould 1999

Our present notions of what it is to be a philosopher are so tied up with the Kantian attempt to render all knowledge-claims commensurable that it is difficult to imagine what philosophy without epistemology could be. More generally, it is difficult to imagine that any activity would be entitled to bear the name 'philosophy' if it had nothing to do with knowledge - if it were not in some sense a theory of knowledge, or a method for getting knowledge, or at least a hint as to where some supremely important kind of knowledge might be found.

Rorty 1979: 357

A small change in [the number of people with whom each scientist has personal contact] can greatly affect the total number of people receiving information after any specified number of exchanges has taken place.

Crane 1972: 23

The actual route taken to closure was a complex one with many overlapping factors playing important roles. Science, even in its products or laws, remains historical or contingent in an essential manner. Developments might have gone a very different way at a certain critical junctures. Why they did not may be as important as the reasons for the 'right' choices that science has made.

Cushing 1994: 199

Epistemic Costs and Institutions in Scholarly Life

Or, why transaction costs in the history of economics matter

Deirdre McCloskey, in one of her classes on *Virtue Ethics* (2004) at Erasmus, once told us a story of a guru and his disciple. The main debate in the classroom at the time was ‘the advance of knowledge’ (i.e. how does science progress?) The story run thus: the disciple wanted to learn how the earth was supported in space. The guru had the answer right away: ‘on the back of a giant turtle.’ The disciple, who was impressed by the answer, asked another question: ‘how is this turtle supported, then?’ The guru: ‘on the back of an elephant!’ The disciple wanted to know more about it: ‘How is the elephant supported?’ The guru knew that his disciple would ask this question. He said: ‘the first elephant is supported by another elephant, and the next by a next: you see, *it’s elephants all the way down*’ (McCloskey 1990: 8).

The question of this chapter is: how is science supported in ‘attention space’ (Collins 1998: 80-81)? To paraphrase the question of the disciple in the story above, does science stand on an elephant (or any other animal or thing) that is supported by another

one? That is to say, is there a solid foundation or essence that sustains the growth of knowledge in scholarly life? The story suggests that this inquiry is infinite. Asking the same question over and over again, we may run into the same phenomenon being repeated endlessly. It does not take us too far.

Some questions in epistemology have lasted so long that although we have traveled all the way down to the very nature of the problem, we have happened to find no such thing as a foundation or essence which support (the advance of) our knowledge. Science seems to be floating in space, vulnerable to the influence of a variety of disturbing factors which destabilize its establishment in time and on occasion.

How does history (of science) advance, then? Or, does it advance at all? In other words, does knowledge accumulate in the sense that past achievements add up on each other until a sound epistemological structure comes into being? Is there no place for interruptions, lock-ins, decadence, or loss of memory? Perhaps, there is. There are wars that damage the processes of social advancement within and among civilizations as well as 'science wars' that damage intellectual peace within and among scholarly communities. Scholars often lose their memories that give rise to the repetition of old assumptions, theories, findings, and so forth and so on. Fraud and plagiarism are among the factors that lead to decadence in the history sciences. The history of science cannot be assumed to possess a tendency towards eliminating the effects of harmful causes all at once.

Paul David, writing on the problems in the evolutionary history of technology, argues that disappointments in 'the advance of technology' have common elements with the disappointments in 'the advance of knowledge' (David 1990). 'I am unable to find any compelling reasons,' David writes, 'why economic analysis should remain "locked in" to an ahistorical conceptual framework, apart from the unfortunate hysteresis effects of "intellectual sunk costs" ... [S]ome injection of further, intellectual "energy" is likely to be necessary in order for our discipline to free itself from the logical region of "low potential" in which it has too long remained trapped' (David 2000). What are the sources of disappointments that accompany the advance of knowledge? Why does economic analysis remain locked in to undesirable states in and of intellectual evolution?

In this article, I am primarily interested in the application of the conception of 'transaction costs' into epistemology, in the view that some of the problems in episte-

mology, at least, have an economic aspect rather than a philosophical one, if and when problems of theory selection, paradigm shifts, correction of errors and so forth and so on are also economical in deeper layers of their nature. I argue that (i) the 'market for economic ideas' (Coase 1974c) is a positive transaction costs world and (ii) methodological and philosophical prescriptions (or '3" x 5" card philosophies,' McCloskey 1994: 349) about model building, theory selection etc. often fail because of the high costs of complications and uncertainty involved in empirical research.

The economic character of such questions, which are traditionally considered to be philosophical in nature, underscores the questions of persistence and change of institutional structure in the epistemology of economic science. In spite of the importance of the subject matter, 'science is rarely included in the economic universe. Check almost any text - introductory, intermediate, or graduate - and verify that science is not an economic topic. Even more significantly, check every monograph and collection of readings on economic methodology and see that the economic dimensions of science have been largely ignored by economic methodologists' (Wible 1998: 164). Scholarly life is a positive transaction costs world in the sense that universities and research institutes 'produce' ideas for science in which high transaction costs of pursuing science require institutional scientific arrangements (such as awareness against fraud and plagiarism, definite codes of behavior, etc.) to cure the negative externalities that may come about as a result of scientific effort. Universities and research institutes minimize the costs that arise out of risk aversion in scientific markets as well as negotiate contracts with researchers and other scientific institutions. The reason why 'scientific institutions exist' is that the sciences have an economic dimension. This dimension is about the efficiency problem of scholarly activity.

Science is a 'resource-using endeavor' (Wible 1998: 170) and resources in the scientific market are scarce. As a result, the opportunity cost of (not) using a specific resource in the market is often high. James Wible argues that, under such circumstances, researchers are like 'entrepreneurs' making a multi-period calculation of the value of each research program in each time period. This calculation involves items such as 'initial costs' of putting the project in place and 'revenues' to be gained from implementing the project. Researchers get involved in a research program if the net present value of the project is greater than all other projects. 'The decision to rethink or reappraise the basic facts of science share the major characteristics of an investment decision' (Wible 1998: 84).

According to Wible's approach of cost-benefit analysis of research programs, introspection of researchers makes them aware of the creative forces that cause them to make the choices they do among a variety of research programs. Wible argues that there are costs - 'epistemic costs' - to defending every theory in the sense of 'epistemic resources forgone, resources which would have been available if one had opted for the competitor of the theory' (Radnitzky 1987a). Epistemic costs involve factors that tend to reduce the productivity of scientific processes, such as gathering data and information, replicating the findings of models in past generations, hiring researchers who are specialized in a specific field of knowledge, and risks that are embedded in the uncertain nature of scientific activity. These costs are not identical; that is, some theories have advantages over others in terms of the explanatory power of certain facts. Researchers are scholarly producers facing the difficulty of making decisions towards large-scale investments under conditions of uncertainty and incomplete information. Under such conditions, universities and research institutes (and the whole academic system in which such institutions operate) organize scientific activity more efficiently than mere individuals or, say, business firms. Co-operation in the market place (i.e. collaboration among academic writers and institutions) could have been (and, in fact, is) done by individuals alone but scientists as intellectual entrepreneurs carry out their function better when they operate within and with the help of scientific institutions. Universities and research institutes are entities which serve to minimize epistemic costs in the market.

A positive epistemic costs (PEC) view of science holds that scholarly life is characterized by 'indeterminism': 'Indeterminism is the thesis that disorder, chaos, and evolutionary change are more fundamental than order, pattern, and natural law. Indeterminism implies fundamental uncertainty. Indeterminism does not deny that there are high levels of order and pattern in our world, both in natural phenomena and in human behavior and in society. Indeterminism means that all order and pattern have been created either by natural or human causes and that order and pattern are still being created and evolving' (Wible 1994: 173). Indeterminacy in the world of scholars implies that there is scarcity in scientific endeavor in terms of time and resources. From an evolutionary point of view,

Indeterminism compounds the problem of scarcity. Scarcity in economics typically means a limitation on resources and time. Scarcity acquires an epistemological dimension. As our world and our economy change, knowledge of existing circumstances becomes dated.

Things which are known acquire a dimension of obsolescence and things which are new and not yet known by all may be difficult to anticipate and imagine. In an indeterministic world and economy, there exists the continuous creation, destruction, and annihilation of knowledge. The epistemic structure of society and the economy is quite fragile. Fundamental uncertainty exists. A situation of epistemic scarcity is created. Thus the two fundamental assumption of a complement theory of economic organization would be epistemic scarcity (scarcity) and indeterminism as compared to scarcity and markets for the traditional mainstream approach (Wible 1994: 173).

What a PEC-worldview suggests: An institutional history of ideas

A transaction costs view of decision making processes in an open and homogeneous society holds that adoption of a new model of behavior or abandonment of an old one depends on whether the benefits of a new behavior exceed the associated costs. If the new mode is attractive to the majority of the population and it does not significantly differ from the old patterns, new behavioral innovation spreads among the population gradually. Individuals would reject behavioral innovations that are (re-)presented by a minority only and not reinforced by 'internal' and 'external' factors such as military strength or 'social outsiders' ('heterogeneous groups') who are not well integrated into the society. Sometimes individuals are constrained by one or all of these factors and such constraints narrow their choice set. Then, increasing returns would disallow individuals to re-contract to a different joint solution. Whether individuals will benefit from the constraints and whether constraints will yield profitable results depend on the factor that is reinforced (North 1990: 96). The result will principally be determined on the basis of 'subjective perception of the costs and benefits of an institutional alternative which might have its cause in changes in the related cost structures or social learning accompanied by changing mental models that lead to a new evaluation of the behavioral alternatives' (Stahl-Rolf 2000).

A PEC-worldview of science suggests that institutions primarily function to remedy market failure in scholarly life. The issues in a PEC-world are how and by means of which institutional arrangements healing market failure takes place in scientific processes. In science and technology studies, policy makers confront a chaotic world in which epistemic scarcity overwhelmingly dominates the evolution of scientific research. In this world, scholars prefer to develop habitual behaviors or they tend to exploit established social institutional resolutions when they face uncertainty. Repeti-

tive behavior often yields better results for minimizing epistemic costs in the market. Repetition is a key to unlock many difficulties in scholarly life.

The institutional history of (economic) ideas is a 'research area' that has been introduced and promoted by the scholars (especially by Esther-Mirjam Sent and Albert Jolink) at the *European Association for Evolutionary Political Economy* (EAEPE) since 1999. They argue that the institutional history of economics is a research area in which economics itself is understood as a social institution, supported by a network of other social institutions, 'instead of an orientation that takes economics itself as an ideal or natural order and as a mere aggregation of individual economists.' It is a research area that 'evaluates relevant tendencies and linkages in actual economics, instead of a methodology that sanctifies fictions and diverts attention from the difficult task of analyzing the practice and culture of economics.'

There are many historical works which accomplish the task from the perspective encouraged by EAEPE scholars such as David Warsh (2006: 9-27) in which he tells the story of Paul Romer's endogenous economic growth theory from an institutionalist perspective. Mitchell Waldrop (1992: 15-51) talks about the experiences of Brian Arthur, Kenneth Arrow, and others at the Santa Fe Institute as an 'intellectual adventure story.' However, not much has been formally said or conceptually discussed about the institutional history of ideas in the field - leaving aside the only exception, Matthias Klaes, who talks about concepts as social institutions (Klaes 2001).

(Esther-Mirjam Sent approved this point in a personal email exchange on April 25, 2007. 'To be frank,' she said, 'institutional history of economics' is a term that I made up when I was asked to coordinate a new research area for EAEPE. This explains why you haven't found (m)any works in the field.' This view is also shared by Wade Hands (2001: 384).)

In a PEC-world, some of the questions of epistemology are rather economical than philosophical. The question now is, how do scientific communities react to any theoretical novelty? What are the scholarly mechanisms that enable or disable the spread of a new idea in the 'market'? How can one convince others about the merit of the new explanation of a specific problem? And, as David points out, are there really unfortunate hysteresis effects of intellectual sunk costs? Can sciences be trapped or locked into specific conceptual frameworks?

Human ideas do not always spread in ways in which the best theories outperform others given sufficient time for intellectuals to complete the processes of 'shooting for the truth.' The market for ideas is so complex that no one may be able to foresee which idea will survive and for how long. A scholarly life means living in an unpredictable world. Moreover, it does not work so well at times.

Many factors transform the (apparently) simplistic 'idea' of the growth of scientific knowledge into a complex conception. Social networks among intellectual elites, collaboration among research institutes, funding opportunities, the role of government, and different streams of thought affect the variations in communication patterns among scientists and the development of knowledge in scholarly life.

Waking up one morning with a bright solution to the problem of trade-off between inflation and unemployment, both in the short and long runs, does not really (or, at least, always) account for the growth of economic ideas. Scholarship is a collective activity. In addition to certain dynamics (mental, psychological etc.) which enable individuals to develop new ideas when they are with themselves, scholars operate within institutions in which new individual behaviors of scholars at 'micro' levels (i.e. stories of creativity and genius) transform into 'macro' patterns (mainly 'conversations,' Klammer 2007). Survival of ideas, to some degree, is dependent on the truth of formulation of ideas. However, if scholarly elegance is not accompanied by 'the mythic expectations of listeners,' ideas stay isolated and do not always add up to the accumulated body of knowledge (March 2007).

New ideas do not always spread at fast speeds. Some are forgotten in time. Sometimes, the 'invisible hand' does not do its job properly and errors are left uncorrected for long periods. Private vices turn into public virtues. More often than not, the market for ideas turns into a giant industry featuring monopolistic properties. That is to say, there is sometimes a lack of pluralism in the market and one view dominates the scholarly life so that there may be only one game left in town for scholars to play: 'epistemic competition naturally leads to monopolies,' Jesus Zamora Bonilla (forthcoming) argues, 'because ... it is assumed that scientific problems have only one "right" answer, or, at least, that the more correct answers "displace" the worse ones.'

Pierre Bourdieu (1999) explains monopolization in scholarly life in terms of *social capital*. Social capital 'can be accumulated, transmitted, and even reconverted into

other kinds of capital under certain conditions.' 'Markets for ideas' operate, according to Bourdieu, in such a way that scholars compete to win scientific authority that would allow them to speak and act about scientific matters legitimately, that is, in authorized and authoritative ways. Legitimacy in scholarly life can be gained only when social capital accumulates (i.e. producers, due to the value of their products, become respected scholars). The amount of social capital possessed by competitors in the market determines the strategies of investment and disinvestment in the research market. This gives rise to a struggle among competitors for reputation, prestige, authority, and competence. 'The scientific field is always the locus of a more or less unequal struggle between agents unequally endowed with the specific capital, hence unequally equipped to appropriate the product of scientific labor accumulated by previous generations, and the specific profits (and also, in some cases, the external profits such as economic or strictly political benefits) which the aggregate of the competitors produce through their objective collaboration by putting to use the aggregate of the available means of scientific production.' According to Bourdieu, unequal endowment of social capital diminishes opportunities of gaining access to scientific problems and tools. The market becomes more restricted (i.e. costs of entry increase) to competitors who are able to produce criticism and discredit established beliefs in the market. '[N]ew comers who refuse the beaten tracks cannot "beat the dominant at their own game" unless they make additional, strictly scientific investments from which they cannot expect high profits, at least in the short run, since the whole logic of the system is against them.' In all that, monopolization of financial resources are not a direct matter of debate: social capital may or may not be transmitted into high salaries in the markets for jobs and high profits in the markets for goods, both of which owe much of its progress and extent to the progress and extent of the market for ideas. Monopolization in the market for ideas is an epistemic problem with economic features (i.e. command and control by a small group of scholars over the use of epistemic sources) whereas monopolization in other markets is economical in which epistemic virtues may or may not turn into (additional) pecuniary gains. (For an economic model of the conditions under which 'truth-seeking' economists behave as (or, turn into) 'rent-seekers,' see Bonilla 2002).

Replication failure

Wible argues that 'the economics of science' has begun with the general problem of misconduct in science, which he thinks is the main source for 'market failure in aca-

demic economics.' In economics, market failure is characterized by a tendency towards moving away or inability to reach to a Pareto optimum state of equilibrium. Market failure, in scholarly life, primarily involves the genetic errors (as in automata theory) generated through and transmitted among generations of scholars: self-regulation of individual factors in interaction with the environment by way of reconstructing copies of themselves (Mirowski and Somefun 1998). Wible identifies three different mechanisms that give rise to market failure in academic economics:

1. Fraud.
2. Plagiarism of procedures, findings, and theories of science.
3. Replication failure.

'Fraud' and 'plagiarism,' in the sense Wible uses the terms, involve deliberate violation of scientific principles whereas 'replication failure' is a dynamic mechanism in science in which intentions of individuals are not necessarily a constituent of the working of the system. Replication failure is the inability or unwillingness of researchers to test the result of previously published scholarly work. It is through replication that theories and research programs are checked in terms of their defensibility, consistency, and coherency. Although replication should be an essential component of scholarly work, such an endeavor is not frequently handled by researchers because 'an economist might allocate a larger proportion of time to producing new publishable results devoting relatively less time and effort to the tasks required for replication' (Wible 1998: 25). Replication of results is time consuming and there is no reward for scholars to repeat another's work. No significant research devotes time and effort to replicating the findings of earlier theories and research programs without compensating their economic loss. Instead, researchers rely on the results of papers published in academic journals and they simply 'reproduce' their findings without examining its significance and validity (Mirowski and Sklivas 1991: 154).

Wible reports that the reason why replication rarely takes place in scholarly life is that 'science is more complex than mechanical reenactments of simple experiments.' Many factors play important roles: for instance, processes of inference and judgement are not totally individual but rather a social phenomenon. It is difficult to replicate certain experiments without the specialized knowledge of earlier researchers. Sometimes, derived results of earlier works could be unreplicable: data may be lost, technical

possibilities may not allow researchers to set up identical experimental environments, there may be informational asymmetries, and so forth and so on. Moreover, attempts by rival scientists and graduate students to criticize and publish new findings on older data as part of their routine scientific doings are construed as hostile acts (Wible 1998: 30).

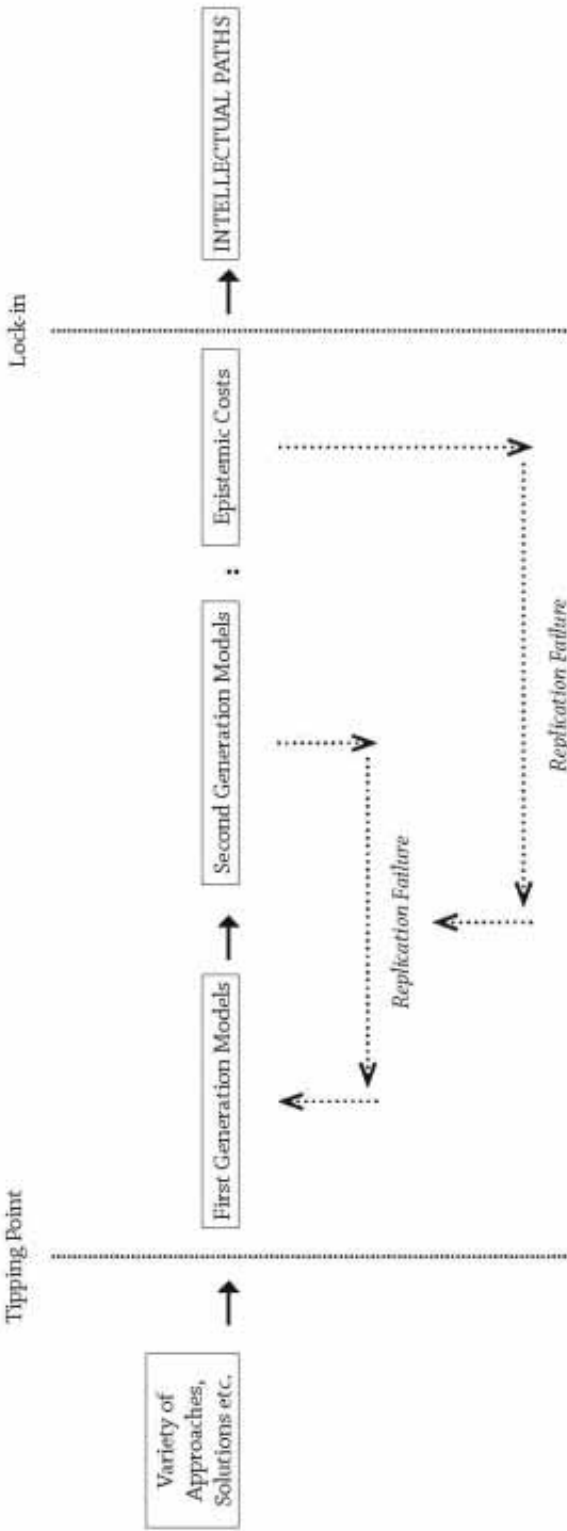
However, scholarly work is 'chain-connected.' Subsequent research depends on previous studies. Findings of prior studies are used as input for upcoming research. For researchers, replication failure is an economic phenomenon. That is to say, there is an economical item that is often neglected by epistemologists, *time*. To put it in a straightforward way: economic behavior in markets is sensitive to the opportunity costs of time. When researchers start off a new research project, they allocate time between replicable and unreplicable research. "The economizing of resources thus exposes science to mistakes," writes Wible (1998: 31),

At some point, these mistakes will be discovered and they will have to be corrected. From an economic point of view, there needs to be a balance between resources devoted to replication in its simpler forms and innovation. Attitudes and reward structures which are skewed toward innovation may set science up for replication failures of many types. But mistakes need to be corrected or they will impede scientific progress and innovation at some point.

Authors, referees, and editors of journals often assume earlier findings are valid without retesting them in significant ways because replication takes time and this imposes significant costs on researchers. Bypassing replication generates the probability of genetic (i.e. reproductive) errors that had occurred in an earlier study but not noticed in time. In scholarly life, it is expected that such errors will be corrected as scientists do further research on the subject matter. But because of the costs of running such tests, some errors may pass unnoticed and be left uncorrected. This is a source of intellectual path dependence in which scientific markets operate in the absence of an 'invisible hand' that could have prevented errors from happening or corrected them in the long run. Seeds of intellectual lock-in are stored in the scholarly market within the epistemic costs organically attached to pursuing scientific research.

Originality of the issue, as is formulated by Wible, is that not all research fails to replicate earlier findings. He argues that a considerable amount of time is in fact devoted to the replication of results. Only a certain proportion of findings are used with-

FIGURE 4: ELEMENTS OF THE FORMATION OF INTELLECTUAL PATHS IN SCHOLARLY LIFE



The figure, by way of using symbols representing sequential stages and mechanisms between stages in the most simplistic form, depicts a typical transmission mechanism in the market for ideas in which decision processes of scholars failing to replicate the findings of past generations transform into intellectual paths. Boxes represent different stages in a typical decision process. Arrows with dots (.....) correspond to replication failures in the market where second generation models do not test the findings of the first generation models and principally rely on (i.e. reproduce) the results of the previous generation. Column (:) signifies the costs generated during the transaction between first and second generation models where such costs take the form of epistemic costs. Epistemic costs are the opportunity costs of allowing time to replicate the results of the models in previous generations (i.e. models before the tipping point). Such costs disallow intellectuals to re-test past results and lock them into particular research programs in the long run. Bold arrows between stages (→) show the direction of the working mechanism. Tipping point is where a small event (such as a replication error) enters the intermediary stage. Lock-in is the final stage of the process in which consequences of small events (such replication errors) grow big by way of feedback mechanisms and evolve into intellectual pathologies in scholarly life. The figure indicates that inputs in such systems, via certain mechanisms, transform into a particular result - intellectual paths.

out being tested by a significant method. Therefore, the problem is, 'by its very nature,' *small*. Certain mechanisms, such as replication failure, have an influence only on untested results that are miniscule in proportion to the amount of tested results. But, in practice, the small errors grow really big.

Figure 4 demonstrates a typical path formation in scholarly life. In this scenario, first generation models include influential articles whose findings, by virtue of innovative research programs, are (re-)formulated in original ways. After the first generation models, findings are popularized and spread in the market. Second generation models often take the form of textbooks and secondary or follow-up research, the findings of which are primarily borrowed from first generation models. Second generation models are so influential that they frequently cite first generation models as well as each other and, as a result, their citation figures increase logarithmically. *Their* results are thus established in the market. The findings of the first generation models are not often replicated because of high opportunity costs of allowing time for re-testing the findings of others. Reputation and power also affect the selection process of researchers where scholars utilize the works of reputable authors to legitimize their own findings (Sterman and Wittenberg 1999, Busch and Muthoo 2003). For instance, research conducted by Nobel laureates and powerful institutions with which Nobel laureates are affiliated (such as Rand Corporation, see Mirowski 2002: 153-231) are highly credited and further research is often directed by the outcomes of such authors' work. During all of this, access to financial resources and possibilities of finding research partners play prominent roles (Dasgupta and David 1994, David and Foray 2002, Fallis 2006). This intermediary phase is thus (i) economically constructed so that the growing popularity of the first and second generation models operates under increasing returns, (ii) the search for research funds is highly influential on the way further research (and its methodology) is conducted, and (iii) opportunity costs (i.e. epistemic costs) determine whether to replicate the findings of the original research program.

The market?

When one sees scholarly life as a market for ideas, principal questions that come to mind are most likely the following: are the features of the market for goods the same, in principle, as the features of the market for ideas in general? Are 'ideas' and 'goods' really counterparts? Is, say, government intervention in the market for ideas as desirable as it is sometimes in the market for goods?

Ronald Coase, writing on the conception of the market for ideas for the first time in the history of economics, argues that, in both cases, similar considerations can be taken into account. There are such historical occasions in the market for goods that no 'first-best' solutions come about. Under such conditions, all that matters for the actors in the market is to find a way to decide on the solution with a lower cost. That is to say: keep over-exploiting old methodologies and techniques insofar as they keep producing satisfying results. In the market for goods, government intervention could provide help (although limited) for the fair allocation of economic resources but, Coase claims, a similar centralized public policy (as a remedy of 'market failure') would not always have the same pleasing effect in each and every case. In other words, the government might be 'inefficient' if it attempts to intervene in the market for goods. This applies to the market for ideas as well. According to Coase, the answer to the question of (government) intervention in intellectual markets should be, 'it all depends.' There is no final answer that would fulfill all the needs and problems of scholars. What matters is a close examination of *epistemic costs in the market for ideas*.

If we try to imagine the property rights system that would be required and the transactions that would have to be carried out to assure that anyone who propagated an idea or a proposal for reform received the value of the good it produced or had to pay compensation for the harm that resulted, it is easy to see that in practice there is likely to be a good deal of 'market failure.' Situations of this kind usually lead economists to call for extensive government intervention (Coase 1994b: 73).

However, quite interestingly, in none of his writings, does Coase mention the importance of transaction costs in the market for ideas in general. The above questions have thus lingered on since then and nobody had undertaken the task until Wible, who put his finger on the issue from a cost-benefit view-point. According to Wible, the market for ideas is not perfect. In other words, market failure occurs because there is a cost for using market mechanisms in scholarly life. Therefore, science exists because science as an institution minimizes the epistemic costs of producing scientific knowledge by means of scholarly mechanisms. Science exists in order to 'reduce the transaction costs of pursuing science' (Wible 1998: 171).

In spite of its strength on epistemic grounds, one difficulty of Wible's approach to science studies in general is that his 'economics of science' is not totally clear about the difference between the financing of scholarly projects (i.e. allocation of research funds to a particular scholarly project) and the epistemic costs (i.e. theoretical and ideologi-

cal risks that are placed on the shoulders of those who pursue research). These two conceptions are used interchangeably in his 1998 book. Financing a research project is certainly an important issue and needs special attention. As Wible argues, 'science is a specialized economic endeavor which must attract, support and retain scientists, support staff, financial capital, and other essential resources. Otherwise science would fail because it would not be economically viable (Wible 1998: 186). However, a PEC-worldview of science does not necessarily mean that the only costs in scholarly activity are those which are needed to provide research funds to pursue a specific scholarly activity. A PEC-worldview of science is rather an expression of the costs that researchers should seriously consider in the formation of their mental models and behavioral patterns. Epistemic costs are the central factor that disallows the market for ideas to operate as desired.

Conclusion

Coase draws parallels between the fields of economic and physics when he asserts that a social world without transaction costs would be like a physical world without friction (Coase 2005). Friction is a factor the effect of which is often neglected in physics - as well as in economics, for that matter, in the form of transaction costs where transaction costs are seen as 'market friction' or 'frictional costs' (see, for instance, Jacobides and Winter 2003). Friction is something that depends on speed. With friction and speed things can get complicated. It can even lead to chaos. That is, neglecting this factor, an equation or a system can generate unforeseen or unexpected consequences. If everything went as smoothly as they do in frictionless models on the blackboard, all predictions would hold and abstract formulations would explain everything but this is not always the case. The world is not as simplistic as blackboard theorems tell. There are such situations in which positive feedback mechanisms often take place, enhancing the significance of small events in the course of history. This inserts the item of *costs* in scholarly research which moves the system away from equilibrium or its systematic course.

FIGURE 5: TRANSACTION COSTS IN THE ECONOMY AND SCHOLARLY LIFE

	World without transaction costs	World with transaction costs
An economist interprets:	Markets for goods clear 'inefficiencies.' No market failure takes place. Economic path dependence does not occur.	Markets for goods do not clear at all times. Non-zero transaction costs cause 'inefficiencies' in the market. Cumulative consequence of individual behavior in the economy, relying on older preference sets, lead to economic path dependence.
An intellectual historian interprets:	Markets for ideas correct errors. No market failure takes place. Intellectual path dependence does not occur.	Markets for ideas do not clear at all times. Non-zero transaction costs cause replication failure in the market. Cumulative consequence of individual research in scholarly life, relying on previous results, lead to intellectual path dependence.

A world without friction and transaction (costs) is an imaginary world that exists on the blackboard only. According to Coase (2005), the view of transaction costs states that there is a cost to every transaction in nature, including scholarly life. That is, scholarly life is a positive transaction costs world too. Intellectual history features such a property that the cost of intellectual endeavor is not at all times ignorable. 'Intellectual sunk costs' in intellectual transactions prevent abstract solutions from becoming real because 'over-exploitation,' misreadings, and errors in interpretation often come about and their consequences do not easily disappear. A system, because of over-investments, locks itself into situations that can end in stasis. A system that doesn't adapt in the face of changing environmental conditions can result in system vulnerability. As a consequence, blackboard theorems, such as Popper's critical rationalism and Hegel's dialectics, do not hold at all times because their 3" x 5" cards of philosophy do not provide us with the underlying principles as to how the institutions of scholarly life work and set the standards for scientific knowledge. Confusion and contradictions are not always negated and falsehood does not turn into truth in time and on occasion.

When misinterpretations are not displaced by true ones and errors are not corrected, the consequences of particular events are not averaged away (that is, self-corrected) and certain intellectual paths occur as a result. Assuming a scholarly world without the costs of undertaking the duty of reconsidering the main findings of past research (including the errors involved in the methodologies of earlier studies) would not be a

'realistic.' There *are* epistemic costs in the global market for ideas. Such costs are often high and have significant consequences for the way researchers pursue science. Were there no epistemic costs, there would be no intellectual basis for the existence of universities anywhere on the globe because the market for ideas would do the job that is done by universities. Or, were there no transaction costs in the job market, there would be no need for contracts with and among professors because markets and individuals would construct contractual agreements in the absence of asymmetric information and this would be organized internally (Williamson 1985: 87). Also, plagiarism would not be a problem then because, no matter what the property rights say, scholars could negotiate without any cost so as to 'acquire, subdivide, and combine rights whenever this would increase the value of [scholarly] production. In such a world, the institutions which make up the [intellectual] system have neither substance nor purpose ... Another consequence of the assumption of zero transaction costs, not usually noticed, is that, when there are no costs of making transactions, it costs nothing to speed them up, so that eternity can be experienced in a split second' (Coase 2005).

An absence of epistemic costs in scholarly life is not the actual case, however. A PEC-worldview suggests that the principle factor that makes scholarly life look like what it is, is non-zero epistemic costs in scholarly processes. In a PEC-world, it is not unlikely that perfect results don't come out no matter how hard intellectuals try to obtain them. In such a world, the 'labor theory of value' does not always tell us successfully which theory is the most valuable in the market. Nor is it possible to show at what time a theory would outperform others. Luck and other chance events play significant roles in this. Defects are abundant in the models and other explanatory patterns that intellectuals build. Disappointments in the behavior of intellectual actors - such as unethical behavior - are not improbable.

Ideas do not come out of nothing. Scholarship has a life. It evolves, it transforms, and sometimes it gets stuck. Scholarship cannot overcome every difficulty. Such difficulties are easily visible to an external eye that has not been blinded by the once-powerful idea of 'progression' or 'growth' of knowledge in scholarly life. A PEC-worldview may help us explain why some ('inefficient') views have survived in the market for ideas and not yielded desirable outcomes as expected. As a matter of fact, a PEC-worldview does not provide us with a blueprint or a master plan for the betterment of the present situation of scholarly activity. It is, rather, a call to account for the role of institutions in scientific research. Scientific institutions matter because institutions in scholarly life

function to clear up market failure. The question now is the following: Is it not possible to avoid mis-readings, over-emphases, and errors? According to the PEC-worldview of science, no, it is not. As a matter of fact, what is more important than preventing such failures from happening is finding institutional remedies immediately. In order to be able to do this, one should perhaps be knowledgeable about the epistemic costs of scholarly life and the consequences that such costs give rise to.

Path Dependence in the History of Ideas

**On the pathway in which
a notion has emerged and spread**

What survive in the scientific market are not always the best (i.e. error-free) ideas. Some ideas outperform others in the 'market' when they become the winner in the game of 'competition for attention' (Klamer and van Dalen 2002): if an idea draws the attention of other scholars, it is in the conversation.

Ideas in conversations are those that scholars often talk about. These ideas are also frequently cited. If an idea is often cited, it has a bigger chance to spread among scholars. To put it differently, scholarly life is a game of 'winner takes all': scientific production operates under the law of increasing returns to *scientific* scale. A small advantage that an idea possesses easily and rapidly gives rise to a big success story. This is most visible in the economics of superstars: 'small differences in talent become magnified in larger earnings differences, with greater magnification of the earnings-talent gradient increases sharply near the top of the scale' (Rosen 1981).

Attention is scarce, however, and the market for ideas is not a really competitive

market. Not every idea can survive in the scientific circles. In other words, some ideas cannot receive (much) attention. Nevertheless, ideas that are outside of scholarly conversations are not necessarily the ones that are falsified or 'proved' to dysfunction. Instead, ideas are 'selected' when they draw the attention of the scientific community. Sometimes, ideas go unnoticed. The 'intensity of attention' in the market is occasionally very low.

The central theme in this chapter is to show how the idea of path dependence has become popularized in the hands of Paul David (1985). His strategy of choosing a catchy example paid him off well, although the example was criticized harshly later on (Liebowitz and Margolis 1990, 1995a, 1995b, 1998). The case that David demonstrates shows that judging an idea according to some criteria of coherence or truth is sometimes pointless. No matter how absurd or erroneous a scholarly idea may seem, it has the chance to spread widely if the idea enters a scholarly conversation. In fact, the mechanics of attention does not help the metaphor of path dependence to spread among scientific networks because it proved to be true in factual terms. The metaphor, rather, solved the 'problem of abundance': when path dependence entered the market, other metaphors calling for attention were simply canceled out. David's example of QWERTY was not flawless but the 'network externality' of the article was so big that the metaphor has set the standard in the market and turned into a constitutive metaphor in the explaining market failure in evolutionary terms.

QWERTY

Typing is an important business that almost every one today should excel. An issue in the business of typing is that we often mistype words and sentences while preparing diplomatic reports, sending emails to friends, or giving directives in bureaucracy. Typing errors happen millions of times a day. They sometimes cost just more than a million Euros. In December 2005, the president of Tokyo Stock Exchange, Takuo Tsurushima, lost his job, after a brokerage, Mizuho Securities lost about \$300 million of its asset in the market, because of a small typing error (BBC News, 13 January 2006). The rumor has it that a diplomatic crisis between the US and Sudan was prevented when it turned out that a report, saying that the US conducted nuclear tests in Sudan in 1960s, was simply mistyped.

Consequences of the business of (mis)typing are important for more than a group

of businessmen and diplomats. It is now important for historians and philosophers of science too. It is ironical that a type of typewrites, namely QWERTY, has become so widespread and started an intellectual debate among economists and (economic) historians. QWERTY-nomics or 'path dependence' is now a subject area that attracts a lot of attention in natural and social sciences.

An article published by Paul David in 1985, entitled 'Clio and the Economics of QWERTY,' has come to be the first of the sequel of articles on path dependence in economics. The article was a short one. The story has soon become a 'famous fable' in economic science (Spulber 2001: 90-109). Following David, economists such as Brian Arthur, Douglass North, and Paul Krugman, among many others, have contributed to the research on path dependence. The notion has turned into a celebrated one in social sciences. (See Figure 6 and 7 below.)

The notion of path dependence in economics was originally applied to the historical evolution of typing machines. During the times of mechanical typewriters, David (1985) argued, the principal problem was clashing and jamming of the mechanical parts of typewriters. The solution was shortly found, and the keyboard of the machine was designed in such a way that the machine reduced the speed of the typist so that the amount of clashing and jamming was less. The solution was initially a smart one because it efficiently generated a working solution to a practical problem. It, however, turned out to be 'inefficient' when digital keyboards were later introduced. The problem of clashing and jamming in digital keyboards was no more, and yet the keyboard design was the same. The typist was now using the keyboard, the fable of the keys goes, at a slower speed than she could although her speed could have been increased if another keyboard had been introduced. The new digital technology didn't allow clashing and jamming but the institution - that is, the keyboard itself - has persisted, in that the problem was passed on to next generations.

If the top row letters of English keyboard layouts in mechanical typewriters in the past and in PCs today were ABCDEF instead of QWERTY 'then many of us would not regard the phenomenon as one that is at all surprising and in particular need of being explained. Of course, even such an unpredictable letter arrangement as QWERTYUIOP is of *prima facie* explanatory interest to an "economic historian" such as Paul David' (Lawson 1997: 249). This example in particular and 'Qwerty-nomics' in general point at a critical issue in the historical evolution of social and economic institutions. The

basic idea behind the story is that evolution of institutions may be locked in to specific paths in history because some unforeseen *small events* grow big and lead to substantial consequences in future. Feedback mechanisms working in certain ways disallow individuals to switch between different behavioral strategies (therefore other paths of evolution) by way of exposing costs to their decisions of changing strategy. It is then impossible or unwise, say, to develop new behavioral patterns or get rid of old habits because uncertainty or imperfect information prevail in the market and limit individuals to behave differently. ‘Toggling’ between paths is difficult also because old technologies do not at all times let individuals operate with new technologies that would yield better result for the industry.

Path dependence before QWERTY

In economics, long before the writings of David, Arthur, and North, Thorstein Veblen argued that for an evolutionary economic science to provide a true account of the facts of the world, we need depiction of cumulative advancement of humans and societies, which does not necessarily consummate in equilibrium, and where the causal nexus among phenomena is fully specified (see Veblen 1898). According to Veblen, ‘neither industrial development nor social change in general converges toward a predefined point. Rather, [economic and social] development proceeds along alternative paths in a non-teleological way: cause and effect relationships produce in mutually dependent potencies, which have positive or negative feed-backs between them, and which have no pre-defined final term to which they naturally converge’ (Argyrous 1996). The growth of culture, says Veblen (1909),

is a cumulative sequence of habituation, and the ways and means of it are the habitual response of human nature to exigencies that vary incontinently, cumulatively, but with something of a consistent sequence in the cumulative variations that so go forward, - incontinently, because each new move creates a new situation which induces a further new variation in the habitual manner of response; cumulatively, because each new situation is a variation of what has gone before it and embodies as causal factors all that has been effected by what went before; consistently, because the underlying traits of human nature (propensities, aptitudes, and what not) by force of which the response takes place, and on the ground of which the habituation takes effect, remain substantially unchanged.

According to Veblen, an economy might be left with a relatively inferior technology. Circumstances in an economy might not be conducive to the best material interest of

the system in force if a community's past habits of thought are at cross-purpose with the conditions of life afforded by the new state of industrial arts. The problem, basically, is a matter of cultural conditions in the early phases of the 'life history' of any community. Veblen's discussion, in a nutshell, is about whether 'technological innovations and creations of an institutional nature have in many cases [reached] their fullest serviceability only at the hands of other communities and other peoples than those to whom these cultural elements owed their origin and initial success' (Veblen 1915: 22). The story is based on whether it is more practicable to carry over a state of art from one community to another. For Veblen, the problem is a matter of 'efficient use of technological developments.'

In a 'case study' in which he checked the availability of his view of *cumulative causation*, Veblen argued that the railways of Great Britain were constructed with too narrow a gauge compared to those of American and German railway systems in the Edwardian Britain (roughly 1885 - 1914). 'Silly little bobtailed carriages,' Veblen thought, was an inefficient technology primarily because British coal wagons had a very limited carrying capacity. He reported that the fact was known by the experts of the time, though the remedy was not so easy to implement. The fundamental reason was that all the terminal facilities, tracks, shunting facilities, and all the ways and means of handling freight on this oldest railway system were all adapted to the bobtailed cars. The infrastructure and equipment, such as the roadbed and metal, and the engines, additionally, were not sufficient to take care of the increased traffic when some technological improvements first went into operation. It was, therefore, not without any trouble to introduce new technologies since 'the chief significance of this work of improvement, adaptation and repair in this connection [was] that it [argued] a fatal reluctance or inability to overcome this all-pervading depreciation by obsolescence' (1915: 127).

Veblen's example is closely scrutinized by Van Vleck, who has shown that the case might not be necessarily as Veblen described. Van Vleck proved that British carriages were not economically 'inefficient' or 'irrational' but merely substitutes for more costly distribution and delivery means such as horses, hay and oats, trucks, and petroleum fuel. Small wagons were used because they suited the existing infrastructure, but not because they were economically at the margin (see Van Vleck 1997 and 1999).

In fact, the essential message of path dependence research has long been considered to mean that there will be 'inextricable inefficiencies' in the economy if and when eco-

conomic transactions require high sunk costs. David (2000) has shown later that this is not the necessary conclusion of the research on path dependence. Path dependence is about the costs involved in various social and economic processes, which may or may not 'turnaround' an inefficient or sub-optimal solution into an efficient or optimal one. Costs are always involved in the problem of lock-in; however, whether such costs give rise to inefficient outcomes is a matter of 'look-and-see.' In other words, mechanisms leading to path dependence do not feature a simplistic logic of efficiency. The whole process of path dependent evolution of a system features rather 'complex logics of change': 'The paths cleared along the way are likely to be crooked since they reflect an accumulation of struggles, negotiations, and recombinations ... The ultimate course of each path can only be identified and described post hoc - it is not pre-determined by any single critical juncture' (Djelic and Quack 2007). (In-)Efficiency view of path dependence is as much identical to the generally accepted view that path dependence is a complaint about the long-term state of an evolutionary system. This is not necessarily the case either, although economists have used the term path dependence as a figure of speech expressing their dissatisfaction with the present state of the evolution of an institution. Dynamics behind the theory of path dependence does not lead to dissatisfying outcomes at all times. Amplification of the consequence of historical small event could unexpectedly give way to pleasing results too. For instance, when the debate on lock-ins is about deliberate 'path-creation' of entrepreneurs, dependency upon the consequences of a number of innovative ideas is desirable (see Karim and Mitchell 2000 and Garud and Karnøe 2001.)

Path dependence in other fields of social research

Apart from social sciences, it is almost impossible in the scholarly literature (except sociology and political science, perhaps, see: Goldstone 1998, Mahoney 2000, and Pierson 2000) to come across any writer using the word 'path' (and its derivative 'path dependence') in the same way as economists have used the term. Nevertheless, many thinkers, with or without calling it path dependence, have expressed similar concerns regarding the specificity of the evolution (of history, politics, sciences etc.) that they elaborate on. The common concern of these thinkers is that no evolutionary process necessarily evolves toward a pre-defined end point. In order for a process to feature a property that allows a specific process to evolve toward a pre-defined end point, 'legitimate trend' should coerce events to evolve in the prescribed way. However, there is no

such final term to every and each evolution. There is no prearranged result for all that exists in nature and society. Exact places where this conception occurs include John Dewey (1910a: 50 and 67; 1910b: 118 and 124), William James (1971), Larry Hickman (2004: 95), and Joseph Ratner (1999: 30-31).

We find in Martin Heidegger, one of the most important and peculiar characteristics of paths in the history of ideas. Heidegger in his *Holzwege* talks about paths in woods. One takes such walking paths, he writes, as one meets them. Those paths, however, were built for different purposes but the mover does not have any other choice. Heidegger thinks that the paths of thought that the philosophers have advanced through for ages are like the trodden paths in the woods.

In the wood there are paths, mostly overgrown, that come to an abrupt stop where the wood is untrodden. They are called *Holzwege*. Each goes its separate way, though within the same forest. It often appears as if one is identical to another. But it only appears so. Woodcutters and forest keepers know these paths. They know what it means to be on a *Holzwege* (Heidegger 2002).

Heidegger's message is also present in the following quote by E. B. White in respect to 'living language' (White 1957, quoted by Garud and Karn e 2001: 28):

The living language is like a cowpath: it is the creation of the cows themselves, who, having created for it, follow it or depart from it according to their whims or their needs. From daily use, the path undergoes change. A cow is under no obligation to stay in the narrow path she helped make, following the contour of the land, but she often profits by staying with it and she would be handicapped if she didn't know where it was or where it led to.

Path dependence represents 'historical specificity' in the evolutionary condition of social and economic institutions in the sense that social and economic evolution '[carries] the conservative baggage of its past' (Hodgson 2001: 148). The theory of path dependence, insofar as economists have advanced the theory, provides social sciences with a perspective emphasizing the possible malfunctioning of human institutions through time. The distinguishing feature of path formation from an economical point of view is that paths and dependencies come about as a result of high opportunity costs of applying or using alternative methods. In other words, path dependence of institutions in the economy is economically constructed. Their power should be tested empirically.

This issue has first been raised by Deirdre McCloskey in the context of a term that she coined in the economic literature: oomph. A long-standing conversation – an e-seminar, so to speak – took place at Eh.net email list in 1999. Many eminent economists expressed their thoughts about the notion online. The conversation started with the summary of the path dependence literature by Stephen Liebowitz and Stephen Margolis, in which they mentioned the roots of the notion in other sciences as well as their well known critique that was published in *the Journal of Law, Economics, and Organization* (1995). During the e-seminar, McCloskey argued that the problem with the path dependence of institutions was rather empirical. Her critique was not directly about the function of the notion of path dependence in social sciences. She has rather raised a crucial question in particular about the story of QWERTY.

McCloskey's claim was as follows: path dependence was certainly important for social sciences but the example of QWERTY was not because no typing intensive industry, since the computers were introduced, has ever adopted an alternative keyboard system to QWERTY. David's story was basically an 'urban myth' because changing keyboards was not difficult for typists. They did so when they used Danish, Russian, or Turkish keyboards. That we didn't switch to another typing machine didn't mean that QWERTY was inferior to, say, Dvorak; it rather meant, simply, no industry has found it profitable.

David's point about typing machines, McCloskey thinks, was principally blackboard economics. Claiming only that 'capitalism is not perfect' – an argument McCloskey thinks David has always had in mind – is not plausible for sciences. For McCloskey, the relevant question should rather be 'how much imperfect?' Capitalism is not perfect, McCloskey argues (McCloskey 2006: 1-53). But it does sometimes work, too. The problem is to show *how* imperfect it is; therefore, the focus is on the question 'how much?' 'The blackboard is of limited help in this,' she argues, 'not useless, but almost so, since it is obvious at the outset that any 'result' whatever is possible if one is ingenious enough with the assumptions. We need measurements, simulations – not more theorems, yes?' Sometimes the scale is too small to matter. One has to show quantitatively in order to know whether the 'second best' is really important.

McCloskey thinks that the scientific question is one of oomph. In other words, 'how important was, say, craft dignity to the old working class (thus E. P. Thompson)?' How much the railway economy contributed to the American economic growth in the nine-

teenth century (thus R. Fogel 1964), and so forth. Likewise, David must show how much a printing house with 300 typists would have gained if the company switched to a 'better' keyboard system than QWERTY. That is, how much oomph?

The question then is empirical. The advocates of QWERTY, according to McCloskey, should show why no typing intensive business firm has since adopted a different keyboard than QWERTY. They have to show how high the training costs of employees are, how expensive it is for a factory producing QWERTY keyboards to produce, say, Dvoraks, and so forth.

McCloskey claims that 'the success or failure of QWERTY as an empirical notion would not settle one way or the other whether such problems are important in the economy.' The point should be understood in economical terms. Path dependence exists, but the question is whether it rules. And the way to show whether path dependence rules is to answer the quantitative question, 'how much?' Does it matter? Does it have oomph? She does think the advantage of Dvoraks would not be anything like 10 per cent, it should be less.

In fact, there is a great score of published articles in economics where institutional costs are empirically calculated and tested whether they constrained optimality. The works include Britain's coal wagons in the nineteenth century (Puffert 2002, Scott 2001; van Vleck 1997 and 1999), VHS / BETA video systems (Liebowitz and Margolis 1995), and nuclear power reactors (Cowen 1990 and Bruggeman 2002). Path dependence research has also provided valuable insights in various disciplines from transitional economics (Nee and Cao 1999; McFaul 1999; Chavance and Magnin 2002; Filippov and Shvetsova 1999; Stark 1992; Zukowski 2004; Magnin 2002) to legislative rules and regulations such as European corporate laws (Kato 2003; Heine and Kerber 2002; Dimitrakopoulos 2001; Magnusson 2002) and urbanization (Meyer-Stamer 1998; Nitsche 2003; Stern 1993) and economic geography (Krugman 1991; Kenney and von Burg 1999), from environmental economics (Goodstein 1995; Messner 2002) to game theory (Garud and Karnøe 2001; Matsuyama mimeo), organization theory (Stack and Gartland 2003; Gartlan 2005; Eriksson and Majkgard 2000; Egidi and Narduzzo 1997; Antonelli 1997; Mueller 1997), corporate governance (Roe 1996; Bebchuk and Roe 1999; Gilson 1996), and behavioral economics (Altman 2000; Gold and List 2004; Anderlini and Antonella 1996; Barnes *et al.* 2004). Empirical data show the influence of path dependence research in natural and social sciences (see Figure 6 and

7). Sociologists, political scientists, and psychologists are attracted by the idea, too (Goldstone 1998; Mahoney (2000, 2001, and 2002); Kiser and Hechter 1998; Hay and Wincott 1998; Griffin 1992; Pierson 2000; Brown *et al.* 1986; Alexander 2001; Berman 1988; Page 2006 and Page and Bednar 2006).

Figures 6 and 7 rank the fields according to citation figures obtained from ISI Web of Knowledge as of November 2008. The first column of Figure 6 - 'Record Count (1)' - shows that natural sciences have widely applied path dependence in diverse fields of research and is the main contributor to the literature (see for instance: F. W. Meyer and H. E. Krause 2005; Gerlagh and Keyzer 2004; Chen and Lu 2004; Schneibel and Munroe 2004; Murken, Höhner and Skrotzki 2003; Vandermeer and Jensen 2001; Hill 2000; van Giessen and Widom 1999). However, there is no study that reports the ways in which natural scientists use the term in their works. We prefer to leave this issue out of the scope of this survey since it is not our expertise. On the other hand, the second column of the same figure - 'Record Count (2)' - shows an important fact: the influence of social sciences and humanities is slightly more than 12% of total citations. This may seem to be too low but we should note that publication facilities in social sciences and humanities are limited in comparison to those of natural sciences. When we compare this with Figure 7, we see that the source has mainly been the publications in economics and contribution figures of political science and sociology have also been significant. However, the most striking finding is to be found in Figure 8 and 9. They show an increasing interest on the research field and provide us with further data on the increasing impact of economics on path dependence research in general. Figures dramatically shift in 1990, that is, right after the works of David (1985) and Arthur (1989).

FIGURE 6: PATH DEPENDENCE LITERATURE IN NATURAL AND SOCIAL SCIENCES

	SUBJECT AREA	RECORD COUNT (1)	RECORD COUNT (2)
1	PHYSICS	2650	
2	ENGINEERING	1365	
3	CHEMISTRY	1292	
4	MATERIALS SCIENCE	1182	
5	MATHEMATICS	561	
6	MECHANICS	449	
7	SPECTROSCOPY	413	
8	CRYSTALLOGRAPHY	391	
9	OPTICS	379	
10	BUSINESS & ECONOMICS		274
11	COMPUTER SCIENCE	260	
12	GEOLOGY	257	
13	INSTRUMENTS & INSTRUMENTATION	253	
14	BIOCHEMISTRY & MOLECULAR BIOLOGY	208	
15	SCIENCE & TECHNOLOGY - OTHER TOPICS		208
16	ASTRONOMY & ASTROPHYSICS	204	
17	METEOROLOGY & ATMOSPHERIC SCIENCES	204	
18	GEOCHEMISTRY & GEOPHYSICS	193	
19	ENVIRONMENTAL SCIENCES & ECOLOGY	190	
20	BEHAVIORAL SCIENCES		181
21	ACOUSTICS	168	
22	PSYCHOLOGY		158
23	THERMODYNAMICS	143	
24	GOVERNMENT & LAW		140
25	PUBLIC ADMINISTRATION		136
26	GEOGRAPHY		132
27	NEUROSCIENCES & NEUROLOGY	124	
28	TELECOMMUNICATIONS	124	
29	BIOPHYSICS	116	
30	METALLURGY & METALLURGICAL ENGINEERING	106	
31	PHYSIOLOGY	105	
32	POLYMER SCIENCE	100	
33	CELL BIOLOGY	92	
34	NUCLEAR SCIENCE & TECHNOLOGY	92	
35	SOCIAL SCIENCES - OTHER TOPICS		74
36	SOCIOLOGY		74
37	OCEANOGRAPHY	70	
38	MATHEMATICAL & COMPUTATIONAL BIOLOGY	69	
39	ENERGY & FUELS	68	
40	GENETICS & HEREDITY	65	
41	AGRICULTURE	64	
42	LIFE SCIENCES & BIOMEDICINE - OTHER TOPICS	63	
43	RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING	62	
44	PHARMACOLOGY & PHARMACY	59	
45	TOXICOLOGY	54	
46	ELECTROCHEMISTRY	53	
47	PLANT SCIENCES	47	
48	COMMUNICATION		45
49	MICROSCOPY	38	
50	ZOOLOGY	38	
51	WATER RESOURCES	36	
52	ANATOMY & MORPHOLOGY	34	
53	ENDOCRINOLOGY & METABOLISM	34	
54	EDUCATION & EDUCATIONAL RESEARCH		33
55	PSYCHIATRY		33
56	MARINE & FRESHWATER BIOLOGY	31	
57	PEDIATRICS	31	
58	PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH		31
59	SOCIAL ISSUES		31
60	SUBSTANCE ABUSE	31	
61	ANTHROPOLOGY		28
62	CARDIOVASCULAR SYSTEM & CARDIOLOGY	28	

63	INTERNATIONAL RELATIONS		27
64	OPERATIONS RESEARCH & MANAGEMENT SCIENCE		27
65	OPHTHALMOLOGY	27	
66	AUTOMATION & CONTROL SYSTEMS	23	
67	BIODIVERSITY & CONSERVATION	23	
68	HEALTH CARE SCIENCES & SERVICES	21	
69	SOCIAL WORK		21
70	MICROBIOLOGY	20	
71	RESEARCH & EXPERIMENTAL MEDICINE	19	
72	DEVELOPMENTAL BIOLOGY	18	
73	PATHOLOGY	18	
74	FORESTRY	17	
75	GERIATRICS & GERONTOLOGY	17	
76	NUTRITION & DIETETICS	17	
77	IMMUNOLOGY	16	
78	ROBOTICS	16	
79	TRANSPORTATION	16	
80	HEMATOLOGY	15	
81	INFECTIOUS DISEASES	15	
82	REMOTE SENSING	15	
83	IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY	14	
84	MEDICAL LABORATORY TECHNOLOGY	14	
85	SPORT SCIENCES	14	
86	EVOLUTIONARY BIOLOGY	13	
87	REPRODUCTIVE BIOLOGY	13	
88	URBAN STUDIES		13
89	INFORMATION SCIENCE & LIBRARY SCIENCE		12
90	FOOD SCIENCE & TECHNOLOGY	11	
91	GENERAL & INTERNAL MEDICINE	11	
92	AREA STUDIES	10	
93	BIOTECHNOLOGY & APPLIED MICROBIOLOGY	10	
94	FAMILY STUDIES	10	
95	MINING & MINERAL PROCESSING	10	
96	REHABILITATION	10	
97	RESPIRATORY SYSTEM	10	
98	DEMOGRAPHY		9
99	HISTORY		8
100	CONSTRUCTION & BUILDING TECHNOLOGY	7	
101	DERMATOLOGY	7	
102	GASTROENTEROLOGY & HEPATOLOGY	7	
103	ONCOLOGY	7	
104	OTORHINOLARYNGOLOGY	7	
105	PARASITOLOGY	7	
106	ORTHOPEDICS	6	
107	UROLOGY & NEPHROLOGY	6	
108	CRIMINOLOGY & PENOLOGY	5	
109	PHILOSOPHY		5
110	HISTORY & PHILOSOPHY OF SCIENCE		4
111	SURGERY	4	
112	ARTS & HUMANITIES - OTHER TOPICS		3
113	DENTISTRY, ORAL SURGERY & MEDICINE	3	
114	LITERATURE		3
115	OBSTETRICS & GYNECOLOGY	3	
116	VETERINARY SCIENCES	3	
117	ENTOMOLOGY	2	
118	FILM, RADIO & TELEVISION		2
119	FISHERIES	2	
120	MEDICAL INFORMATICS	2	
121	PALEONTOLOGY		2
122	RELIGION		2
123	VIROLOGY	2	
		TOTAL	12568
		PERCENTAGE	88
			1550
			12

(7 Subject Area value(s) outside display options.)

(8 records (0.1599%) do not contain data in the field being analyzed.)

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[Accessed in November 2008]

FIGURE 7: MAIN CONTRIBUTORS ON PATH DEPENDENCE RESEARCH IN SOCIAL SCIENCES (TOP 10 IN ISI RANKING)

	AUTHOR(S)	TITLE	NUMBER OF CITATIONS	FIELD
1	BECK, KATZ, AND TUCKER (1998)	TAKING TIME SERIOUSLY	375	POLITICAL SCIENCE
2	PIERSON (2000)	INCREASING RETURNS, PATH DEPENDENCE, AND THE STUDY OF POLITICS	335	POLITICAL SCIENCE
3	GREIF (1994)	CULTURAL BELIEFS AND THE ORGANIZATION OF SOCIETY	224	ECONOMICS
4	BRENNER (2001)	THE LIMITS TO SCALE?	130	GEOGRAPHY
5	MAHONEY (2000)	PATH DEPENDENCE IN HISTORICAL SOCIOLOGY	128	SOCIOLOGY
6	STARK (1992)	PATH DEPENDENCE AND PRIVATIZATION STRATEGIES IN EAST-CENTRAL EUROPE	122	ECONOMICS
7	LIEBOWITZ AND MARGOLIS (1995)	PATH DEPENDENCE, LOCK IN, AND HISTORY	103	ECONOMICS
8	BEBCHUK AND ROE (1999)	A THEORY OF PATH DEPENDENCE IN CORPORATE OWNERSHIP AND GOVERNANCE	98	ECONOMICS
9	MEYER-KRAHMER AND MEYER-KRAHMER (1998)	SCIENCE-BASED TECHNOLOGIES: UNIVERSITY-INDUSTRY INTERACTIONS IN FOUR FIELDS	78	ECONOMICS
10	COHEN AND LEVINTHAL (1994)	FORTUNE FAVORS THE PREPARED FIRM	74	ECONOMICS
+	DAVID (1985)	CLIO AND THE ECONOMICS OF QWERTY	798	ECONOMICS
+	ARTHUR (1989)	COMPETING TECHNOLOGIES, INCREASING RETURNS, AND LOCK IN BY HISTORICAL EVENTS	759	ECONOMICS
+	DENZAU AND NORTH (1994)	SHARED MENTAL MODELS - IDEOLOGIES AND INSTITUTIONS	130	ECONOMICS

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* David (1985), Arthur (1989), and Denzau and North (1994) do not automatically appear in path dependence topic search of ISI. It is likely that they are not properly encoded in the ISI software. However, these articles are crucially important in path dependence research as the citation figures show. Therefore they are manually added in order to make a proper comparison.

FIGURE 8: DEVELOPMENT OF PATH DEPENDENCE RESEARCH OVER YEARS
(GENERAL)

	PUBLICATION YEAR	RECORD COUNT		PUBLICATION YEAR	RECORD COUNT
1	1965	2	21	1989	6
2	1968	3	22	1990	15
3	1969	3	23	1991	139
4	1970	3	24	1992	180
5	1971	3	25	1993	213
6	1972	2	26	1994	220
7	1974	4	27	1995	187
8	1975	7	28	1996	284
9	1976	3	29	1997	225
10	1977	4	30	1998	298
11	1979	2	31	1999	273
12	1980	4	32	2000	290
13	1981	3	33	2001	313
14	1982	4	34	2002	308
15	1983	3	35	2003	300
16	1984	5	36	2004	303
17	1985	8	37	2005	349
18	1986	5	38	2006	356
19	1987	3	39	2007	348
20	1988	7	40	2008	314
			SUBTOTAL		4999
			(5 Publication year value(s) outside display options.)		5
			TOTAL		5004

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[Accessed November 2008]

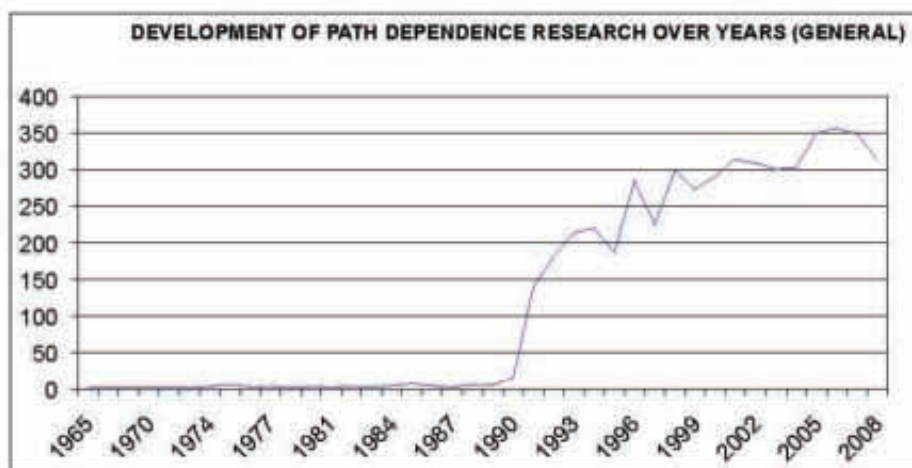
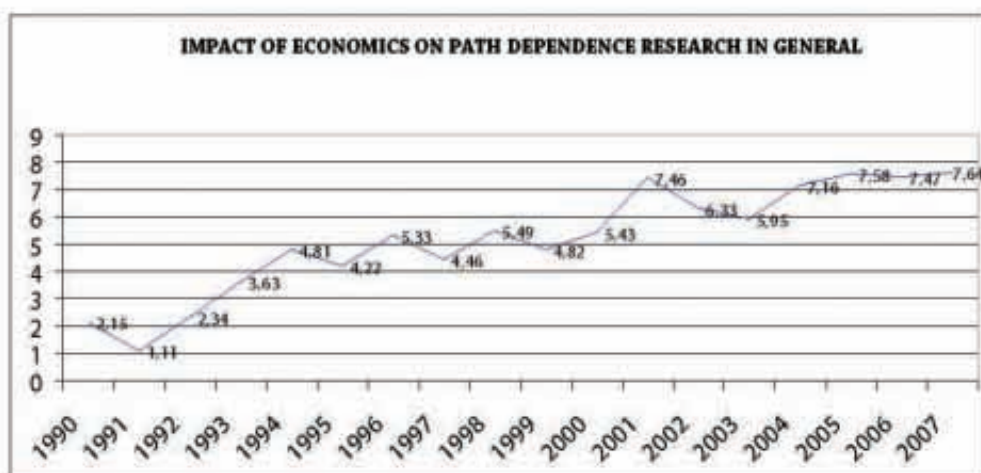
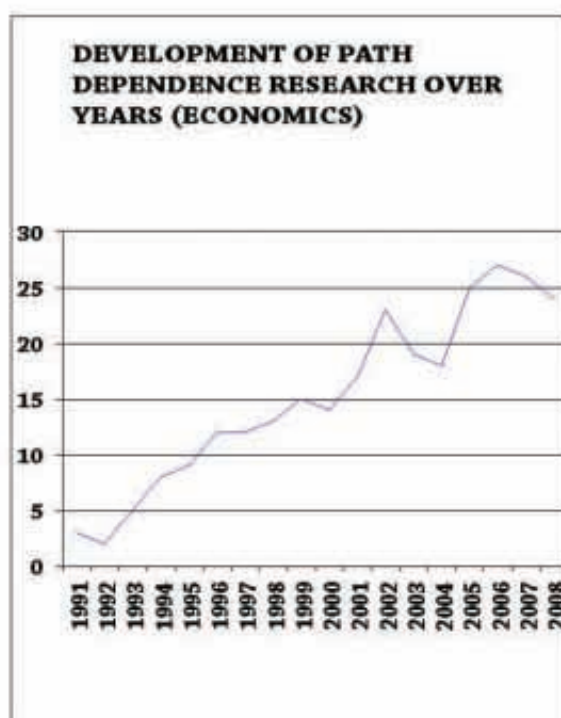


FIGURE 9: DEVELOPMENT OF PATH DEPENDENCE RESEARCH OVER YEARS (ECONOMICS)

	PUBLICATION YEAR	RECORD COUNT
1	1991	3
2	1992	2
3	1993	5
4	1994	8
5	1995	9
6	1996	12
7	1997	12
8	1998	13
9	1999	15
10	2000	14
11	2001	17
12	2002	23
13	2003	19
14	2004	18
15	2005	25
16	2006	27
17	2007	26
18	2008	24
TOTAL		272

(2 Publication Year value(s) outside display options.)



Path dependence in intellectual history

Path dependence research also includes works about the 'tangled pathways of history' (Collins *et al.* 1999), the institutional history of thinking systems (Graff 1987) and 'evolution of vocabularies' that have been locked in to specific paths (Ocasio and Joseph 2005). However, the so-less number of publications lack a pleasing conclusion about the lessons to be drawn from the general evolution of intellectual institutions such as universities, sciences, and the scholarly methodologies and vocabularies that scientists have long used in order to communicate among themselves. Many conceptual works in the field overlook the issue (see for instance, Cowan and Gunby 1996; Puffert 2003; Rizello 1997; Dutt 1997; Arrow 2000; Balmann 1996), and a general theory of path dependence in regards intellectual history is not taken so seriously by researchers.

To take some examples: John D. Sterman and Jason Wittenberg (1989) depart from Kuhn's argument (2000: 104) that 'small changes ... can have large-scale effects' and claim that 'self-reinforcing processes amplify intrinsically unobservable micro-level perturbations in the environment - the local conditions of science, society, and self faced by the creators of a new theory - until they reach macroscopic significance.' They develop a Kuhnian model of interacting paradigms in which the creation of new theories is stochastic and endogenous. According to Sterman and Wittenberg, it is positive feedbacks that

create the self-organizing dynamic by which uncommitted and unorganized practitioners coalesce into a highly focused paradigm with a productive program of normal science. Through these feedbacks a successful paradigm alters its environment by suppressing the creation of competitors and rapidly starving any that do emerge of the resources they would need to succeed. The same feedback processes operate in the opposite direction during the crises period to accelerate the collapse of a paradigm which has accumulated sufficient anomalies for confidence to begin falling.

In a similar fashion, Albert Jolink and Jack Vromen (2001) argue that scientific knowledge and procedures are vulnerable to lock-in effects and multiple self-reinforcing mechanisms. Members of the scientific community use each others' results, build upon each others' work, and seek out recognition and prestige among their peers. As a consequence, Jolink and Vromen remark,

The more scientists accept the same concepts and standards, the more attractive it be-

comes for those scientists to stick to their guns and for others to join the bandwagon. By the same token, with the lion's share of the community converging on the same concepts and standards, barriers to exit conventional science are erected (Jolink and Vromen 2001).

Path formation: A few clarifications

In order for us to talk about path dependence in the life history of societies we need to observe certain characteristics regarding the initial conditions of a system. A path dependent system is one in which the outcome of a sequence of events is not determined by initial conditions. Instead, a path dependent system exhibits such property that outcomes are *stochastically* generated by initial conditions (Goldstone 1998). In other words, in path dependent processes, outcomes of a sequence of events are indeterminate. They depend on the intermediary mechanisms between initial conditions and the outcome. When we 'run' a system, we have no idea (i) as to which initial conditions would give rise to path dependent outcomes and (ii) as to whether same path dependent outcomes would come about had there been another occasion in which we could repeat the 'game.'

Path dependence of a system has much to do with the relation between initial conditions of a system and 'lock-in's in the end of feedback mechanisms. A crucial issue here is that initial conditions do not at all times lead to lock-ins. And when they do, further mechanisms often take place, helping perhaps lock out the system from the influence of its past states. Sydow, Schreyögg, and Koch (2005) suggest analyzing the subject matter within a three-phase framework ('classical model'). According to Sydow *et al.*, Phase I comprises of a social selection mechanism in which some events are stochastically selected and their consequences linger on in the long run. That is to say, selection of events cannot be explained in deterministic terms by initial conditions or past states of the system. In other words, 're-playing the tape of life' once again, we would not have identical consequences at the end necessarily (Gould 1991: 49-50). Once such events are selected, 'it becomes progressively difficult to return to the initial point when multiple alternatives were still available.' On the other hand, the distinguishing feature of Phase II is 'path formation' in which feedback mechanisms reproduce the significance of the consequences of events selected in Phase I. The transition is marked by contingent emergence (i.e. free from strict necessity of a law-like rule) of a small event which has significant and sustainable effects on the system. The option set of economic

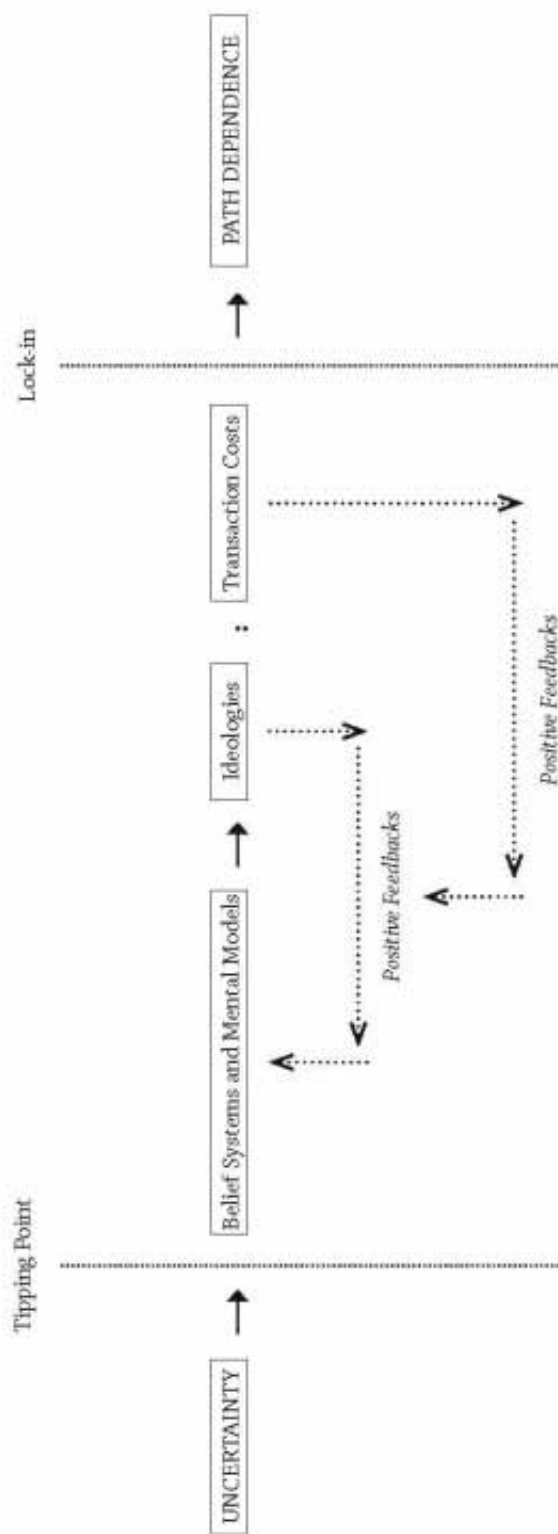
agents is narrowed by feedback mechanisms as a consequence of which 'a path emerges and renders the whole process more and more irreversible.' Finally, Phase III is the last stage and characterized by lock-in. Lock-ins are the conditions in which individuals are not able to change decisions without considering substantial costs of switching to another decision set. After lock-ins, alternatives are not accessible anymore (i.e. costly), although in Phases I and II, different decision sets were still available at lower costs. In Phase III, processes do not converge to a fixed end-point. Rather, 'one particular technology or institution has been generally adopted and forcefully makes new entrants adapt to it' (Sydow *et al.* 2005).

Figure 10 may help us comprehend the elements of path formation in a typical path dependent process. Figure shows that a typical process is characterized by three subsequent stages. In the first stage, an event is 'naturally' selected and enters the intermediary stage as a result of a stochastic procedure. That is to say, inherited traits of a group of selected events start to become commoner in successive stages by way of re-producing consequences that are more favorable or advantageous for decision giving individuals in the market. In this stage there is no determinate rule governing the selection of events. In other words, there is no guarantee that event(s) chosen are necessarily 'small' or that identical events would be chosen if the process had been repeated or that the process is 'progressive.' The intermediary stage is where feed back mechanisms operate without a determinate destination. In this stage mechanisms magnify the consequences of the significance of some selected events by way of generating a congested circle in which getting out of it is more and more costly as 'belief systems' and 'mental models' feed back upon ideologies and *vice versa*. When 'transaction costs' become so substantial to be overcome, the process is locked into a specific path in which switching between different decision sets are not easily accessible to every individual. This final stage is characterized by stasis in which decisions are often stable and no substantial changes in preference come about without 'switching costs.' Lock outs are not impossible. Further operating mechanisms allow additional opportunities for decision giving individuals but the nature of a typical path dependent process is not changed after all: even after lock outs there is no guarantee that the world would be as before because individual actions give rise to irreversible consequences.

The principle goal of the book is to check the applicability of path formation in scholarly life in the light of the Coasean idea of institutions. We depart from the assertion that '[w]here transaction costs [are] costly and the monitoring of performance

and third-party enforcement of contract [is] problematic, organizational arrangements would indeed matter and [is] expected to be made the subject of conscious deliberate exercises in “institutional mechanism design” (David 1994). The main task here is to highlight the intermediary mechanisms among academics which give rise to large outcomes in terms of the magnitude of the causal significance of individual events in response to relatively small ‘accidents of history.’ In this vein, institutions of scholarly life are seen as ‘carriers of history’ in the sense that social arrangements in human societies are durable. Expectations and individual behavior that come out of the expectations become established in social environments when ‘contracts’ reinforce a well-specified role to joining individuals of a society or club such as a university or research institute. Institutions structure the lives of their members and reward them ‘values’ which reinforce the consequences of particular behavior by way of making the members conform themselves to the well-specified rules and the behavioral outcomes of others’ adoption to the same rules. Values such as honesty, respect, and appreciation constitute the norms of scholarly life which reproduce themselves through intermediary mechanisms that enforce sanctions against not-behaving or generating costs for mal-adapting to certain rules and preventing from participation in the ‘game.’

The intermediary mechanism between the initial cause and the final consequence of individual behavior, which we adapt in the book to the workings of scholarly life, is called self-reinforcement or ‘positive feedback dynamics.’ ‘Positive feedbacks can be defined as ‘circular arrangement[s] of causally connected elements, so that each element has an effect on the next, until the last feeds back the effect into the first element of the cycle’ (Capra 1997: 56, quoted by Walby 2007). Under positive feedbacks, ‘institutions provide ways of performing a multiplicity of generic functions’ (David 1994): then, either a norm spreads wide and fast in the community (‘stasis’) or a ‘selected’ small change in the behavioral system of the community escalates further change and drives the system away from equilibrium (‘catastrophe’). Which of the solutions will dominate depends on the complex nature of the channels of events filtering and reproducing ‘selected’ events in stochastic manners. Complexity emerges out of the versatile effects of intermediary mechanisms that never cease to operate in diverse directions. Even after an event is selected, it can be de-selected later on or another selected event may generate results smoothing out the previously emerged consequences and get the process back to its initial state. Under such complex circumstances, systems resisting outside pressures towards change evolve into stability. When small events

FIGURE 10: ELEMENTS OF PATH FORMATION

The figure, by way of using symbols representing sequential stages and mechanisms between stages in the most simplistic form, depicts a typical transmission mechanism in economic and social life in which decision processes of individuals in face of uncertainty give rise to path dependent outcomes. Boxes represent consequent stages in a typical decision process. Arrows with dots (.....) correspond to positive feedback mechanisms in which little input is put into the equation and the outcome - which feeds back itself into the equation again - is so large as to have significant effect on the result. Column (:) signifies the costs generated during the transaction between belief systems and ideologies where such costs come about as a consequence of the positive feedback between the two. Transaction costs disallow actors in the market to apply another behavioral pattern under the conditions of uncertainty and is a factor feeding the reinforcing mechanism. Bold arrows between stages (.....) show the direction of the working mechanism. Tipping point is where a small event enters the intermediary stage. Lock-in is the final stage of the process in which small events grow big by way of feedback mechanisms. The figure indicates that inputs in such systems, via certain mechanisms, transform into particular results - path dependence. Compare the figure with Figures 3 and 4.

lead to further change (and therefore to larger consequences), however, eliminating the random effects of emerging macro patterns is often difficult. In either way, new pathways eventually occur. Under such circumstances, 'historical small events are not averaged away and "forgotten" by the dynamics,' Arthur argues. 'History may decide the outcome' (Arthur 1994b).

Accumulation of the consequences of small events under increasing returns resembles to the growing probability of drawing the same colored balls in a typical Polya-urn process. The process runs as follows: suppose there are initially equal numbers of red and blue balls in an urn. We randomly draw a ball. Then we return the ball to the urn, with another ball of the same color. That is, if the ball that we draw is red we return the red ball with another red one. If there were initially one red and one blue ball in the urn, there would now be three red balls in the urn - two reds and one blue. We draw another ball. We repeat the game. The consequence of the process is that, as we make further draws, the probability of drawing the same colored ball increases and converges onto 1. The process, in other words, is reinforced by the small event of initially drawing a red ball from the urn. (For 'Polya-urn processes' in economics, see Arthur, Ermoliev, and Kaniowski 1987.) History decides the outcome.

Path dependence in the broadest sense of the term asserts that 'history matters.' This is too broad an assertion to make, however, and is prone to cause misunderstandings because it helps us too little in comprehending the complex dynamics which cause durability of institutions. Path dependence is not present in each and every process in which history matters for a thorough understanding of the phenomenon. To put it differently, economic and social developments that are thought to be historical 'by their very nature' are not necessarily path dependent. On the other hand, in processes in which history does not really matter path dependence is by definition not present because path dependence implies in the first place that institutions have memories and, secondly, sequence of events in the formation of institutions is shaped in significant and persistent ways by particular events that occur in the past. Path dependence is a label for a particular class of processes that involve historically contingent evolution (David 2007).

Economists usually feel offended when critics ask them to elaborate on their subject matter within historical narrative (for instance, see: Blaug 2001). In many econometric models, relations among economic parameters are often mathematically constructed

in a timeless, ahistorical universe (Hodgson 2001: 3-21). However, the 'quest for historical economics,' the central lesson to be drawn out of the literature on path dependence, has nothing to do with the anti-historical bias among neo-classical economists (David 2000). The critical debate is rather that proportion of path dependent processes in general is on rise and special attention should be attached to them by way of using original analytical tools that are different than those of neoclassical economics. A principal issue here is the following: economic processes did not work in the same way through out history. For instance, history matters in understanding the Industrial Revolution (O'Brien 1996, Rosenbloom 2002, Clark and van der Verf 1998, and Clark 2001 and 2003) because it is 'by its very nature' an historical phenomenon but industrial evolution is not totally a path dependent process and many occurrences in Britain in the nineteenth century could be modeled with standard econometric tools of neo-classical economics (for a survey, see McCloskey 1985). Research on path dependence 'needs greater investment in suitable theory, and the kind of theory that is required is harder than that upon which ahistorical economics has been able to rest' (David 2000). None of the 'new economic history' movement during 1960s and 1970s has provided us with the necessary tools to account for the mechanisms behind path dependency in the unusual life story of economic and social institutions.

Increasing returns to scientific scale

In path dependence research, particular attention is paid to feed back mechanisms, namely 'increasing returns to scale,' which cause little changes to have big effects by way of turning the selection of small events in a typical process of path formation into 'tipping points.' (Compare the notion of tipping points with 'turning points' (Abbott 1997) and 'critical junctures' (Collier and Collier 1991).) In economic systems, increasing returns is the principle feedback mechanism in markets magnifying the significance of the consequences of unexpected and accidental occurrences. Under the conditions of increasing returns, consequences of small events give rise to aggregate outcomes. 'The earlier the events that precipitate a shift in the system occur in a series of events the more important they may be' (Walby 2007). This may seem 'counter-intuitive,' Malcolm Gladwell (2000) argues, because we are intellectually born into a conception of approximation among causes and consequences. Changes in social life, we presuppose, take place steadily and slowly. 'We are trained to think that what goes into any transaction or relationship or system must be directly related, in intensity and dimension, to

what comes out' (Gladwell 2000: 11). However, this is not necessarily the case 'in the real world.' Consequences are often far out of proportion to initial causes when evolution takes the form of 'geometrical progression.' Under such conditions, what matter are little things, like small events.

Epidemics are, at the root, about this very process of transformation. When we are trying to make an idea or attitude or product tip, we're trying to change our audience in some small yet critical respect: we're trying to infect them, sweep them up in our epidemic, convert them from hostility to acceptance. That can be done through the influence of special kinds of people, people of extraordinary personal connection ... It can be done by changing the content of communication, by making a message so memorable that it sticks in someone's mind and compels them to action ... [S]mall changes in context can be just as important in tipping epidemics, even though that fact appears to violate some of our most deeply held assumptions about human nature (Gladwell 2000: 166).

In economics, there are various types of increasing returns to scale. The main source of increasing returns is the positive reaction of the system to any perturbation from within the system. Here, 'positive' does not necessarily mean desirable or pleasing in the popular sense of the term. Positive reaction rather refers to the amplification of individual (often small) events that have causal significance. Arthur, principally interested in detecting increasing returns in market economies in such path dependent circumstances as Beta-VHS video systems, Silicon Valley, and the Microsoft Trial, describes path dependence, in the simplest way, as a consequence of increasing returns operating in the market. Arthur argues that we are living in a dual world of business operating according to two different principles. We, on the one hand, have such industries as construction and 'bulk-production' of manufacturing automobiles and refrigerators, operating according to the principle of decreasing returns. And alongside those industries, there are knowledge-based industries, such as informatics and computer industries which operate under increasing returns. They are intertwined and do not exclude each other in the operational level. What works in one industry, however, is not appropriate for the others: the two industries differ in behavior, style, and culture (Arthur 1996). They call for opposite features of management strategies of investment.

Under decreasing returns, if an economic agent increases the amount of hamburgers she eats, she would run into less satisfaction with every extra unit. Likewise, if a company, operating under the law of decreasing returns, is to keep expanding the business of growing potatoes, it would come across increasing costs of production with

every extra unit. Marginal physical product of an input tends to decrease, *ceteris paribus*, as the amount of the input increases. Under decreasing returns, the more you eat or produce the less you get in return.

The economy, especially since the Industrial Revolution, had mainly been an economy of decreasing returns and of producing goods and services in massive amounts by virtue of rigid technologies such as assembly lines. Technologies were engineered to reduce costs as production kept increasing. In industrial economics a well-defined solution always followed, generally speaking, because problems were frequently expressed in terms of decreasing returns. Problems of choice between consumption of apples and oranges and production of war tanks and refrigerators were easily solved by virtue of optimization techniques. But Arthur asked: 'Can the assumption that individuals find optimal solutions to economic problems be justified so that we can avoid studying the details of decision process? In simple cases the answer is yes. In most cases, however, it is no' (Arthur 2000).

Emergence of industries based on increasing returns such as software industries causes numerous alterations in economic theory. The milieu of knowledge-based industries favors the flattening of hierarchies between bosses and workers, Arthur reports. 'Re-everything' changes companies, re-invents goals and ways of doing things, and forces a never-stopping adaptation. People in such industries are not merely employers. They are treated as equals in the business of the company's success.

Although traditional industries of 'bulk production' still require people to carry out production and people to plan and control it, the style of competition in the world of increasing returns is more like 'casino gambling' (Arthur 1996), where the game is to choose which game to play. The principle of increasing returns maintains that optimization in the world of casino gambling, that is, the world of knowledge-based industries, is not always possible. Such industries have never been like the industries of bulk production. Actors as gamblers in the market only watched for the next wave, Arthur says, and re-positioned themselves to take advantage of the new. They have been in a new world of mission orientation, Arthur claims, not a world of five year plans (Arthur 1996).

An example to increasing returns in a free market economy is 'information effect.' Consider the following case: an automobile brand, *Smart*, can dominate the market,

firstly, if *Smart*, say, is economically more efficient than its alternatives. Such reasons could cause the product to dominate the market: individuals, unsurprisingly, would prefer *Smart* because it consumes less petrol than any other average one in the market. Using a cheap car, individuals would allocate more resources to other goods. The motivation economically guides individuals in making up their mind.

The product, however, might dominate the market also in the absence of such reasons. In the event that individuals are *uncertain* about the quality of the product they are planning to buy, the product may win the market share independently, taking the advantage of haziness and consequences of lack of perfect information. Consider a buyer who does not have control over all the factors that would influence her decision. The car that she intends to buy might have been involved in a crash and badly repaired. Trying to make the best decision, she would augment the information publicly available by, say, asking a friend who knows more about detecting crash repairs in a car. The decision would, therefore, depend on the preferences of others in the market. Since there is no free tool available to the buyer for collecting all the information about alternative products in the market - many people would not think of inquiring into the public records of a car - they would not know in advance 'the various practical difficulties and unexpected advantages [and disadvantages] that will inevitably emerge after [they take] up a given program' (Arthur and Lane 1994: 70). If the prospective buyer does not have access to perfect information about the product, she would decide to buy a car, depending on the information she obtains from other buyers.

Under certain circumstances this informational feedback can cause the market shares to become self-reinforcing. Prospective purchasers are more likely to learn about a commonly purchased product than one with few previous users; so that, if they are risk averse, products that by chance win market share early on are at an advantage. Under certain circumstances, in fact, a product may come to dominate by this advantage alone (Arthur and Lane 1994: 70).

The consumer may not have a bible, so to speak, to tell her how to avoid from evil in the diverse circumstances of a market economy. But she may know about the purchasing decisions of others. The best she can do is to exploit such knowledge. She will buy the car from the same vendor who in the last two weeks sold cars to 10 more people most of whom - only those she could interview - have been happy with their cars. Preferences and intentions of others then would shape the decision of the prospective buyer. Even if each user would benefit from switching to another standard - switching from manual

to automatic clutch, for instance - none would dare. This is what Arthur calls 'excess inertia': the prospective buyer could identify the shortcomings of a product, which is in fact a good reason not to buy the product. But preferences of previous users would influence her purchasing decision in such a way that the prospective buyer would unquestionably confine herself to the tried (Arthur 1988: 118).

As a matter of fact, we do have beliefs in the absence of evidence. The social world we live in is not only a world of evidence and facts but also of social networks in which we trust, respect, have responsibility, behave in solidarity, not sneer, and not lie towards our fellows. A factual world without such social institutions would cease to exist. Hardwig argues that 'one can have good reasons for believing a proposition if one has good reasons to believe that others have good reasons to believe it' (Hardwig 1985). We are epistemologically dependent on others' beliefs and on the evidence which are only available to others. Some evidence may be only available to experts or to a minority of non-experts, in that one may never have the opportunity to possess facts to perform an experiment or conduct an inquiry. Then, the only opportunity, if at all, is to replicate the results of experts based on the reports prepared - that is, assess the findings in the light of new and further data in order to be sure whether one is informed or misinformed by a particular judgment. However, if this epistemic individualism were accessible for us at all times, why would we need scholarly communities at all? In practice, what we often do is check whether these experts find those expert reliable. We trust the chain of authority within a scholastic circle which disallow us to establish epistemic autonomy. Such processes are blind: 'a layperson (or a scientist in a different field) cannot be rationally justified in trusting an expert' (Goldman 2001).

'Network effects' are another type of increasing returns in a free market economy under which the total utility of individuals boosts in increasing proportions with successive individuals added into the production function. Only then individuals would have the chance to benefit from coming together and do joint business. Thus whatever network is ahead can advance further. The more a company takes over the market, for instance, the more it obtains the advantage, so that marginal costs decrease when the amount of production increases. The first disk of Windows 95 operation system was \$250 million, reports Arthur in an interview with Joel Kurtzman in 1998 (Arthur 1998), whereas the second, the third, and the rest cost only a few cents. In a similar fashion, after the introduction of fax machines 1980s, the sales tipped in only a few years. When Sharp first introduced cheap fax machines in 1984 the company sold about

80,000 only in the US. By 1989 the sales had increased up to two million (Gladwell 2000: 12). Under increasing returns it is not likely that 'products of companies that get ahead in a market eventually run into limitations, so that a predictable equilibrium of prices and market share is reached' (Arthur 1996).

Krugman argues that '[if] there is one single area of economic in which path dependence is unmistakable, it is economic geography - the location production in space. The long shadow cast by history over location is apparent at all scales, from the smallest to the largest - from the cluster of costume jewelry firms in Providence to the concentration of 60 million people in the Northeast Corridor' (Krugman 1991: 80). In so far as the economic geography is concerned, 'agglomeration effect' is an example to increasing returns in the market. In geographical economics, the infrastructure of an industry such as transportation possibilities and geographical endowments is an important factor for starting a business. Other factors, however, such as the location preferences of other firms, are sometimes equally important. In that, location preferences of other firms may dominate other factors such as transportation possibilities and geographical endowments. Early places attract others-to-come who are to pick up a place to locate the industry. The early firms might have given their decision accidentally long before there were any infrastructural reasons available for them to consider. As more firms start doing business in a region, others are more likely to follow. Advantages of doing business in the location could overwhelm the ('real') advantages of the infrastructure at another location. The industry is then located in the early chosen places. The outcome is unique: another set of accidental small events could have caused the industry to settle in another location.

Agglomeration in geographical economics implies that

[t]he more firms and workers there in a locality, the more the locality becomes attractive as a location for further firms and workers. This creates a cumulative process whose end result might be that all economic activity turns out to be concentrated in one locality ... The cumulative nature of the process of agglomeration is such that a small advantage of one location due to locational chance events in the past can have snowball effects which turn that location into the centre of economic activity, even though this outcome might not be the optimal one (Marchionni 2005: 132).

This is valuable insight for, and one of the most crucial contributions of the economics of increasing returns to, science and technology policy studies in the last few decades.

Publications in this field suggest that peculiarity of scientific development in the last century has been that the more industrial science has become, the more the conditions of *increasing returns to scientific scale* have prevailed in scholarly life: 'the bigger a theoretical construct gets, the higher the pay-offs of additional contributions' (De Lange and Greiff 2008). Science does not at all times yield best result when scientists work on their own and on their behalf only. Science is rather a collaborative field of intellectual specialization and new findings require an audience to judge and replicate the novel implications and findings. Granted that scholarly institutions such as respect and trust as well as 'principles of testimony' are well established and operating (Hardwig 1988 and 1991), there is not much reason for the conditions of decreasing returns to exist. Under such conditions, marginal returns to every scholarly contribution is often on the rise with every novelty added to the scholarly network. Scholars are standing on the shoulders of giants, in other words, '[a]s such, the addition of one scientist to a scientific community doesn't decrease the other scientists' prospects of success ... but increase the prospect of success for the community exponentially' (De Langhe and Greiff 2008).

In the world of increasing returns to scientific scale, the higher the pay-offs the higher the funds raised by government and other research institutes to finance a research project. The reason for this is that science has long ceased to operate like a local, small scale *atelier*: it has become expensive to pursue scientific research in universities and research institutes since new technologies, such as computers, required more capital-intensive investment. Under such conditions, one of the problems awaiting such institutions in the US and Europe in the post-war period has been the systematic examination of calculable items in the processes of allocating resources for doing research: *costs*.

Expenses for conducting science has principally been the costs of (i) investing capital required to start up and run a research project, research center etc. and (ii) the time that must be allowed for scholars to do research. In fact, problems of optimizing costs (and benefits) have never stopped occurring to science since science has come to mean 'organized knowledge' in the sixteenth century or even earlier. But a consequence of this peculiarity in the world of increasing returns to scientific scale has for the time been that the more economical science has become (in terms of the applicability of such analytical tools cost-benefit analysis), historically, the more *military* was involved in it. Military was a sign for, and factor of, enhancing self-reinforcement between war-

time technology spending and university research funding. Military has been the main source of finance for formulating as well as implementing innovative ideas since WWI. 'The important thing is to view the massive military reorganization of American science in midcentury,' Philip Mirowski writes, 'as essentially *continuous* with the prior corporatist innovations pioneered at the beginning of the century. The leaders of this movement themselves managed to combine corporate foundation, and military ties ... The superficial lesson to be drawn from this dense web of interlocking directorates is that, at least in America, postwar science policy was itself developed in close conjunction with both military and corporate imperatives' (Mirowski 2002: 156-157).

AnnaLee Saxenian (1994: 11-27) argues that federal funds after WWII and especially during the Cold War were channeled to university labs, such as those at Stanford and MIT, which were pursuing military research and working in close collaboration with industries such as radar and navigational systems as well as war-related technologies (e.g. submarine warfare). In early 1970s, these industries became self-sustaining and turned into centers for electronics innovation and entrepreneurship. Private investments in industries that required and depended upon the supply of high-skilled labor and constant innovation boosted over decades. Electronics were then the real dynamo of the economy especially in the US.

Indeed, the technological trajectories and potential of semiconductor industry in Silicon Valley and minicomputer industry in Route 128 determined the future of both regions. After WWII they became the centers for electrical and electronic industries. In both Silicon Valley and Route 128 new firm formation was very easy and free from the rigidities of bureaucracy which helped feed the growth of new and small start up firms. This created an ecosystem for the industry in the regions. 'This is not a simple case of lowering entry barriers,' Martin Kenny and Urs von Burg (1999) argue, 'it is also a matter of turbo charging early growth.' The more new firms launched business in the Silicon Valley and Route 128 the easier it was to build networks that would mobilize the resources to generate further opportunities for businesses. Law firms and consulting firms were established. Investment banks and other venture capitalists are attracted by the regions. Existing firms benefited from new comers and in return they increased their R & D expenditures. In the postwar period, almost every electronic innovation was based on semiconductors and minicomputers. Transistors, radios, TVs, and more recently PCs and microprocessors would be impossible without them. In short, electronics industry in the US is clustered in Silicon Valley and Route 128 not because the

locations were close to Pacific sources of supplies and had better access to skilled labor and academic engineering. The regions were established in where they are now because of historical accidents.

In the simplest formulation of this view (Maruyama 1963), an industry starts off on a uniform, featureless plain; early firms put down by 'historical accident' in one or two locations; others are attracted by their presence, and others in turn by *their* presence. The industry ends up clustered in the early-chosen places. But this spatial ordering is not unique: a different set of early events could have steered the locational pattern into a different outcome, so that settlement history is crucial. We might call this view *historical dependence*. Here the locational system generates structures as it goes. It is fundamentally dynamic. It can follow divergent paths, therefore it is nonergodic. It possesses a multiplicity of outcomes, therefore it is nonpredictable ... Historical dependence would see 'Silicon Valley' and similar concentrations as largely the outcome of chance. Certain key people - the Hewletts, the Varians, the Shockleys of the industry - happened to set up near Stanford University in the 1940s and 1950s, and the local labor expertise and inter-firm market they helped to create in Santa Clara County made subsequent location there extremely advantageous for thousands or so firms that followed them (see Cohen (1984)). If these early entrepreneurs had had other predilections, 'Silicon Valley' might well have been somewhere else (Arthur 1994c).

The second contribution of the economics of increasing returns to science studies is the following: our reasoning largely depends on our past experiences especially when the problems that individuals face lie outside the borders of what individuals have been used to. Individuals, under such circumstances, look for ways to frame the situation. They try to make associations to simplify and single out the sophistication that faces them. When past experiences are the first option for the one who seeks guidance for action, alternatives to behavioral patterns that have so far been formed by history are usually ignored. Staying away from alternatives would cause an impact of over-utilizing - 'over-exploiting,' in Arthur's terms - aged methodologies and techniques. This may generate several paths of evolution with undesirable outcomes.

Such a procedure enables us as humans to deal with complication: we construct plausible, simple models that we can cope with. It enables us to deal with ill-definedness: where we have insufficient definition, we use working models to fill the gap. Such behavior is inductive. It may look like ad-hoc and messy, but it is not antithetical to 'reason,' or to science for that matter. In fact, it's the way science itself operates and progresses (Arthur 2000).

Arthur reports that this sort of finding, where there are thresholds beyond which better alternatives become difficult to discriminate, is not familiar in economics. Borders among theories are often clear-cut, not allowing any communication with others. Indeed, it is true that it may be hard to talk to a game theorist in terms of conflicts rising out of gender, race, and class. And it is also true that Marxists would resist the idea that cultural factors such as religion are among the determinants of economic relations. Nevertheless, it has long been accepted in psychology (and other disciplines, too) that our principal habit of conduct, say, while typing documents in MS Word, is that even if there were alternatives, humans would not choose them (Arthur 1994a: 152-153). This may sometimes yield the highest payoffs - writing a doctoral thesis at Harvard on game theory would guarantee a position after graduation. It is no guarantee, however, that the next paper that the graduate student writes would not be another 'statistical significance test' which McCloskey considers as a sin in economic theorizing (McCloskey 1993 and Ziliak and McCloskey 2007). As a result, there will be more and more papers on less and less significant and intellectually interesting papers. Keeping up the same set of preferences and exploiting the same path, therefore, may also cause lower payoff alternatives to be chosen. As Arthur says, 'multiple equilibria, path dependence, possibly inefficient incomes (relative to the perfect-information one), non-predictability, and lock-in - the standard increasing returns properties cannot be escaped under rational learning in the presence of positive discounting' (Arthur 1994a: 136). Path dependence, under such circumstances, is inevitable.

Path dependence of institutions is in the first place about complexity of popular action in which individuals make decisions and affect others in their preferences in a reciprocal fashion. An individual or a small group of individuals starting off using a different 'standard' may not bother the entire industry in the short run at the slightest because frequency of the new method could be so low to become a large scale practice for others. On the other hand, popularity of a certain standard may well increase as a consequence of a little trigger ('tip') and actors in the market may respond to this in a positive way because markets, under certain conditions, feedback upon new preferences in reinforcing fashions. Individuals do not act like robots, of course. Particularly in scholarly life, individuals act mostly in independent manners. But they are influenced by others as well as their past preferences. Rising of paradigms (i.e. standards prevailing) and falling of paradigms (i.e. locking out, shaking free from the influence of past events so forth and so on) is a process in which different factors (especially the

ones related to their past) affect each other in complex ways. A key issue here is that old paradigms do not fall easily although change is not impossible. What matters is how individual preferences spread among the community. In other words, how a new method wins popularity? We take up this issue below.

Uncertainty, belief systems, and ideology

Douglass North is one of the writers among the theorists of path dependence in economics whose research program is so broad as to embrace a large variety of topics in a diverse field of social research. The notion of path dependence plays a key role in his writings and in many places he applies the notion in decision theory in economics as well as economic history, development studies, political science, and political history. He is well aware that the scope of the notion is not limited to economic science only. Path dependence is an appropriate notion applicable to other fields of knowledge, too.

One of the elements which one successively finds in the writings of North, in association with his view of path dependence is the element of uncertainty in human decision. Individuals making up their minds in diverse and unique situations usually face difficulties that damage the desirability of the consequences of their reasoning. The difficulty is principally that individuals in economic and social life do not always have a clear and precise idea about the changing character of diverse circumstances within which they have to make decisions. They usually suppose that what they did in similar situations in the past will cause similar consequences for the present. After all, they think, alike causes generate alike consequences.

However, this principle does not hold in practice at all times, North thinks. Individuals, despite the limits to their knowledge, have to keep up making choices and constructing theories under conditions of uncertainty. Under such circumstances, 'belief systems' serve as a basis for their decision-making. Although consequences are not always what individuals predicts, North argues, the direction of the evolution of the economy, politics, and intellectual life is shaped by the decisions made towards such beliefs (North 1996).

For North, belief systems are highly influential in the way theoretical models are formed and on the way old models are abandoned and new ones are created. Acting in accordance with an established belief system is convenient - or less costly, economically

speaking - especially when 'one cannot ascertain the probability of an event and therefore cannot arrive at a way of insuring against such an occurrence' (North 1990: 126). This does not mean to say that individuals acting according to their beliefs can never predict the consequences of their actions. It is rather to say that consequences that are not anticipated by the actors in advance might sometimes dominate the situation in such a way that actors facing increasing complexity of the situation may prefer to stick to the same set of beliefs instead of measuring their performance and adopting new tools if necessary. Individual actions, North argues, can thus have such consequences that choices made can create and perpetuate unproductive economic and political markets (North 1992).

In economic and social life, North points out, we have 'ignorance, incomplete information, and the resulting prevalence of ideological stereotypes as the underpinnings of the subjective models [which] individuals develop to explain their environment and make choices [leading] to political markets that can and do perpetuate unproductive institutions and consequent organizations' (North 1992). In other words, we reduce uncertainty by structuring human interaction. However, institutions we create need not necessarily perform as effective under diverse circumstances.

One can think of two separate possibilities here. In the first situation, individuals have access to full information. There is no uncertainty, and neither is there risk as a consequence, because decisions are made by the actors who are conscious of the consequences of their actions. Economic models are mostly built in the assumption that actors have access to full information during market transactions. For instance, there is no ambiguity about the quality of the products that are bought and sold; individuals know the consequences of consuming A good instead of B good or working for X company instead of Y company etc. As a result, resources are allocated in the most efficient ways; defaults in financial contracts are eliminated so forth and so on.

In the second, the situation is completely different. The actors now do not have access to full information. They give decisions in the face of uncertainty and therefore take the risk that consequences of their action can be other than those that they had anticipated before they took the action. In such a case, in contrast to full information - that is, no uncertainty situation - actors try to reduce the cost of the risk that can diminish the cash-value of the consequences of their decision. To do so, they build key ideas upon their perception of their environment. Those 'mental models' (that is,

belief systems such as myths, dogmas, and taboos in 'primitive' societies and religions and ideologies in 'civilized' societies) enable actors to work out the uncertainty that they have to face. In such situations, they rely also on their habits which they form on the basis of the past experiences where a set of tools proved to be successful before. It is believed (and hoped) that the same set of tools, although the situation might have changed dramatically, would perform best as compared to the alternatives.

What all this shows is that we are involved in such circumstances that consequences of our actions may not be the best ones at all times. Uncertainty that individuals face, and their inability to access to full information, cause such an unpredictable condition that individuals might be content with the unintended consequences of their action that reduce the pay-offs of their decision. Even if an 'efficient' outcome occurs, this would not be systematic. Repetition of the same decision might not give a way to the best outcome in every and each turn.

The situation can get even tougher. Uncertainty can become stronger, as Denzau and North (1994) report, especially when 'one is not even certain whether a particular choice will improve one's circumstances or not. The choice may be made infrequently, sometimes only once in a lifetime. Without direct experience, information about potential outcomes may not be known or easily acquired' (Denzau and North 1994). The so-called *tabula rasa* situation at birth is counted as one of the instances for such a state.

The pervasive human attempt to reduce uncertainty is the key to understanding the way belief systems evolve. In order to make uncertain situations 'comprehensible' humans will develop explanations. The pervasiveness of myths, taboos and particularly religions throughout history (and prehistory, as well) suggests that humans have always felt a need to explain the unexplainable and indeed it is probably an evolutionarily superior trait to have any explanation rather than no explanation (North 1996).

One of the key issues here is the role that ideologies play in the doing and making of scholarly life. Ideologies help people understand and explain the events taking place around them insofar as they provide the epistemological tools of understanding to analyze the world. Such tools are formed via past experiences of individuals which proved to be useful in certain circumstances in earlier periods. However, ideologies may have further consequences for the advance of human understanding: ideologies may set borders and rules that would regulate the pathways of scientific and artistic

progress. When ideologies operate so as to set borders and rules they regulate the scientific advancement towards an abstract systematic. That is to say, ideologies set off to organize the scholarly activity in order to achieve specific goals or manners in which individuals or groups view 'reality.' Scientific theory is now not a bunch of theories only but a system of attitudes. Instead of providing advantages against uncertainty, in particular, ideologies impose habits and reinforce and exist by virtue of aged (epistemological) institutions.

Despite various meanings of ideology, this meaning of the term has come into existence only after the rise of American Pragmatism in the writings of Charles S. Pierce, William James, and John Dewey. According to Pierce, 'the meaning of any idea can be determined only by observing the habits of action which it produces' (Aiken 1956: 264). Insofar as habits are the primary code of behavior among scholars and the entire function of scholarly activity is to produce more habits of conduct, scholarly life is under the risk of becoming ideological, i.e. getting locked into a set of ideological judgments about scientific method. The more intellectuals consult ideologies for more answers the more it becomes difficult (i.e. costly) to change viewpoints, methods, and paradigms. Such pathways emerging out of influential ideologies and habits of action may both have advantageous and disadvantageous consequences for the scholars, depending on the extent and the way ideologies operate and provide scholars with up-to-date tools for understanding the events in nature and society. Although 'new' does not necessarily mean 'better,' lock-ins amount to irreversibility which may easily turn out to be undesirable especially in the long runs.

The ideological stereotypes that dominate making choices in political and other contexts - such as conservatives and liberals - are 'looser' constructs that guide choices in the face of uncertainty just as surely as more organized structures. But whether organized or 'loose' ideologies play a complementary role to institutions in making behavior predictable. While institutions structure the external environment between human beings, ideologies structure the mental 'environment' thereby making predictable the choices of individuals over the range of issues relevant to the ideology (North 1996).

Under such uncertainty conditions, 'path dependence of knowledge' come about (Nooteboom 1997 and Bonilla 1999) because intellectual institutions impose costs ('switching costs') on individuals which individuals should seriously consider in case they attempt to explore decisions alternative to what institutions already provide them with in the first place. Actors then have basically two options: they are either going to

be content with the consequences of their actions that have evolved out of ideological judgments, or they are going to exchange the risk that the current uncertainty creates with the risk that exploring a new path of evolution could lead to. What they only possess in exploring a new path is their faith in getting free of the path that has been doomed to yield nothing more than it yielded in the past. But not considering such alternatives may cause incapacity to over-stand: exploiting the same path of evolution, actors would rid themselves of the risk of a worse consequence of their action but would be left without the pay-offs from exploring alternatives. Switching among different paths is worth considering because pay-offs from curiosity of exploring a new path could overwhelm the cost that such an exploration would create. Disregarding new paths will only lead to 'widening the candidate's field of ignorance while it intensifies his effectiveness within his specialty' (Veblen 1918: 286).

Size Matters

Or, when a little neglect breeds mischief

V. I. Lenin was carrying a bouquet of roses when he arrived at Saint Petersburg's Finland Station on the night of April 16, 1917. He stepped off the train. His comrades welcomed him with tears on their cheeks. He addressed the crowd from the balcony of Kshesinskaya Palace which was at the time captured by the Bolsheviks. 'On the journey here with my comrades,' Lenin said, 'I was expecting that they would take us straight from the station to Peter and Paul. We are far from that, it seems. But let us not give up the hope that we shall not escape that experience' (Wilson 1953: 472).

It was the early days of the Russian Revolution. Lenin was trying to flee from Switzerland where he had been in exile. He was put in the train, and entered Russia. He was not caught by the police on the border. Such a *small event* was very important because its consequences, Lenin knew, would dominate the world and fuel important political and intellectual movements in the twentieth century. It was a small event that functioned as 'the key of a philosophy of history [that] fit to an historical lock' (Wilson

1953: 467).

In *To the Finland Station* (1953), Edmund Wilson portrayed a prophecy of the inevitability of socialist revolution as a human phenomenon (see also Murphy 1992: ix-xv). He did not write about abstract principles running history but how the execution of Lenin's brother by the Tsar when Lenin was 17 affected Lenin's views on social revolutions. He did not write about necessities in human history but about how Lenin was not allowed to reenter the University of Kazan, and subsequently started by chance reading Marx. He did not write about socialist theories of 'blackboard Marxism' that did not touch a bit the 'real' world that theorists lived in but about concrete events such as that it was only by accident that Lenin had not been caught and arrived safely at the Finland Station. He wrote about small events that had big consequences for the future.

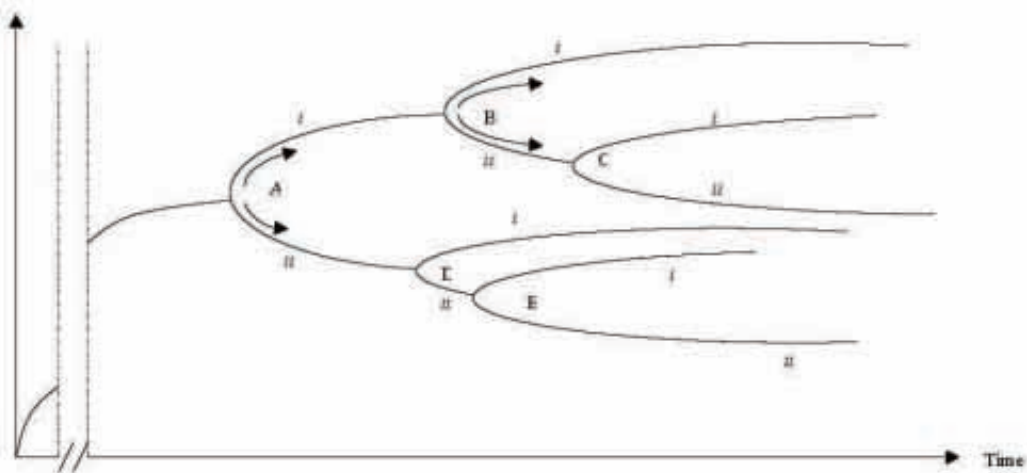
As a matter of fact, economists have pointed out a specific group of events that can dramatically change the course of history in exceptional ways. Such events hardly fit the general picture drawn by conventional historians. Their consequences accumulate in noticeably different fashions. They are *casual* events of history that have *causal* significance for today. Following the writings of Brian Arthur on complexity, increasing returns, and path dependence, such events are called 'historical small events.' According to Arthur (1989), historical small events are

those events or conditions that are outside the ex-ante knowledge of the observer - beyond the resolving power of his 'model' or abstraction of the situation ... [T]he small events ... determine ... the path of market shares; the process is non-ergodic or path dependent - it is determined by its small-event history.

Historical small events play significant roles in the path dependent evolution of intellectual ideas. 'Intellectual paths' or 'intellectual path dependence' means that the initial conditions of certain ways of thinking sometimes lock us in to particular pathways. Such pathways occur when the follow-up of small events catches intellectuals in its complex web irreversibly and grow bigger in the future. The distinctive property of such conditions is that the evolution of ideas does not necessarily lead to any pre-defined end point. Small events trigger shifts in the course of events and this leads to (extra-) positive or (extra-) negative consequences that move the system away from its systematic course. After small events take place, complex webs of scholarly life function in either of two ways: (i) as a short-cut that moves the system to a better state

and elevates it to higher levels of order which could only be reached within longer time spans if there had been no interruptions or (ii) as a hindrance that would break the system down and disallow intellectuals to proceed further and achieve intellectual advancement. When historical small events become a hindrance (ii), a little uncorrected error sometimes feeds back a negative cumulative effect on the progress of scientific knowledge. When they operate as a short-cut (i), however, the conditions that turn an event into a starting point of a new pathway can be the breaking point of an old one as such that they unlock the old course of events bearing path dependent properties and perhaps lead to more complex evolutionary pathways. This would mean an upward movement of the system to more coherent and sophisticated levels. Within intellectual paths, setting a new start in motion is not easy (and sometimes impossible) for a number of reasons. Such uneasiness (or impossibility) could be a chance for the improvement (that is, further sophistication) of the evolution of ideas; however, the direction of the evolution of events after such bifurcation points depends completely on the conditions that take place afterwards.

FIGURE 11: EVOLUTION OF IDEAS



The figure demonstrates the evolutionary pathways of intellectual ideas in which historical small events (represented by A, B, C, D, and E,) disturb the systematic course of evolution ('normal science,' in Kuhnian terms) in such a way that there is no single, pre-defined end point to which the evolution of ideas leads. Compare the figure with the 'bifurcation diagram' developed by Prigogine and Stengers (1984).

Economists have used the metaphor of path (dependence), primarily, in order to express their dissatisfaction with the present state of the evolution of an institution. The term is often used in order to communicate a complaint about the historical conditions of social and economic institutions.

Intellectual paths, however, do not necessarily amount to a hindrance or negative cumulative effect on the accumulated body of knowledge. Intellectual paths help new ideas spread and let loosen the inertia in our ways of thinking especially if and when economists are in scholarly 'conversations' (Klamer 2007). A conversation is the performance of intellectual actors in scholarly circles so as to convince their peers about new ideas. Deirdre McCloskey claims that economic conversations feature a 'meta-economical hierarchy': at the bottom is methodology (with a small 'm'), that is, the toolbox of a practicing economist. In the middle is Methodology (with a capital 'M'), that is, the rules that demarcate 'science' from 'non-science' such as the Popperian program of falsifiability. And at the top of the hierarchy lie 'conversational norms' that 'we implicitly adopt by the mere act of joining what our culture thinks of as conversation' (McCloskey 1984, quoted by Park and Kayatekin 2000): 'Don't lie; pay attention; don't sneer; co-operate; don't shout; let other people talk; be open-minded; explain yourself when asked; don't resort to violence or conspiracy in aid of your ideas' (McCloskey 1994: 99).

'Economics as a bunch of conversations' is not only about models, mathematics, and econometrics. It is manners and habits, too, which make it possible for economists to interact and converse with each other. It is about the ways in which they persuade their audience. In all that, disagreements, social networks, creativity, and the ability to draw the attention to yourself matter interactively (Klamer, Mignosa, and Velthuis 2000, Klamer 2002). This means that no science is a 'hard discipline' only. There are no ultimate objective criteria necessarily determining who is in or out of the conversation. Economics is a multiplication of the consequences of such factors altogether. In that, the outcomes are often much farther and bigger than the intentions of economists at individual levels.

New ideas often come about only when intellectuals invest time in examining the facts of the world until they generate intellectual paths (i.e. conversations) in which they establish the borders of their science and the standards of doing it. As a matter of fact, new pathways are often created intentionally by way of entrepreneurs' taking initiatives on the course of events. Such initiatives cause deviations from the possible

set of actions that an individual is expected to take in reaction to certain conditions. Entrepreneurs, by so doing, win the ability to explore new pathways, thus alternatives, of motivation for proceeding further. New pathways mobilize new sequences of events in the future so that entrepreneurs escape possible long time lock-ins. Under such circumstances, historical small events turn into starting points of creativity which involve 'the disembedding of an individual from localized structures of relevance and provinces of meaning, overcoming the inertia and momentum that he encountered, mobilizing others to work on an idea that transformed over time, all the while being flexibly resolute with a vision of what might be possible' (Garud and Karnøe 2001: 20). 'Entrepreneurship,' Garud and Karnøe argue (2001: 9), 'involves an ability to exercise judgment and choice about time, relevance structures and objects within which entrepreneurs are embedded and from which they much deviate mindfully to create new paths.'

Entrepreneurial initiatives are crucial to unburden the constraints that are set in motion as a consequence of past actions. When lock-ins operate as hindrances for further progress, which is not a rule but is occasionally the case, entrepreneurship affect the fate of the course of events and change tipping points into starting points of creativity. An example of this is the development of Post-it® Notes. Many accounts of its development say it was the result of an 'accident' by Spencer Silver, one of the 3M scientists working on the original formula of Post-it® glue, to discover the 'glue that did not glue' (Garud and Karnøe 2001: 17). Silver took the initiative and his experiment paid off for him with a revolutionary finding that de-framed the evolutionary pathway of the industry all at once. Silver reports:

In the course of the exploration, I tried an experiment with one of the monomers in which I wanted to see what would have happened if I put a lot of it into the reaction mixture. Before, we had used amounts that would correspond to conventional wisdom. The key to the Post-it® adhesive was doing this experiment. If I had really seriously cracked the books and gone through the literature, I would have stopped. The literature was full of examples that said you can't do this.

People like myself get excited about looking for new properties in materials. I find that very satisfying, to perturb the structure slightly and just see what happens. I have a hard time talking people into doing that - people who are more highly trained. It's been my experience that people are reluctant just to try to experiment - just to see what will happen! (Nayak and Ketteringham 1986: 57-58, quoted by Garud and Karnøe 2001: 13).

When new paths are created or generated, the triggering event is not necessarily a small event. Mechanisms giving rise to path dependence may yield a recombination of further consequences. Also, other mechanisms (e.g. international dynamics or local cycles in certain regions) function in such ways that old paths are broken over time and new ones are created with enduring effects. Karim and Mitchell (2000) argue that firms using acquisitions to achieve long term reconfiguration generate new pathways of organization and production when they use acquisitions in the form of 'resource extension.' According to Karim and Mitchell, 'path breaking change may occur in cases where expansion incentives and competitive pressures out-weigh path dependence. Path-breaking change occurs when acquirers retain targets' resources that are distinct from their own' (Karim and Mitchell 2000). In a similar fashion, Djelic and Quack (2007) point out different mechanisms that open the way to 'processes of path transformation.' The authors argue that 'path transformation often stems from a gradual succession and combination of incremental steps and junctures' when we study more closely the national and trans-national systems. In the cases that they thoroughly analyze, competition regimes in Germany and the United States after 1945, they show that 'some reinforcing mechanisms generated momentum towards a new path or towards a path deviation in one case, and secured the reproduction and entrenchment of existing path dependencies in the other.' According to Djelic and Quack, in the strongest versions of path dependence, path transformation is assumed to be unlikely. Only in rare cases of external shocks, systems lock out from dependencies. They claim that new paths often occur when established institutional paths confront and collide with other institutional paths - new or transitional.

Path generation must be seen as a 'political' process of emergent nature. Different societal actors with different economic and political interests, normative orientations and social identities strive to shape the institutional rules used to govern the overall societal system or specific subsystems ... In doing so, they draw on an existing institutional repertoire of variably acceptable courses of action that leave considerable scope for strategic and tactical decision-making by purposeful actors ... Path generation is therefore a highly complex phenomenon that often involves a sequence and accumulation of events over a long period of time. The complexity of actor constellations means that the paths are likely to develop emergent qualities, i.e., characteristics not directly intended by any of the actors involved (Djelic and Quack 2007).

Insofar as borders and standards lead to innovations in the market, intellectual paths

are desirable and even necessary. As a matter of fact, standardization in high tech industries - such as the telecommunication and computing standard of Transmission Control Protocol / Internet Protocol (TCP / IP) and secure e-commerce standard of Secure Sockets Layer (SSL) which made the World Wide Web possible - are necessary and advantageous for both producers and consumers in the market because innovation continues at a reasonable pace when it operates as an incentive to further progress. As Brian Arthur claims, 'these temporary monopolies are a prize for innovation. They're the incentive for innovation. If you took that incentive away - requiring, say, that for every lock-in you have in high tech, somebody else has to be cut in on the deal for 50 percent or there have to be at least three players - then you will see less innovation' (Arthur 1998).

Economists worry about standardization and monopolization particularly when an economic actor, say, a firm, achieves a monopolistic power that lasts for a long time and uses it unfairly in the market (see Kwasnicki 2000 and Rocha 2000). Under such conditions, positive feedbacks are a factor of risk in the market because consequences of particular events are not necessarily for the best or superior in the long run when they reinforce the monopolistic power of an economic actor. For instance, 'cultural standardization' (Pagano 2007) can seriously limit the diversity of solutions and approaches found and developed by scientists to deal with the intellectual problems of scholarly life. Cultural standardization, while making it possible for intellectual actors to interact and exchange ideas on a global scale, 'induces a global dilution of the standards of social protection' (Pagano 2007). Different distributions of intellectual assets among academic circles and even nations affect the pathways of scholarly advance, in which the overall outcome of interaction and exchange of ideas can end up with inequalities among intellectual actors. Initial endowments of property rights, as a result of self-reinforcing mechanisms, such as positive feedbacks, transform into a dominant system of rights. In that, the ownership of intellectual assets does not go to those who make use of them in the most efficient ways. Second best solutions, that is, unequal distribution of property rights, resulting from the tendency of standardization and monopolization in 'intellectual capitalism,' is always likely. When this happens,

only the agents who own the intellectual assets have sufficient safeguards to develop the ability to improve them. Only the individuals or the firms who already own the preceding version of a certain piece of software (that is, the most important input for producing the next version) will have adequate incentives and safeguards to produce improvements

of the software. Thus, countries, owning a high initial stock of property rights, are likely to develop more intellectual abilities and to acquire even more intellectual property in a self-reinforcing virtuous circle (Pagano 2007).

Therefore, intellectual path dependence has both negative and positive connotations depending on the occasion in which historical small events operate. When intellectual path creation is at stake, dependence of the followers upon the innovative idea that was initially introduced by an entrepreneur should be considered as a positive occasion. In this case, path dependence leads to a short-cut (*ii* in Figure 11) that moves the evolutionary system to higher levels of sophistication. If path dependence gives rise to a hindrance (*i* in Figure 11), there is reason for intellectual historians to consider this transition as a breakdown of the system that disallow intellectuals and entrepreneurs to achieve advancement. In each case, the tipping point is realized after a small event.

Events and their sizes

There is a tendency in scholarly life to analyze the evolution of human institutions as if the history of human civilizations were only a story of wars and social uprisings and profitability of a solution or some technique or invention in the market. The history of human civilizations, however, cannot be reduced solely to the consequences of such 'big events' of our past. Neither can it merely be a bunch of 'big' success stories. There are such occasions in history that a blind chance occurrence unexpectedly gives rise to a remarkable success story or accidentally to an ultra-disappointing drama. Big consequences do not follow big causes at all times. The difference of magnitudes of significance among events often matters. Intellectual path dependence principally addresses the idea that there are scores of historical occasions in which consequences of some occurrences should stand out as significant but their causes are still considered 'small.' Historical small events do not necessarily provide the most accurate explanation about each and every social and intellectual occurrence but only a retrospective understanding of small-ness of some events in regard to the magnitude of their significance at the time they first appear.

There are countless occasions in history where 'big' events lead only to 'big' consequences (and 'small' only into 'small'). Under such circumstances, the difference of significance among subsequent events does not matter at all. In other words, every event is equally significant. Evolutionary analysis of path dependent patterns, in which his-

torical small events play significant roles, is an alternative to ‘one-size-fits-all epistemology’ (Tetlock and Aaron 1996). There is no uniform model or pattern of explanation that would account for how the outcomes have come into existence. Blackboard notions fail to function here.

Behind the classification of events according to their size lies the following dictum: causes and consequences are not proportional. The sum of the parts of a system is often bigger than the whole. In other words, summation of the causes within a system does not exactly enable us to predict the behavior of the system at all times. The reason for this is that the output of the system is ‘fed back’ into the system. Interaction among causes amplifies the impact of each cause on each other cause.

The distinguishing property of disproportionateness is that it runs against Newton’s Second Law. The law, $f = ma$, states that ‘an object that is subject to a force responds by accelerating at a rate *proportional* to that force’ (Bak 1996: 3). That is, what comes in the equation (force) is the equivalent of what goes out of it (velocity). Inputs and outputs are thus proportional. The case of historical small events implies the opposite of the law: when path dependence occurs, causes are smaller and consequences are bigger in the sense of *the magnitude of their significance* in the course of events. In order to help us better understand the semantics of the ‘small event’ and ‘big event’ dichotomy, let us elaborate on the matter via the matrix below.

FIGURE 12: EVENTS AND THEIR SIZES

		EVENTS AS CAUSES	
		SMALL	BIG
EVENTS AS CONSEQUENCES	SMALL	(1)	(2)
	BIG	(4) PATH DEPENDENCE	(3)

According to the matrix, events in the course of natural and social evolution can be classified in two ways. In the first possibility, *events* are the cause or the consequence of a happening. In other words, the unit of analysis is events, not objects or things, in nature and society. We are interested in the changes in a state of affairs (Hare and Madden 1975: 15). What matters for us here is how, for instance, silicon made it possible for the computer engineers to produce micro-chips and how this gave a way to a revolution in the global economy. We are not interested in the small material called silicon chips only. We pay primary attention to the *stories* attached to such objects and things. A story about the silicon microchip might take the following form: a micro-chip is an essential component of a computer. They enable engineers to produce highly complex machines like computers. By virtue of computers, economic agents are able to move their assets with a click of a mouse among numerous world markets. This generates complex patterns of asset flows on a global scale for the analysis of which scientists again use computers, etc.

The matrix tells us, as a second possibility, that each event can be classified according to its size, either as small or as big. Events, that is, both causes and consequences, are therefore subject to a sub-classification which tells us that the role of some events does not sustain their significance at a constant pace but amplify with every follow-up event that feeds itself back into the process. The process grows, as a result, exponentially and its more accurate examination requires discrimination of the sizes of events that have causal impacts on future occurrences.

This provides us with the following scheme:

1. The cause and consequence of a happening can both be small.
2. The cause of a happening can be big but its consequence small.
3. The cause and consequence of a happening can both be big.
4. The cause of a happening can be small but its consequence big – that is, path dependence.

For simplification, let us use the following terminology in order to remark on the combinations of events in a period of time: let 'small *events*' and 'big *events*' mean, respectively, 'small events as *causes*' and 'big events as *causes*.' Likewise, let 'small *consequences*' and 'big *consequences*' mean, respectively, 'small events as *consequences*' and

'big events as *consequences*.'

The four possibilities mentioned above are the following:

1. *Small event-small consequence scheme*: In this scheme, causes and consequences are not really relevant or important for the issue at stake. We can ignore them completely. An example of this might be the economic historian examining the conditions that gave rise to the Industrial Revolution in the eighteenth century, and assuming that the density of sea water in the North Sea was an important factor. In fact, no one has ever opened a debate about the significance of the density of seawater in the Industrial Revolution so far. Whether such a fact played a role, if any, is asking the question 'how much': how much of a role did the seawater density play in the Industrial Revolution? Perhaps, the difference between the densities of the seawater in the North Sea and Mediterranean affected, in some hitherto unaccounted fashion, the way engineers built cargo ships and the wood carried from Scandinavia to Great Britain. But in order for this to be a scientific fact, it is necessary for the scientist to show quantitatively how big the effect was. In other words, size matters for an event to be considered a cause.

Measurement, therefore, is certainly an issue. McCloskey has long debated the issue in a number of different contexts. Oomph is a term that she coined in order to imply the question of 'how much?' which she thinks economists have ignored in their works. She argues that there are such phenomena in our economic and social lives and that they do not really matter as the magnitude (and, therefore, significance) of their consequences are not very big. Economists have long been obsessed with finding out (or just making up) qualitative correlations among data that they could find (or generate) and completely put aside the true economic question, 'how much?' Such correlations that economists prove by way of using numerous econometric tools - such as significance tests - do not prove whether the tested variables are economically significant. In economic life, in other words, some small events cause small consequences only although there is a strong correlation between them. However, 'what matters is oomph,' she writes (McCloskey 2003: 195), 'oomph is what we seek. A variable has oomph when its coefficient is large, its variance high, and its character exogenous. A small coefficient on an endogenous variable that does not move around can be statistically significant, but it is not worth remembering.'

Significance is about measurement. And we need empirical material to judge. We need the material not because we are necessarily willing to be empiricists in the British tradition of philosophical empiricism. Rather, having an understanding of the issue of size in the course of events is being a 'good empiricist' in the sense Paul Feyerabend (1968) used the term. This requires quantification and comparison of the phenomenon as well as openness to diverse theories about the (very same) observation – say, *how much* did the market transaction of hiring a foreigner cost a shipping firm in the 1780s and *how much* does it cost to an IT firm today? The 'method of reasoning in science is look-see,' McCloskey argues (2001: 255). To put it differently, viewing the subject from within epistemology, 'capitalism is bad' or 'markets are efficient' are not exactly scholarly statements for those who are interested in the ways in which the evidence they possess transforms into something else. And neither are such statements sufficient for many evolutionary scientists because they would rather like to see the course of change, not merely the end product, which enhances (or in some cases decreases) the significance of the initial conditions helping the species survive in a specific environment or causing the water molecules to start a turbulent flow. Such an outlook is about measuring the steps or stages that give rise to the transformation of magnitudes.

2. *Big event-small consequence scheme*: The importance of oomph reveals itself also when a big event results in a small consequence. Again, in big event-small consequence scheme, the consequence is too small to be relevant. But with a difference from the previous case: in this scheme, consequences are either counterintuitive or disappointing in the sense that the significance of the consequence is smaller than expected. 'The Santa Barbara earthquake caused the collapse of numberless chimneys,' is an example in the scheme of big event-small consequence (Ducasse 1993: 125). Or, as the Roman poet Horace (65-8 BC) wrote in his *Ars Poetica*: '*Parturient montes, nascetur ridiculus mus* - Mountains will be in labor and the birth will be a funny little mouse' (Brewer's *Dictionary of Phrase and Fable* 1987: 760). Mighty effort is made for a small effect, in other words. Likewise, the English idiom 'to make a mountain out of a molehill' is used in order to mean unnecessary stress on a small matter (*Oxford Dictionary of Phrase and Fable* 2000: 711). Nicholas Udall paraphrased Erasmus (1548-1549) in the following lines: 'The sophicists of Greece would through their copiousness make an elephant of a fly and a mountain of a molehill' (*Concise Dictionary of Phrase and Fable* 1993: 213). There is a similar idiom in Turkish, too: 'after a prolonged period the mountain gave birth to a mouse.' Such phrases are used precisely to imply the big event-small conse-

quence scheme in natural and social history.

The phenomena of Post-Millennialism and Y2K can be considered big events that many expected to produce big consequences. But they produced only small ones. Millennialism was originally an apocalyptic story of Christian traditions (Gould 1997). It implies a 'blessed end of time.' The religious and political implications of millennialism are present throughout history. As we approached the year 2000, the definition of millennium transformed into a calendrical meaning. People's concern was now the number 1000. It turned into a 'number mysticism' (Gould 1993: 37). Traditionalists started to think that 4000 years must have elapsed between the creation of earth and the birth of Jesus; therefore, an apocalypse would take place in year 2000.

No such apocalypse has come about, however. The argument was awfully weak and disappointing because the promises and prophecies by the forerunners of Post-Millennialism, such as Jonathan Edwards, did not materialize. '[T]he classic argument for linking the apocalyptic and calendrical millennium may seem awfully weak and disappointing,' writes Gould (1993: 71), 'for the junction requires a symbolic interpretation that will probably strike most of us today as fatuous and far-fetched.' As a matter of fact, if Satan had been bound for one thousand years, as described by Saint John the Divine (Book of Revelation, Chapter 20), and Christ returned and brought back to life the Christian martyrs for a 1000 years, and so forth and so on, it would have resulted in the biggest consequence for humans ever, that is, a 'blessed end of time.'

And I saw the dead, small and great, stand before God; and the books were opened ... And whosoever was not found written in the book of life was cast into the lake of fire (Book of Revelation, Chapter 20).

'Calendrics' were not alone in claiming that the year 2000 would generate big consequences. Computer and network experts, too, warned the world that by the end of the 1990s, a software problem that they called Y2K would cause turmoil in such critical industries as overseas flights, water and electricity monitoring, global finance, and so forth, which could soon turn into a critical trigger that might cause a serious crisis worldwide. The problem was that engineers equipped computers with an internal digital clock which was able to show the time in 6 digits only. When December 31st, 1999 (31.12.1999) turned to January 1st, 2000 (1.1.2000) the digital clock in the computer would switch to 01.01.00 thinking that it was re-adjusted to show January 1st, 1900 (01.01.1900). It didn't take too long for the engineers and network experts to envisage

that all of the computers (especially the old ones) should be checked. Thomas Friedman claims (2006: 126-136) that Y2K was initially a very big threat for the world economy as well as an important opportunity especially for the Indian computer engineers because India had educated a vast amount of genius engineers who were certainly able to fix the problem for cheap. Indeed, Y2K, within a little while, caused the Indian industry of computers to boom.

No significant failures for the world economy occurred, however. Neither was it an opportunity for the Indian economy as a whole. The problem was overstated.

3. *Big event-big consequence scheme*: This is one of the most widely-used schemes in accounting for natural and social phenomena that has long been the dominant paradigm in classical science theory. In big event-big consequence scheme, causes and consequences are proportional. The general characteristic of the big event-big consequence scheme is the reversibility of outcomes and determinism of connections in the course of events. Knowing the circumstances of an object or event at a certain moment, one can identify the consequences that the object or event would lead to. The system is predictable. Phenomena, in this scheme, are those that we explain in deterministic terms. In this scheme, there is no place for historical small events. In the course of events, effects cancel each other out and, typically, errors are corrected sooner or later. No surprises occur. In the big event-big consequences scheme, events in nature and society are accounted for as if they were components of a smoothly running clock. Results are universal. Mechanisms identified in such courses of events are generalizeable to other cases without respect to the specificities peculiar to each case. We usually classify wars, social uprisings, policy reforms etc. under the big event-big consequence scheme. In economics, constant returns to scale may be considered as an example.

Such systems are also called ergodic. Ergodic systems are those that 'come near almost every possible state over time but do so in a regular manner' (Jansen 1990: 99). Ergodic systems give rise to predictable consequences when the system is not sensitive to its initial conditions. Future states of an ergodic system are the same without regard to the states in which these systems started out. In statistics, when a system is ergodic, there is zero possibility for the system to be in any other state. The only factor that is necessary for this to happen is time. When there is a sufficient amount of time, the moving system will arrive at a unique stationary state ('ensemble average') whatever the initial states were. 'Stir a large pot of treacle in a vigorous way,' writes John Barrow

(1991: 48), 'and it will quickly settle down to the same placid state no matter how you stirred it. Drop a rock in air from a sufficiently great height and it will hit the ground at essentially the same speed no matter how hard you threw it initially because the competing effects of gravity accelerating the stone and air resistance slowing it down always act to create a situation where they have an equal and opposite effect, and thereafter the stone feels no net force at all and falls at constant speed.'

4. *Small event-big consequence scheme*: Atoms in nature and individuals in society, however, don't quite work that way most of the time. In other words, some of the initial conditions will never be damped down sufficiently and the system will stand sensitive to such conditions. Complexity of the system and numerous positive feedback mechanisms magnify the consequences of 'initial events' exponentially. Each time, amplification of causes evolves the system from a given initial state to a 'far from equilibrium' attractor. An attractor is a rest point to which a system eventually settles down. Contrary to what Laplace claimed, the world is full of unpredictable consequences stemming from relatively small causes in earlier stages. Small scale errors and uncertainties, under certain mechanisms, such as positive feedbacks, become larger and larger. There is no short-cut to predict the evolutionary future of the system. Henri Poincaré argued in 1903,

A very small cause which escapes our notice determines a considerable effect that we cannot fail to see, and then we say that the effect is due to chance ... It may happen that small differences in the initial conditions produce an enormous error in the latter. Prediction becomes impossible, and we have the fortuitous phenomena (quoted by Crutchfield *et al.* 1990: 81).

The effects of historical small events multiply in unforeseen and unexpected manners - especially when neglected or overlooked in scientific experiments. Such events are sometimes the *errors* that researchers overlook. Von Neumann, for instance, who built the first computer with the intention of predicting weather, Gleick reports, 'had overlooked the possibility of chaos, with instability at every point ... [B]eyond two or three days the world's best forecasts were [thus] speculative, and beyond six or seven they were worthless ... [because] the errors will have multiplied to the ten-foot scale, and so on up to the size of the globe' (Gleick 1987: 19).

Robert White, a fellow meteorologist at MIT, gave the answer to von Neumann's problem later on. His idea was that 'small modifications, well within human capability,

could cause desired large-scale changes' (Gleick 1987: 22).

James D. Fearon (1996) argues that the model known as 'cellular automaton' helps us best in understanding the behavioral pattern in which 'a little neglect breeds mischief.' A cellular automaton is a computer simulation firstly developed by John von Neumann and Stanislaw Ulam in the 1940s. (For a general theory and logic of the theory of automaton, see Neumann 1987.) It mimics a certain outcome of individual behavior in nature and society. Suppose you have a chessboard on the screen of your computer, made up of a number of cells larger than 8×8 , say, 100×100 . Every cell has either of the two colors: black or red. In every successive period, cells of the board will change color according to a simplistic algorithm. Let the algorithm be the following: red if two neighboring cells are red, and black otherwise. When you run the simulation, colors of cells will change following the deterministic rule that is set *ex ante*. You may know the deterministic rule but it may be impossible to generate a formula that would tell you which color pattern the entire chessboard will have in the end. Merely knowing the initial conditions, you would not be able to project the system's behavior. It is essentially unpredictable. The only way to find out the pattern of the system is to run it numerous times and observe the varying outcomes each time (Fearon 1996: 42).

The simulation shows that even deterministic behavior in nature and society may generate highly chaotic and complex aggregate patterns. There is no long run equilibrium in such models upon which the system converges. Instead, it follows stochastic pathways. Changing the color of only one cell and re-running the simulation, you may have an unrecognizable outcome. And once the structures are formed, they may endure for longer periods until another factor is included to disintegrate the system.

The only way to understand how the way such a world would most likely work is to observe the system running and develop inferences about the regularities across changing cases. Such regularities would tell you only how the behavioral pattern is in the short intervals. What if we had started with more black than reds? What if the number of blacks had been larger than the red's? No matter how perfect your knowledge of the changing patterns, it is not possible to have a general law-like statement telling you the long run behavior of the system every time you run it. Only knowing the simple deterministic regularity wouldn't be sufficient to draw out the consequences of a particular antecedent at all times. The larger the system the more complex it is and the more likely it is that only short term regularities are possible to predict. Deriving

the systematic regulatory rule that would have told you the long run state of the system is less and less likely.

In effect, the consequences of historical small events are usually against intuition. They surprise the researcher as multiplication of the consequences of neglected events is never expected. Small events can create a similar effect to the crises that cause 'paradigm shifts' in the Kuhnian sense (Kuhn 1962). James Gleick, once again, writes,

In science as in life, it is well known that a chain of events can have a point of crisis that could magnify small changes. But chaos meant that such points were everywhere. They were pervasive. In systems like the weather, *sensitive dependence on initial conditions* was an inescapable consequence of the way small scales intertwined with large (Gleick 1987: 23).

The large comes out of the pathway in which early events interact with and feed back upon each other. However, sensitivity to initial conditions does not at all times lead to big consequences. Initial conditions are also in operation when causes and consequences are proportional (i.e., causes and consequences are of the same size). In other words, even in the first or third scheme, initial conditions can be in operation. Consider chess. In principle, each move by both chess players is equally significant. In other words, the significance of every move is statistically equivalent. Every time a new game starts, however, they play a different game. The outcomes are different because possibilities are immense - practically infinite. The player builds a model and ignores some variables or is not able to calculate all the possibilities. The model is not a complete one but the player can win even if her model not perfect - it only need to *better* than her rival's. Start a new game and a new model will be built. Strategies as well as the winner will change every time at a high probability.

The reason for such outcomes is that certain mechanisms - such as positive feedbacks - become randomly effective in the routine course of events. Via such mechanisms, random outcomes do follow only because initial conditions are altered. This is the principal difference between linear and non-linear systems: linear systems feature negative feedbacks which regulate the system and move it to equilibrium, whereas non-linear systems feature positive feedbacks which amplify the magnitude of certain causes and push the system far from equilibrium. When there are positive feedbacks within an equation, the terms of the equation generate disproportional impacts on other terms; terms are repeatedly multiplied by themselves (Briggs and Peat 1984: 24).

When a microphone is located in front of a loudspeaker, the output from the microphone is fed back into the system as the microphone picks up the signal and sends it back to the loudspeaker. The same outcome comes about when we place a camera in front of a mirror. The mirror reflects the image on the screen into the camera which reflects it through the screen back onto the mirror. This goes *ad infinitum* and the same image is re-produced and magnified during the experiment.

"The basic difference between the two dynamics, linear and non-linear, is simple," writes Ziliak in the introduction to his book in which he edited and compiled McCloskey's works, (Ziliak 2001: xviii).

If a 'path' of events (such as rocket trajectory or economic growth or women's liberation) is in fact non-linear, then small beginnings can have large effects. And if the true path is linear, then large effects can only stem from large beginnings ... [McCloskey] uses small beginnings ('metaphors differ from stories') to make small points ('metaphor and story are linked by a theme') and she uses small beginnings ('metaphors differ from stories') to make big points ('humanists and economists need each other'). In other words, McCloskey uses the means of linear and non-linear dynamics to construct an argument about the narratival ends of linear and non-linear dynamics. The rhetoric of the rhetoric explains itself.

Niall Ferguson's analysis (Ferguson 1998) has shown that WWI was not inevitable and that it could have been avoided or it could have given rise to alternative outcomes if Britain had not appealed to France and Russia on imperial and later continental issues after 1905 or if Germany had been able to strengthen its security before 1914 or if Germany had been pushed to sign a peace agreement. The reason for the war was a number of factors which were causally related to all others. Ferguson claims that the Anglo-German confrontation was one of the most over-determined events in modern times, which caused transformation of a continental conflict into a war. Britain thought that if it stood aside and allowed France to be crushed by Germany, Germany would have been the supreme tyranny of the continent and Britain isolated. Such a thought was dominant in Britain and became even more powerful with the media influence over the public. Also, theatres and cinemas as well as journals and newspapers of the time propagated the view that all European states had their imperial plans so that the Britons should take immediate action. "The combination of censorship and the spontaneous bellicosity of many newspapers tended to discourage arguments for compromise and to encourage demands of annexation and other war aims which only a complete

victory could achieve,' writes Ferguson (Ferguson 1998: xli).

Another perspective on the way in which positive feedback loops generate turbulence at macro levels is developed by Prigogine and Stengers (1984). According to Prigogine and Stengers, every system involves sub-systems that work independently from a regular principle. Occasionally, such sub-systems can be affected by a number of positive feedbacks which result in the destruction of the past states of the system. Prigogine and Stengers call the phenomenon 'bifurcation.' After bifurcation takes place, it is not certain which direction the system will move in. Microscopic changes under the influence of numerous positive feedbacks revolutionize the system at macro levels. The system stabilizes itself by virtue of exchanging energy with other factors in the environment. The entropy consumes the energy of the system and minimizes the differences among the systems in the environment. The new stabilized systems are called 'dissipative structures.' Although randomness, with the help of certain positive feedback mechanisms, causes such systems, dissipative structures, once occurred, are ruled by deterministic principles. The course of events after bifurcation evolves along the lines of predictable rules; however, it is not possible to predict when the next bifurcation will occur. In the foreword Alvin Toffler wrote to Prigogine and Stengers' book,

Thus, according to the theory of change implied in the idea of dissipative structures, when fluctuations force an existing system into a far-from equilibrium condition and threaten its structure, it approaches a critical moment or bifurcation point. At this point, according to the authors [Prigogine and Stengers], it is inherently impossible to determine in advance the next state of the system. Chance nudges what remains of the system down a new a path of development. And once that path is chosen (from among many), determinism takes over again until the next bifurcation point is reached (Prigogine and Stengers 1984: xxiii)

A puzzling issue here is whether the presence of small events precludes the role of deterministic structures in the course of events. Neither thermodynamics nor the occurrence of dissipative structures, as is illustrated by Prigogine and Stengers as well as many others, is a story of random occurrences *alone*. Random events play an important role when positive feedbacks destabilize the macrostates of a system by way of causing determinate consequences at micro levels to move in the same direction as their causes. Determinist structures fail to function in the predicted way at the very moment of the bifurcation giving rise to unaccountable changes. This causes fluctuations in the system but it eventually results in dissipative structures whereby the occurrence of

indeterminate small events is less probable and determinate relations prevail.

After every bifurcation, the world is divided into numerous 'parallel universes,' so to speak. In every universe, events take place either according to deterministic laws or according to random occurrences and mechanisms. Which game is selected, we never know unless we stop thinking and take one of the paths. In other words, exact prediction of the future values of the terms of a system is theoretically and practically impossible. Contrary to what Albert Einstein claimed in the 1920s, God plays dice.

In fact, the real question is not even whether God plays dice or not. As Ian Stewart once put it, it is *how* she plays it (Stewart 1989: 1-3). Erwin Schrödinger illustrated the case with a thought experiment in a paper published in *Die Naturwissenschaften* in 1935. He wanted us to think of a cat imprisoned in a steel chamber along with a tube full of hydrocyanic acid and a device which was programmed to detect the existence of radioactive substances in the chamber. Radioactive substances were released when atoms decayed and this did not follow a deterministic pattern. If the device detected the decayed atoms, it would trigger a hammer which would break the tube of hydrocyanic acid and kill the cat inside the chamber. The issue here is that one could not know whether an atom decayed prior to observation and that the probability of the cat in the chamber to be alive is just 50 per cent. Schrödinger's example demonstrates that one cannot be sure of the outcome unless the observer opens the box and observes the case. The result cannot be predicted beyond statistical measures. The experiment tells us that macroscopic states of objects, such as a cat in a chamber, cannot have unique deterministic descriptions. Every system becomes either this or that only at the very moment that one observes the system. There is no 'truth' about possible states of a system unless observation takes place. 'It is typical of these cases,' wrote Schrödinger, 'that an indeterminacy originally restricted to the atomic domain becomes transformed into macroscopic indeterminacy, which can then be resolved by direct observation. That prevents us from so naively accepting as valid a 'blurred model' for representing reality. In itself it would not embody anything unclear or contradictory. There is a difference between a shaky or out-of-focus photograph and a snapshot of clouds and fog banks' (Schrödinger 1980 and Gribbin 1984: 1-6 and 235-254).

The lesson to be drawn from Schrödinger's thought experiment is that an outcome doesn't exist without measurement. It does not really make any sense (at least scientifically) to prove any theorem on the blackboard only without observing or testing it

with the facts of the world. A possibility could be claimed to be 'true,' such as the claim that the cat in the chamber is 50 per cent alive and 50 per cent dead. But the claim is practically insignificant. We are not at all times able to predict the direction that the terms of an equation or the components of a system will move in before we run the equation or put the system in motion. The relations among terms and components are not always deterministic. Several mechanisms are able to track off the course of events at any time. Thus, small perturbations may result in large occurrences. What matters is the measurement of possible states of the system. We must observe how big the effect of each term is on others.

The issue here is that we do not know *ex ante* whether and when an event becomes dependent on a feedback mechanism which amplifies the magnitude of the effect of a small event. To put it differently, knowing the initial conditions of a system, we may not be able to predict the result. It is probable that a random occurrence might dominate the entire course of events. This does not rule out the deterministic relations after such an event happens. Whether the system will lead to this (deterministic) or that (random) result is only a matter of probability.

We should of course underline the fact that consequences of blind chance occurrences are not always amplified so as to lead up to path dependence although they may still cause the general course of events to diverge from its systematic course. A chance occurrence can trigger a 'domino effect,' for instance, in which, all of a sudden, an unexpected cause generates a remote consequence. A remote consequence does not necessarily mean that the outcome is bigger than its cause. A domino effect is a special circumstance in which a small event does not translate into a big consequence, but rather gives rise to further small changes in a linear fashion. It produces like changes in sequence and no difference among events is present in terms of the magnitude of their significance. Under such circumstances, the direction of the change can be blind but it is not required for any of the changes to be bigger than their antecedents. Instead, they are all lined up in such a way that the process is usually, say, out of the experimenter's control or it is simply a sudden occurrence with a definite end-point.

During the Cold War, international politics was influenced by a particular view. It was thought that communism would spread around the world just like falling dominos. The analogy of falling dominos was often employed to illustrate the, perhaps paranoid, ideas of proponents of this viewpoint. Most of us are familiar with the phenomenon

of dominoes, stood on the narrow end and lined up in a close proximity to other, will, when the first is pushed towards the next, all fall in succession. Proponents of the 'domino theory' asserted that if the United States did not prevent a country from the influence of communist ideas, the tainted country would turn communist and influence all the countries neighboring it which would succumb as well to communist ideologies. Capitalism would then disintegrate and disappear from that region of the world. The principle was openly proclaimed by one of the presidents of the US, Dwight David Eisenhower, in the 1950s. It was such a powerful idea at the time that it motivated the US to intervene politically and militarily in Vietnam in the 1970s and to support anti-communist militias in the Middle East and Afghanistan in the 1980s and 1990s (Mamdani 2002: especially, 52-57). It turned out, however, that the doctrine was incorrect because after China was revolutionized in 1949, many countries, such as Thailand, resisted the winds of change, even without US interference. In any case, it was an influential ideology that shaped international politics during one of the most critical moments in modern history.

Another example in which the issue of difference is still involved but blind chance occurrences happen to produce big changes without giving way to path dependent circumstances is 'chain reactions' in chemistry and physics. Such systems are quite common and have inspired a number of innovative ideas in the sciences, such as nuclear reactors and atomic bombs (with unhappy consequences), since the 1930s. Chain reactions cause a system to diffuse the type of change that take place in the very beginning of the process. Subsequent changes are reactive to the preceding ones, can be self-sustaining for a period, and the process usually does not die out quickly. Such systems are sometimes even ergodic (not always though) in the sense that, without regards to the initial conditions, only one specific outcome is produced in the end. The process is usually under the control of the experimenter and the outcome is as a rule intended. (For the chain reaction approach in economics, see Karanassou and Snower 1998 and 2007.)

The theory of path dependence states that historical small events, by way of amplifying mechanisms such as positive feedbacks, could cause the evolution to diverge from its systematic course. The primary property of such amplification processes is that initial conditions commencing the course of transformation of sizes are blind chance occurrences in which no causation of necessity is inevitably involved. That is, one may not ever be able to know which butterflies will flap their wings as well as when

and for how long. Nor can one ever predict the ways in which a plague will hit a region or an invention take place and twist the direction of the historical pathways of societies. There could, however, be a plurality of self-reinforcing counter-acting mechanisms, too, that might move the system in the opposite direction.

Consider thermodynamics. The path dependent evolution of natural and social events might be a consequence of the irregularities caused by the increasing entropy that comes about as a result of a working system. The entropy law states that the heat that is produced within a system moves the system away from equilibrium. This does not mean, however, that no further entropies would ever occur in the future states of the system so as to counteract and generate a tendency that would smooth out the irregularities in the course of events. Further and bigger entropies, under such conditions, could move the system back to equilibrium and thus, diminishing the significance of chaos, could cause a perfect equilibrium. To put it differently, the vicious circles caused by positive feedback loops are broken by other vicious circles caused by other positive feedback loops. "This sounds like an attractive scenario," writes John Barrow (1991: 49), "[t]he main problem is that the smoothing of irregularities is [only] one of those processes that is governed by the second law of thermodynamics. Irregularity in the expansion can only be reduced if this partial reduction in disorder (or 'entropy' as it is called) is paid for by an even larger production of entropy in another form.' In other words, it is certainly not true that small events subject to positive feedback loops will necessarily cause big consequences or path dependence. It all depends on the specificity of the evolution of events - that is, the type of amplification process - in which every single occurrence is connected to each other in the most varied ways. Conditions and particularities in the environment matter at the same time.

To summarize: the systematics of the general course of natural and social events is threatened by historical small events at all times. But this does not guarantee every similar happenstance to end up with path dependent circumstances. The consequences of small events can be small as well as big. Moreover, small events are not always what one should be looking for in order to account for the occurrences in which outcomes are sufficiently big to surprise the observer because big events often generate big consequences. What we are interested in in the research into path dependence is primarily the power of the process that amplifies the significance of early small occurrences. In such cases 'smallness' of an event is relative to the size of the consequences and what matters is *how* the big comes out of the small - and again, of course, *how much*.

The only way for a small event to be big, obviously, is amplification by virtue of which the significance of events simply grows - not all types of amplification, though. What we mean by amplification is the system of accumulation in which contiguous events feedback upon each other so as to increase the impacts of earlier causes and lead to path dependence. In order to demonstrate a case in which no feedbacks take place and are allowed to give rise to non-linear outcomes, think of an amplifier converting the signals that a guitar or an electronic piano produces at a certain amount of energy into identical signals with higher energy. Such devices somehow work in a linear fashion in that no feedbacks are permitted in the task that the device accomplishes. This is an ideal situation for the device to work within. Such amplification processes are predictable.

The ideality does not hold at all times, however, and feedbacks occasionally occur unintentionally. Under such conditions, the process can go off track and end up with unpredictable results. Signals are amplified in unlikely fashions. This is the occasion in which path dependent circumstances most likely come about.

The logic of amplification, on the other hand, does not necessarily coincide with blindness or randomness either. Speaking in general terms, blind chance occurrences need not at all times play the same roles in the course of history as those of small events. Consider gambling, for instance. While throwing dice or playing poker in Holland Casino, the outcome is, after all, a blind chance occurrence. The distinctive property of gambling is that the probability of having a number or drawing a card on the table is always constant. In other words, it is not possible to classify the coming of a double six or an ace as small or big. All possibilities are equal, causes are essentially equivalent, and they can be foreseen (although at low levels of statistical probability). In the case of small events, the significance of the consequences of some events is disproportionately bigger than the significance of their causes. It is not possible at all times to tell *ex ante* which event is smaller or bigger before we push the play button of the universe. They are historically conditioned, that is, consequences of some events become bigger in the long run although their significance in the short run was smaller. Their size, in other words, changes only as time goes by and we recognize path dependence only *ex post*.

The differences that positive feedbacks engender are by and large irreversible (that is, time-dependent). The reason why the consequences of intellectual paths are called irreversible has to do with an analogy between intellectual history and thermodynam-

ics and evolutionary biology. The point here is that we cannot easily subtract the accumulated effect of a factor from its evolutionary past because, under such conditions, consequences of certain events do not add up; they multiply. In order to contrast this case with the one in which causes only add up, consider the following example. *The Economist* (June 9th-15th 2007) reported in a short article, entitled 'It All Adds Up,' that every summer, millions of small engines mow the lawns, whack its weeds, and trim its borders in the US. Each engine produces little smoke but after using a chainsaw for two hours it adds up to an amount of pollution equal to what would be produced after ten cars drive 400 km. The carbondioxide emission, escaping fuel vapors, and leaking oil make them dirty machines for their size. Although operated only for short periods, lawn mowing contributes a lot of pollution which the federal government now is planning to take action against.

Such problems of policymaking are simplistic in the sense that 'unnecessary contingencies' in the way the problem is stated ('it all adds up') are shaved away. Simple problems satisfy the conditions of 'Ockham's Razor' - a statement by a fourteenth century English logician William of Ockham who claimed that 'entities should not be multiplied beyond necessity.' 'Ockham's razor from philosophy demands,' Klaus Mainzer claims (1996), 'that we cut away superfluous hypotheses, remain economical with the postulation of metaphysical entities, and restrict hypotheses to the minimal number that seems indispensable for empirical research.'

Problems of policy-making as well as scholarly life are often complex, however. While the consequences that the adding up of causes leads to might be smoothed out if necessary precautions are taken in time, consequences that are generated by way of multiplication of a number of causes are not at all times eliminable. Such phenomena are irreversible. We call, for instance, a chemical reaction in chemistry and an evolutionary pathway of a species in biology irreversible when the system cannot return to its initial conditions once the chemical reaction or evolution starts. A system is irreversible when it loses memory of its past conditions at the very start. Chemical systems are irreducibly irreversible because the heat that comes out as a consequence of a chemical reaction can never be recovered again in the subsequent stages. Such a 'loss' is an inevitable outcome of every chemical reaction (Prigogine and Stengers 1984: 75-77). Likewise, in evolutionary biology, Stephan Jay Gould argues, a particular historical item or organism - such as dinosaurs - cannot be recovered. 'If all information about a historical event has been lost,' writes Gould, 'then it just isn't there anymore and the

event cannot be reconstructed. We are not lacking a technology to see something that actually exists; rather, we have lost all information about the thing itself, and no technology can recover an item from the void' (Gould 1993).

Intellectual systems are like chemical and biological systems. Initial conditions and numerous small events by virtue of a number of spatio-temporal mechanisms give rise to irreversible consequences in scholarly life; they reinforce the influence of their own causes upon future happenings. Once they happen, they never un-happen again (David 2000).

The event in the night of April 16, 1917 when Lenin was trying to flee from Switzerland was another event, consequences of which never un-happened again (at least for 72 years). If Lenin had been caught on the train by the police, the chain of events that resulted in the Russian Revolution would not have taken place. Such a small event reinforced future causes and the influence of the initial condition grew so big that it led to intellectual and political movements in the twentieth century. The consequences of Lenin's arriving at Finland Station safely became irreversible. The outcome in this specific case has nothing to do with the necessities of history; as a matter of fact, Lenin could have been caught. It is not 'blackboard social science'; it is about the 'real' fact of the world. The outcome is a human phenomenon in the sense that it was an accident (i.e. not designed) that Lenin crossed the border. Rewinding the tape that recorded this period of history, we would have another story and another outcome for sure.

PART III

IMPERFECTION IN SCHOLARLY LIFE

It is an error to imagine that evolution signifies a constant tendency to increased perfection. That process undoubtedly involves a constant remodeling of the organism in adaptation to new conditions; but it depends on the nature of those conditions whether the directions of the modifications effected shall be upward or downward.

Thomas H. Huxley

'There is no 'natural process through which all ideas proceed'.

Coats and Colander 1989: 10

In Western thought the notion has existed that competition in the marketplace of ideas enhances truth and discourages falsehood and error. As Bartley has noted [1984 and 1990], many intellectuals and scientists have maintained such a position. However, it is quite possible that imperfections exist in such a competitive marketplace of ideas. Some theories and ideas may get emphasized too much and others too little ... The implicit incentives within science, which mostly encourage innovation, may also lead to replication failure and a small number of deviant scientists may intentionally deceive their peers thus committing fraud. Inefficiencies, such as a misconduct and market failure in science, may lead to a thoroughly revised vision of the nature of science compared to the contribution of other approaches to science.

Wible 1998: 115-116

Evolutionary theory is anti-utopian.

Herbert Simon 1983: 73

Scholarly Small Events Have Gone Mad

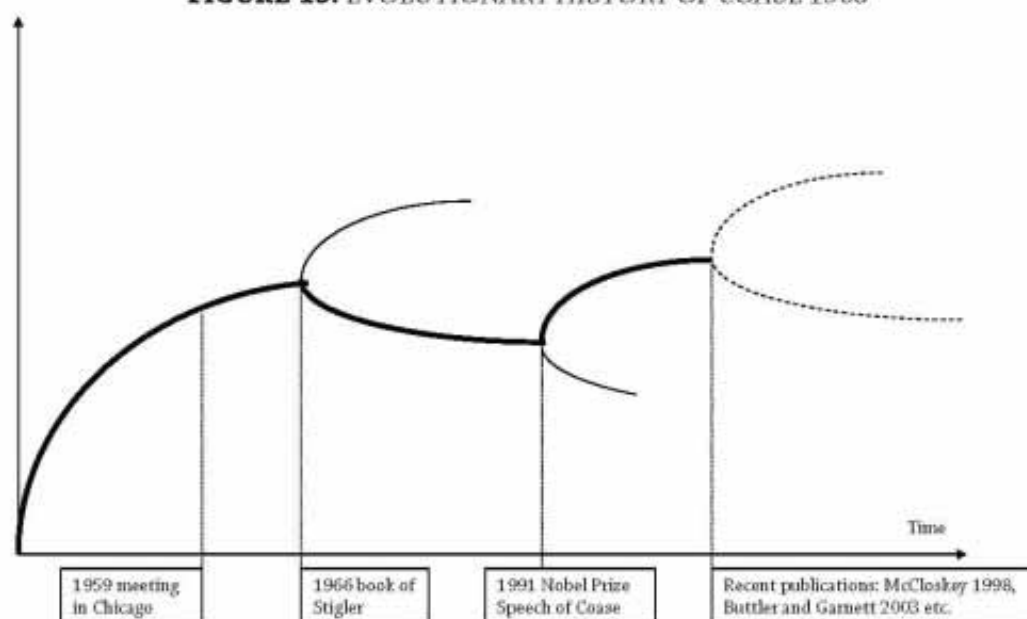
**What if evolution of ideas signifies
no tendency towards *Utopia***

‘Small is beautiful.’ This is now a very well-known cliché (Schumacher 1973). ‘Small’ does not always mean uninteresting or weak or superficial or ignorable. On the contrary to the widely accepted common sense view about the size of objects around us, some of us prefer it small. Small causes are significant especially in intellectual history.

‘Small but significant ...’ In scientific prose, these two terms are often used in contradiction to one another. This phrase frequently appears when one speaks about a factor that is generally ignored and yet has a potential to produce effective consequences in exceptional fashions. However, ‘smallness’ and ‘significance’ are not opposite terms. It is not necessary for a cause to be big in order for it to give rise to a big consequence. ‘There is very little difference between one man and another,’ claimed William James (James 1992: 648, quoted by Rosen 2007: 176), ‘but what little there is, is very important.’

In the case of the 'Coase Theorem,' the cause was too small in relation to its consequence. An error in the history of the 'theorem' has turned into an intellectual pathology. In fact, Stigler's misrepresentation of Coase's contribution could have been corrected long ago, but the 'theorem' remained as Stigler introduced it in 1966 because the economics of this particular case has prevented correction from happening. In other words, the reason why the 'Coase Theorem' has not been corrected for so long is principally economical: since the market for ideas in a positive transaction costs world doesn't allow negative externalities to disappear quickly, (due to high epistemic costs of retesting previously published findings of scholarly research), economists have failed to replicate the original results of Ronald Coase in 1960 and onwards. Retesting the original contribution would have changed the fate of the 'Coase Theorem' long ago. But running experiments about the validity of past findings requires time and this has been the scarcest 'commodity' for university researchers.

FIGURE 13: EVOLUTIONARY HISTORY OF COASE 1960



The 'Coase Theorem' should be interpreted in the same vein. The 'contribution' of Stigler to Coase (1960) should be seen as an interruption in the systematic evolution of the Coase Theorem Proper. Even if some attempts towards correction had taken place, evolution may have been further disturbed and caused to follow additional numbers

of diverse pathways. When we compare the above figure with Figure 11 we can easily detect the differences in the accounts of intellectual history and reach a more concrete resolution on the debate about Coase 1960. Figure 13 shows that the evolution of Coase (1960) is bifurcated after a number of tipping points which in 1966 caused a negative (i.e. erroneous) effect on its systematic evolution and in 1991 generated a positive (i.e. self-corrective) one. Pathways are not headed toward a pre-defined destination. The bold surface of the figure shows the evolution of the idea after an extra-negative and an extra-positive effect that follow up two tipping points in its history. The first tipping point was in 1966: Had Stigler interpreted Coase (1960) properly, history would have shifted after 1966. The second tipping point was in 1991: Had Coase not been awarded the Nobel Prize in 1991, we would perhaps have never paid sufficient attention to the error in the 'Coase Theorem.' Curves after the third tipping point are not bold but rather dotted because we have not yet known the effects of recent publications (such as Coase 1991, McCloskey 1998, Buttler and Garnet 2003, and Yalcintas 2004) that point at the error in the formulization of Coase (1960).

Utopia with No Pragmatic Content

Frequency of path dependent occasions in intellectual history is high and second-best outcomes (i.e. pathologies) do repeatedly come about. Thus, idealities of perfection turn into mere utopias with no pragmatic content. Does the problem refer also to a philosophical condition? Why is perfection in scholarly life not attainable at all times?

Mark Blaug (1979: ix) states that 'but equally obviously, it must be insisted, great chunks of the history of economic thought are about mistakes in logic and gaps in analysis ... [mistakes which were] propelled forward by the desire to refine, to improve, to perfect.' What if intellectual history has been full of mistakes and errors? For many historians, this is quite 'normal' because error in the making of civilizations is merely a result of the imperfect nature of human understanding. For them, errors are sooner or later corrected; more important than errors are corrections. However, the path dependent evolution of institutions suggests that self-correction processes are often complex and that there is no guarantee that corrections would waive all of the irreversible effects of the past with a finger snap. In other words, every error amounts to a compromise (small or big) in the continuity of history where the success of social and intellectual projects relies on uninterrupted maintenance of ongoing scholarly conversation and empirical back-ups in old theories. When errors do not disappear easily and

without causing further trouble, they make a long lasting idea in history impossible – the idea that perfection in the world of scholars is achievable.

Morris Ginsberg, founding chairman of the British Sociological Association, argues that evil has its own ‘solidarity.’ What he means by this is that although misunderstandings in intellectual history often fade away as the results of new research keep providing novel findings, social and intellectual development in history may not be progressing. The flow of events has perhaps never involved the ‘spirit of betterment.’ In other words, we may have never been able to develop conclusive answers to the fundamental questions of intellectual history, such as those regarding truth, justice, and so on because many small events have disturbed the so-called spirit. ‘Error and vice,’ claims Ginsberg, ‘are in their own way cumulative and tend to produce further error and vice in individuals as well as in nations. There is no assurance that the forces making for disruption or deterioration must cancel each other out and thus bring about their own defeat’ (Ginsberg 1953: 5).

Despite the importance of the matter, many historical narratives have stood fixed on the idea of perfection without paying sufficient attention to the cumulative character of human error that has kept causing adverse consequences for the future. Few thinkers have been willing to get to the heart of this social phenomenon of scholars’ capability of error. Errors are so crucial that they sometimes disallow the sterilized blackboard principles to work. Scholars’ underlying belief about the evolution of societies has been that of Condorcet:

[N]ature has assigned no limit to the *perfecting* of the human faculties, that the *perfectibility* of man is truly indefinite; that the progress of this *perfectibility*, henceforth independent of any power that might wish to arrest it, has no other limit than the duration of the globe on which nature has placed us. Doubtless this progress can be more or less rapid; but never will be retrograde, so long, at least, as the earth occupies the same place in the system of the universe, and the general laws of that system do not effect on this globe either a general destruction or changes which would no longer permit human kind to preserve or to exercise thereon the same faculties, and to avail themselves of the same resources (Condorcet 1795, quoted by Teggart 1949: 323. *Italics added.*)

There is, of course, not so much wrong about having ideals or different kinds of motivation for striving for what we may consider the perfect being, the best society, or the most efficient technology. The intellectual pathology here is perhaps the unquestioned

prestige of what is 'inhuman' in various accounts of human history. (See Nietzsche 1878 and Mirowski 2002: 437-452.) Obviously, most people have ideals in life. They feel morally better when they preserve in their mind the idea of a perfect being or desire for a just society. Most people believe in God, pray for their beloved, and think it is important to be virtuous citizens. There is no doubt that what we can achieve in our scholarly world has much to do with what we can imagine.

As a matter of fact, the images scholars have created are mostly products of fairy tales, religious theory, folklore, and so forth. That they refer to a world beyond facts and experience is refreshing and progressive. Scholars' faith in different conceptions of perfection, however, is bound up with the responsibility of their actions about images which are outside of their beliefs. In other words, the idea of perfection is fruitful in scholarly life insofar as there is enough space for others to think and live by alternate metaphors within various paradigms. Knowers, doers, and makers of this world are responsible for their actions, no matter what sort of belief precedes or causes them - religious or secular. Beliefs are not there only for the behavior's sake (James 2000: 198-219). Whenever we are to change public life by virtue of our passions - e.g. hope, love, and faith - 'the principle concern must be the extent to which the actions of religious believers frustrate the needs of other human beings, rather than the extent to which religion gets something right,' argues Richard Rorty:

[A]lthough your emotions are your own business, your beliefs are everybody's business. There is no way in which the religious person can claim a right to believe as part of an overall right to privacy. For believing is inherently a public project: all we language users are in it together. We all have a responsibility to each other not to believe anything which cannot be justified to the rest of us. To be rational is to submit one's beliefs - all one's beliefs - to the judgment of one's peers (Rorty 1997).

The conception of perfectibility has a long standing history. The idea of perfection has existed since the ancient Greeks, especially in the writings of Plato. It has been influential in Europe primarily since the Renaissance. It became famous, although in a very specific form, by Thomas More's *Utopia*. It was More who helped popularize a constitutive metaphor in and of intellectual history. In his *Utopia*, More gave an account of a community in which its citizens enjoyed the perfectibility of human institutions and morality. Nature has assigned no limit to the inhabitants of Utopia. The ideal social order on the island was perfectly maintained. More, a 'man for all seasons,' has had many admirers, from the Catholic Church, which canonized him as a saint in 1935, to the

Politburo of the USSR, where a sculpture of him was erected at Lenin's behest after the revolution of 1917. His *Utopia* has influenced almost every text written on such social and philosophical issues of justice, poverty, social order, and so on. The book inspired the projects of changing (and even revolutionizing) the world with a faith in perfection. (For an inclusive survey see Frye 1966, Carey 1999, and Guy 2000.)

Scott Gordon argues that many writers have read *Utopia* from the view of religious freedom and secularization in political and intellectual life. In fact, *Utopia* has been influential on such diverse issues as secularization, communism, and liberalism. (See Hexter 1961, Pienas 1964, Nendza 1984, and Engeman 1982, and more recently Carey 1999: xi-xxvi and Hodgson 1999: especially 1-14.) The book has been extremely important in the process of reforming church-state relations - it was perhaps the first attempt to articulate a comprehensive religious freedom (Kessler 2002). 'Despite More's religious feelings,' says Gordon,

his *Utopia* is not notably a portrait of a perfect social order built upon religious foundations or governed necessarily by priests. In fact it was the forerunner of the form of social perfectionist writing that rose to dominance in the eighteenth century: the vision of a *secular* utopia ... [S]ocial science and social philosophy underwent a profound transformation from a religious to a secular orientation during the seventeenth and eighteenth centuries. This was also true of that branch of social thought most intimately connected with religion, the concept of a social order: paradise, in effect, was brought down to earth (Gordon 1991: 160).

The conception in *Utopia* is challenging. For *Utopia* is a special utopia in which there is one unalterable world and no alternatives at all. It is a world of perfection - a world in which everything that can be thought (or imagined) can also be attained and realized. It was one of the utopias that demonstrated a world by which many thinkers such as Léon Walras and Karl Marx were inspired. It was the world in which the citizens of the Soviet Republic hoped to reside. It was not a factual demonstration, though - it was a story about a country that had never existed, for 'utopia' meant 'the place that did not exist' (Kumar 1991: 1). Obviously, after such disappointments as the collapse of the Soviet Union and the war in Iraq as well the bombings in Gaza, we have started to think that we might have started the 'adventure of enlightenment' erroneously and we should consider the initial assumptions and preconditions once again. This amounts to getting concerned about errors in intellectual history - errors that resulted in path dependent circumstances in the history of human ideas.

Many age old metaphors of Western thought, which were to be used to build such perfect structures, were basically symbolic figures. By virtue of such figures, 'some have sought the good in self-realization,' Dewey said, 'some in holiness, some in happiness, some in the greatest possible aggregate of pleasures. And yet these schools have agreed on the assumption that there is a single, fixed, and final good. They have been able to dispute with one another only because of their common premise' (Dewey 1950: 132). While Heraclites thought it was fire that was intrinsically stable and certain, Plato thought it was the rational spirit. St. Augustine thought it was love of God that was fixed and final in nature, and Spinoza thought it was emotion and affection. Marx thought it was class struggle that determined the course of social and economic history. Certainly, accusing intellectuals for using and over-using the same metaphors may seem pointless because this resembles accusing societies for having social values and blaming governments for having armies. Using metaphors and other placeholders turns out to be a problem, however, as Rorty once said, when the 'happenstance of our cultural development [is] that we got stuck so long with place-holders' (Rorty 1979: 83).

The problem with the majority of those figures of speech was that we have used these symbolic figures literally. In fact, such figures of speech were chosen arbitrarily, mostly with references to religious and transcendental doctrines. Utopias generate a similar effect. Utopias are, in a sense, free exercises about free worlds where constraints are loose and sometimes non-existent. They are, after all, constructed worlds - the worlds that thinkers make for themselves. Such metaphors aim to form an imaginary, balanced construction of human ideas. 'Beneath the surface of economic theorizing,' Robert Nelson writes (Nelson 2001: xx), 'economists are engaged in an act of delivering religious messages. Correctly understood, these messages are seen to be promises of *the true path to a salvation* in this world - to a heaven on earth.'

Utopia as a metaphor implied that it was possible to build perfect structures in the human world. It was possible, for instance, to create or discover a 'perfect language,' that is, a world of one language. Perfect language means that we name objects in such a way that we unambiguously communicate their inherent properties when we talk about them. It implies there should be one name for a tree and the name should represent the 'essentials' of the object. Names in languages would then have definite meanings. 'The dream of a perfect language,' as Umberto Eco once said, 'did not only obsess European culture. The story of the confusion of tongues, and of the attempt to redeem

[European culture's] loss through the rediscovery or invention of a language common to all humanity, can be found in every culture' (Eco 1995: 1).

One can read *Utopia* in countless ways, underscore a variety of its aspects, and criticize or praise its conclusions and implications. In fact, the ideas presented in *Utopia* have long been challenged by a number of critics. Isaiah Berlin, for instance, reports that the originality of Machiavelli was his disbelief in an ideal state of affairs. 'Machiavelli ... undermines one major assumption of Western thought,' Berlin argues, 'namely that somewhere in the past or the future, in this world or the next ... there is to be found the final solution to the question of how men should live ... [But] the very search for it becomes not merely *Utopian* in practice but conceptually incoherent' (Berlin 1953: 72-76, quoted by McCloskey 2006: 247). Path dependence research provides another critique of *Utopia*, conclusions of which are similar to those of Berlin.

Utopia is not always possible to attain in the evolutionary history of scholarly life because remote consequences of small events cannot be predicted at all times. Small events shift the evolution of ideas and can cause (extra-) positive or (extra-) negative consequences moving the system away from its systematic course. As a consequence, pathways of evolution are not always non-linear. That is to say, evolution is not headed at a pre-defined perfect stage but rather bifurcates after several tipping points that historical small events cause without any time-regularity or periodicity. In fact, imperfections that come about as a consequence of tipping points are the central characteristic of natural selection and evolution. Richard Dawkins (1986: 91) remarks that 'evolution can be more strongly supported by evidence of telling imperfections than by evidence of perfection.'

Imperfection in Nature: what evolution teaches

Lying on a sunny bank in Australia in 1836, Darwin was puzzled by an idea: why would there be so many diverse creatures in similar climates and geographies? Darwin (1952: 60) writes: 'but it may be objected that if all organic beings thus tend to rise in the scale, how is it that throughout the world a multitude of the lowest forms still exist; and how is it that in each great class some forms are far more highly developed than others? Why have not the more highly developed forms everywhere supplanted and exterminated the lower?' The answer would be either that there were two creators at work at the same time or that species evolved separately, tracking down different pathways

at different times. It seemed certain to him that, in either case, there would have been no inherent direction or tendency of internal perfecting among species. 'Natural selection,' Darwin claimed (1952: 98), 'will not necessarily lead to absolute perfection; nor, as far as we can judge by our limited faculties, can absolute perfection be everywhere predicated.'

The existence of imperfections and oddities among species, according to many natural scientists such as Stephan J. Gould, proved to Darwin that there were pathways in nature in which we could trace the particular causes that led life's history to follow this or that route (Gould 1982: 28). One couldn't demonstrate evolution with perfection, Gould claims, because perfection didn't need to have a history. If perfection existed, any organism in nature would have been created for the purpose to which it pertained perfectly. To put it differently, there was proof of evolution because the root of an organism didn't always coincide with the 'modern form' of the organism. If these two were equal, then there was no indication of evolutionary history. 'Oddities in current terms are the signs of history,' writes Gould (Gould 1982: 29).

On our theory the continued existence of lowly organisms offers no difficulty; for natural selection, or the survival of the fittest, does not necessarily include progressive development - it only takes advantage of such variations as arise and are beneficial to each creature under its complex relations of life ... Although organisation, on the whole, may have advanced and be still advancing throughout the world, yet the scale will always present many degrees of perfection; for the high advancement of certain whole classes, or of certain members of each class, does not at all necessarily lead to the extinction of those groups with which they do not enter into close competition. In some cases, as we shall hereafter see, lowly organised forms appear to have been preserved to the present day, from inhabiting confined or peculiar stations, where they have been subjected to less severe competition, and where their scanty numbers have retarded the chance of favorable variations arising (Darwin 1952: 60-61).

Natural selection is a mechanism that causes 'better adapted' species to win. A species' better adaptation, however, does not necessarily mean the species' transforming into a superior creature in some anatomical sense. Natural selection involves mechanisms of positive feedbacks in which consequences of historical contingencies are sometimes reinforced in such a way that some birds without aerodynamic design of feather or some insects by way of mimicry that enable them to look like a leaf or a stick survive. Optimal adaptation does not always occur in life's history. 'Darwin recognized,' Gould

claims, 'that perfection cannot provide evidence for evolution ... that the primary evidence for evolution must be sought in quirks, oddities, and imperfections that lay bare the pathways of history' (Gould 1991: 300).

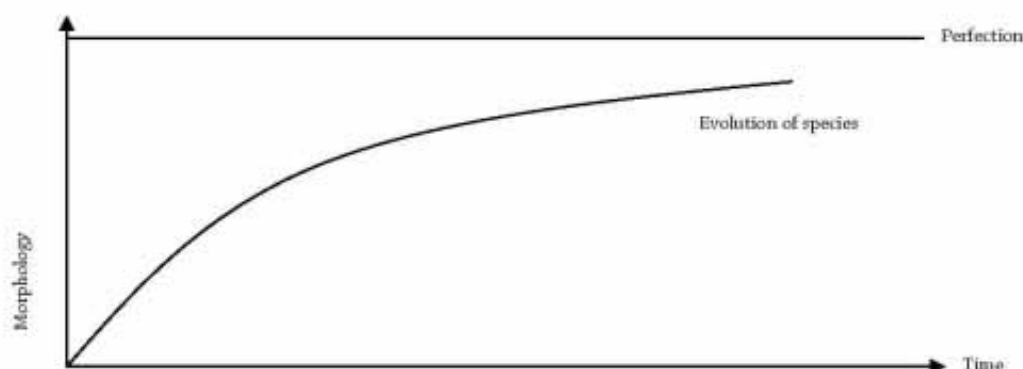
However, as Nicholas Georgescu-Roegen argued (1974: 196), 'if science were to discard a proposition that follows logically from its theoretical foundation, merely because its factual realization has never been observed, most of modern technology would not exist. Impossibility, rightly, is not the password in science.' Indeed, from a theoretical point of view, perfectionism does not go hand in hand with evolutionism but, as a matter of fact, perfect solutions have often come about in natural and social history. The difficulty here has to do with the explanation of 'repeated perfection.' Repeated perfection indicates that some organisms converge upon the same solutions again and again. In the evolutionary history of a number of species oddities never occur. Some kind of an 'ordering force' interlocks evolution to certain directions. This is not a contradiction, Gould argues, because the Darwinian notion that evolution is unplanned and undirected does not cancel out the fact that 'natural selection builds good design by rejecting most variants while accepting and accumulating the few that improve adaptation to local environments' (Gould 1982: 40). Optimal solutions are prevalent in natural history and it is repeated more than twice in different lineages. In disparate groups, abstract forms of ideal worlds exist. Final adaptation is so complex and peculiar that in some cases physical forces override natural selection in such a way that species obtain an optimal form by virtue of physical forces acting upon them. Complex forms are shaped by simpler mechanisms in a variety of unsuspected ways. A number of natural states, Gould claims, such as hexagonal creatures or spiral leaves, are created as a consequence of only a small perturbation and modification in the form of the species. Numerous social insects, identically, relied on the perfect division of labor and harmonious collaboration among individuals in their colonies in order to survive in nature (Mayr 1976: 31).

The reason why perfection does not take place at all times is not solely the interruption of historical small events. Perfection may not come about even when the general course of events follows some kind of a systematic pattern. There is no guarantee, for instance, that a research project will achieve success even if a strict research plan is implemented step by step over years. Underachievement of a project is not always because of some small events in the history of the project interrupting the systematic course of research. We may never be able to develop a cure for HIV, for instance. The

same applies to cancer research as well: no researcher in the field starts tests in the laboratory with a guarantee in hand to find a vaccine against the pathology. The negotiation talks, likewise, between the EU and Turkey may end up in failure, as the negotiations are 'open-ended.' Such a failure is not always expected to be due to a historical chance occurrence in the history of the negotiations. Big events may well be the cause of us not achieving perfection. To put it shortly, even if systematic forces are all that matters to a process (that is, even if the process is path independent) perfection is not guaranteed.

Nevertheless, examples of the most incredible and miraculous adaptations in nature and deterministic shapes in physics, as well as other instances in economics, do not serve as 'proof of intrinsic *tendency* toward perfection' (Mayr 1976: 46). An organism's inborn actions to its environment in the most efficient ways are not sufficient for evolutionists to conclude that nature is designed so as to serve a perfect purpose. Evolutionists claim that behind all perfect solutions that species generate for themselves to survive in nature are basically arbitrariness, planlessness, and accidents. '[A]ll evolution is due to the accumulation of small genetic changes,' Mayr writes (1963, quoted by Brooks and Wiley 1986: 21), 'guided by natural selection, and that transspecific evolution ... is nothing but an extrapolation and magnification of the events that take place within populations and species.'

The figure demonstrates an evolutionary pattern headed at a perfect steady-state situation. The theory of path dependence suggests that perfection cannot be the only purpose of the course of life's history. In other words, perfection is not at all times the case because even if we suppose that the demonstration is flawless, it is not certain that after evolution hits the bar of perfection, there would be no more motion (that is, mutation) in nature. Put it differently, historical small events would never cease to threaten the systematic course of a process and, as a result, be a potential factor causing discontinuities in the form of decadence or degeneration or further enhancement at any time in the course of history. In that, any perfect form in the course of evolution can lose its usefulness in the race for survival. We humans have the advantage, for instance, of using our hands to make tools, fight, or do many things that, say, pandas cannot easily do. The up-right skeletal structure of our body enables us to stand up, walk, run, and stand straight on foot. This nevertheless puts high amounts of pressure on our backs and such an advantage can turn into a disadvantage on occasion or in time. Imperfections prove to evolutionists that there is evolution in nature because if nature were

FIGURE 14: PERFECTION AND EVOLUTION

The figures above illustrates evolutionary pathway of species as if it were a single line of advancement. This is the dominant illustration in evolutionary biology and palaeontology, Gould argues (1982). According to the linear interpretation of evolution, Gould writes (1982: 139), '[t]he pathways of improvement are rigidly limited by the nature of building materials and the earth's environment. There are only a few ways - perhaps one - to construct a good flyer, swimmer, or runner. If we could go back to that primordial bacterium and start the process again, evolution would follow roughly the same path. Evolution is more like turning a ratchet than casting water on a board and uniform slope. It proceeds in a kind of lock step; each stage raises the process one step up, and each is a necessary prelude to the next.'

designed to work in the most efficient ways, why were there imperfect solutions? Why did they not disappear? Again, efficient and optimal solutions alone do not prove that perfect species can never be seen in nature (and inefficiencies and sub-optimalties in the market). Perfection in nature is rather by trial and error, Mayr argues. The driving force of evolution, as a consequence, is not 'single mutation'; neither is it permanent progress because periods of evolutionary stagnation are prevalent in the course of history as well. 'Once the ontogenetic pathway has been organized in such a manner that it tends to form horns on the skull,' reports Mayr,

[i]t will be relatively easy for the formation of horns to be actually realized in various groups. The potential is presumably still present even in lines in which the formation of horns is suppressed and therefore can again be expressed at a later evolutionary stage. However, a group that lacks such ontogenetic tendencies will form horns only with a very low probability (Mayr 1976: 59).

The issue of imperfection in philosophy

The idea of 'continual progress' has long dominated the positivist thought in Europe. Continual progress would mean that human civilization had, slowly and gradually, advanced from a state of uncertainty, ignorance, and cultural deprivation to higher levels of prosperity and wisdom (Nisbet 1994: 10). Human civilization could only move one way and each generation 'on the shoulders of giants' was bound to add to it (Pollard 1971: 20). Every generation, according to the idea of continual progress, is superior to its predecessor. Human ideas enlarge toward new horizons. Step by step, the human mind frees itself from obstacles. The flow of events involves the spirit of betterment. Perfection is the point at which the evolution of human institutions is headed. It is a unique point. It is the final destination, pre-determined. The course of progression is only to terminate where there is nothing better beyond. Betterment upon that point is not possible. Nicolas de Condorcet (1795, quoted by Teggart 1949: 323) wrote thus:

[N]ature has assigned no limit to the perfecting of the human faculties, that the perfectibility of man is truly indefinite; that the progress of this perfectibility, henceforth independent of any power that might wish to arrest it, has no other limit than the duration of the globe on which nature has placed us. Doubtless this progress can be more or less rapid; but never will be retrograde, so long, at least, as the earth occupies the same place in the system of the universe, and the general laws of that system do not effect on this globe either a general destruction or changes which would no longer permit human kind to preserve or to exercise thereon the same faculties, and to avail themselves of the same resources.

Perfection in philosophy has various meanings. In general, it signifies a phase where no undesirable outcome is possible. It is a phase upon which evolution converges through time by means of incremental improvements. Upon such a path, there is no room for regression and depreciation. According to perfectionists, 'philosophical theories [converge] - a series of discoveries about the nature of such things as truth and personhood, which get closer and closer to the way they really are, and carry the culture as a whole closer to an accurate representation of reality' (Rorty 1989: 77). This is the view that intellectual history has long been locked into - perhaps since Plato.

Karl Popper (1971: 158-167) criticizes the view of 'perfectionism' in philosophy, especially inherent in Plato's program, which he 'believes is the most dangerous,' and compares it with his alternative, piecemeal engineering, which he 'considers as the only

rational strategy' in international politics. Perfectionism, according to Popper, is one of the forms of social engineering that requires the policymakers to have a blueprint of the society before their minds at which they aim. Such a blueprint would help them find the best ways and means to achieve happiness and perfection on earth. This would require them to experiment on large scales and develop theories based on trial and error. The experience of perfectionist social engineers would thus enable them to recast the structure of the society on which they experiment.

Popper does not claim perfectionism is unattainable or that it should always remain a *Utopia*. He argues that many things that were once declared unrealizable have since been realized. Institutions have been established, he suggests, to help secure civil peace that would prevent international crime and armed aggression. What he criticizes under the name of *Utopianism* recommends

the reconstruction of society as a whole, i.e. very sweeping changes whose practical consequences are hard to calculate, owing to our limited experiences. It claims to plan rationally for the whole of society, although we do not possess anything like the factual knowledge which would be necessary to make good such an ambitious claim. We cannot possess such knowledge since we have insufficient practical experience in this kind of planning, and knowledge of facts must be based upon experience. At present, the sociological knowledge necessary for large-scale engineering is simply non-existent (Popper 1971: 165).

Perfection in politics, Popper claims, can easily turn into violence in place of reason. The cause of this is that, because of lack of experience and the cumulative consequences of policy mistakes, unexpected results of large scales are very likely to materialize. No social action results in expected outcomes. 'It is not reasonable,' Popper argues, 'to assume that a complete reconstruction of our social world would lead at once to a workable system' (Popper 1971: 171). Perfectionism in politics would necessarily lead to strong centralized rule of a few, which would transform into a dictatorship. Such authoritarianism would discourage criticism and violent measures would be taken against those who advocate compromise and improvement via democratic methods.

Popper's political program is basically Darwinian in the sense that he points out the lack of necessity and even dangers of a perfectionist view in politics. Perfectionism in politics would only lead to further disaster, Popper argues, not happiness. The international political situation is not perfect and cannot be considered to have a tendency to

perfection. It is instead a complex, flawed, and evolving system. Just as there is no evidence for the whole of species in nature to evolve towards perfect individuals so there is not any logic in expecting a perfect political system that would bring contentment for the world's people.

The idea of perfectionism fascinated many thinkers especially in the Victorian period - and, of course, Darwin himself, too (Wright 2005: 1-28). Darwin saw the large in the small but he didn't argue, Gould claims, that the large would emerge out of the small by basically adding time into the process. Natural (and social) patterns are not always the outcome of uninterrupted proliferation and betterment. Patience has never been the sole point of history. Imperfections in nature occasionally prevailed and mostly did the job better than the perfect. Pandas, for instance, didn't have perfect 'thumbs.' They had five digits and the 'thumb' evolved separately. Pandas used it like a sixth finger to run, stab, and strip off the bamboo leaves. The pandas' thumb was remodeled for a new purpose which helped them survive by virtue of a different diet than that of ordinary bears and raccoons (Gould 1982: 19-26). Dinosaurs were anatomically superior to many other species in their local environment yet they didn't survive. Interestingly, however, some other small animals survived the conditions which caused the mass extinction of dinosaurs not because the small animals featured some anatomic superiority. Their smallness was a negativity in 'normal' times; no one could have predicted that their size would win them an advantage in the future. They remained small for some other reasons which helped them survive whatever catastrophe destroyed the dinosaurs (Gould 1991: 307).

Losers do not easily disappear by inferiority in competition (Gould 1991: 302). The pathway from small to large involves short-cut generating mechanisms. There is no single pattern which determines who gets through and who doesn't. There is no unique key to unlock the secret doors of history. Most of the species survive through special reasons because they take advantage of pathways in which causation running cumulatively enhances the impact of certain events immeasurably. This wouldn't happen for a second time. As a consequence, imperfections and oddities are not singled out automatically. On the contrary, they prevail in such a way that, down the pathway, evolution has no direction. Evolution does not lead to higher and superior species. It is not always progressive.

The key evolutionary point of punctuated equilibrium

If evolutionary progress meant continual progress alone, the pathway from antiquity until today would be linear and directed toward inevitability and superiority. But success is not always nature's theme, Gould argues. Some species are unfit and they survive while others are perfectly fit and they become extinct. The difficulty arises as the evolution of species is nevertheless illustrated by the 'ladder of life' because 'they nurture our hopes for a universe of intrinsic meaning defined in our terms ... our continued allegiance to the manifestly false iconographies of ladder and cone [points at] cosmically justified hope and arrogance' (Gould 1991: 43 and 45).

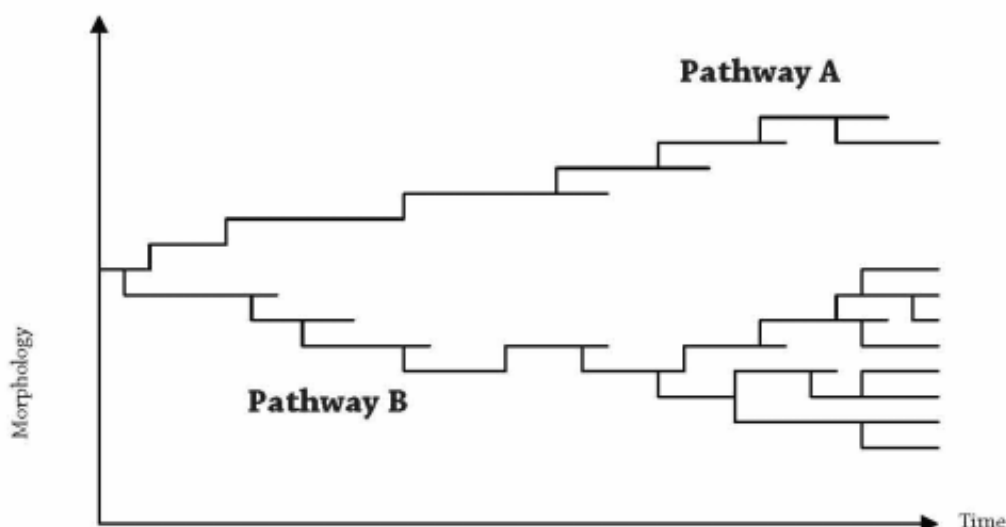
Gould argues that life is often demonstrated in evolutionary biology and paleontology, incorrectly, like a growing bush and there is almost always more than one surviving twig. Every pathway is only one among thousands of others on a complex bush. Conventional iconography, writes Gould, 'has fastened upon a primary model, the 'cone of increasing diversity,' an upside-down Christmas tree. Life begins with the restricted and simple, and progresses ever upward to more and more, by implication, better and better' (Gould 1991: 38). Such trees grow upwards and widen outwards, expanding the 'cone of diversity.' They also imply ranking among ancestors and cousins. Upward and outward species take the advantages of complexity which grow out of the consequences of success of species at each successive stage of evolution. The problem with such iconographies is that they do not illustrate different pathways in life's history and demonstrates evolution as if there were only one pathway directed to some perfect ideal that will eventually come out in future.

Gould and Niles Eldredge show the implausibility of this, developing their own theory of 'punctuated equilibrium.' Like most other theories, Gould and Eldredge argue, 'punctuated equilibrium is a claim about relative frequency, not exclusivity' (Gould and Eldredge 1993). The logic behind the theory is that while large populations in nature change slowly and maintain relative stability of variety among themselves, tiny populations separated from bigger populations, moving to other areas of residence, develop more rapidly and produce daughter species through speciation. Speciation is the main mechanism that leads to the evolution of new species. It takes place within only a 'geographical millisecond' - that is, a thousand or tens of thousands of years - and fails to change thereafter (Gould and Eldredge 1972). Newly speciated daughters are excluded from others because of reproductive isolation (Elsberry 1996).

The theory argues that new species may arise when a small population becomes isolated at the periphery of the parental geographic range. Isolation can occur by a variety of geological and geographic contingencies - mountains rising, rivers changing course, islands forming. Without geographic isolation, favorable variants will not accumulate in local populations, for breeding with parental forms is a remarkably efficient way to blur and dilute any change that might otherwise become substantial enough to constitute a new species. Most peripherally isolated populations never become new species; they die out or rejoin the larger parental mass. But as species may have no other common means of origin, even a tiny fraction of isolated populations provide more than enough 'raw material' for the genesis of evolutionary novelty (Gould 1991).

The theory of punctuated equilibrium maintains that the possibility of perfection among species in nature is not always possible. It is, however, not because nature does make leaps through time. As Gould has expressed repeatedly, the theory of punctuated equilibrium is not a theory of saltationism; it does not give rise to *natura facit saltum*. Punctuated equilibrium is rather a theory of differential rates of evolution between splitting lineages only (Broyles 1997). It explains how a large population can come out of a small population. The total number of species increases; however, no species transforms into another. In other words, 'punctuated equilibrium clearly does not require or imply macromutation' (Gould 2002: 1006-1021.) The new population need not be bigger than their parent species, either. It is the proliferation of stasis that generates branches which do not lead in the same direction as that of their ancestors. The small sub-population after speciation gets bigger and bigger, and new pathways occur. In other words, evolution is not directed to a single superior, perfect creature but maybe two or even more. Evolutionary pathways are rather a combination of a number of evolutionary lineages. By way of several mechanisms in nature, such as speciation, diversity among species increases, resulting in the co-existence of only a few diverse species at the same time which have long been isolated from their parent species and feature no anatomical advantages upon others necessarily.

In other words, stasis, not diversity, is at times the point of biological evolution. After a level of diversity in history, evolution may proceed by elimination instead of further expansion. Evolution may hit such a pathway that 'life settles down to generating endless variants upon a few surviving models' (Gould 1991: 47). The system may lock itself into specific evolutionary lineages in and out of which an overwhelming majority of species is destroyed and only a few survive. The number of anatomical

FIGURE 15: PUNCTUATED EQUILIBRIUM

The figure is adopted from Gould and Eldredge (1972, figure 5-10). It shows how speciation may lock morphological change in to two particular pathways (A and B). The history of evolution is 'disturbed only rarely (i.e. rather often in the fullness of time) by rapid and episodic events speciation,' write Eldredge and Gould. Diversity, in other words, is not inevitably the outcome of life's history. Shifts in evolutionary lineages are not too frequent. Evolution of most of the species is nevertheless discrete. That is, small breaks shape evolution. After every disturbance, however, stasis dominates the course and it is unlikely that species show further gradual change. The system is, then, inert.

designs is reduced. Evolutionary history in the iconography now demonstrates both simplicity and complexity as well as both 'old' and 'new.' Species that survived may have prevailed not for a cause on the Darwinian basis of success in normal times. 'Perhaps, the actual reasons for survival do not support conventional ideas of cause as complexity, improvement, or anything moving at all humanward' (Gould 1991: 48). Perhaps an earthquake hit the region. Or an unpredictable environmental catastrophe provoked mass extinction. Evolution may have become dependent upon improbable courses of events which are sensible in retrospect and unpredictable and unrepeatable in prospect. Gould calls this thought experiment 'replaying life's tape.'

You press the rewind button and making sure you thoroughly erase everything that actu-

ally happened, go back to any time and place in the past - say, to the seas of the Burgess Shale. Then let the tape run again and see if the repetition looks at all like the original. If each replay strongly resembles life's actual pathway, then we must conclude that what really happened pretty much had to occur. But suppose that the experimental versions all yield sensible results strikingly different from the actual history of life. What could we then say about the predictability of self-conscious intelligence or of mammals or vertebrates or of life on land or simply of multicellular persistence for 600 million difficult years? (Gould 1991: 49-50)

This does not mean that evolution after a chance or contingent event is senseless. It only means that strict determinism of perfection may not apply. Each stage gives way to the next one for a cause but no final term can be specified *ex ante*, knowing the initial step of a process. Moreover, perhaps no term would occur again if we had run the system for a second time. No matter how small in size, replace any event or insert another event that seems improbable or without apparent importance, and evolution would lead to a completely different pathway (Gould 1991: 51).

Many, if not all, substantial variations among species in nature are because of some small imperceptible changes taking place randomly on genetic levels. Large color differences among caterpillars, for instance, result from a small underlying genetic change: 'the effects of a slight delay or enhancement of pigmentation early in growth increased through ontogeny and led to profound differences among fully grown caterpillars' (Gould 1982: 191). Such events in history are unique. They need a special treatment. When such events are present, artificial repetition of the same sequence of occurrences within a model or a laboratory is not always possible. They do not violate the principles of causation as one can still explain why and how such and such consequences occur out of such and such causes; however, after historical small events take place, complexity of the course of events is not always reducible to a number of law-like statements, providing the scientist with the ability to quantify, experiment, and predict future occurrences.

Life, as Darwin claimed, is between natural laws in the background and contingencies in detail (Gould 1991: 290). Every event in nature is a unique phenomenon and has a specific role in the sequence of events. If only one singular event had not occurred during the course, the results would be radically different. Or had there been the slightest unpredictable change - such as injection of an extra factor seemingly without any causal significance - the same consequences wouldn't follow. Every (final) term

is dependent upon antecedent states, the consequences of which are not eliminable and never un-happen again. Each event in every course, no matter how small, has the power of transforming the impacts of events after it. How about other realms of nature? Does the evolution of social network in our daily and intellectual live feature the same property?

The key epistemological point of punctuated equilibrium

From an evolutionary perspective, geographical factors are the main contingent factors that affect the prospects of societies on earth. In fact, many events in our daily lives happen as a consequence of contingencies as well. In the presence of contingent events, there is less guarantee than many assume that the courses of events would end up with a pre-defined outcome. Under such conditions, a small perturbation in the course of events turn into a critical trigger and the response of the system to a tiny change increases the power of the change in the same direction. Every subsequent change speeds up the course of events. Consequences are bigger and more substantial in proportion to earlier causes in the course.

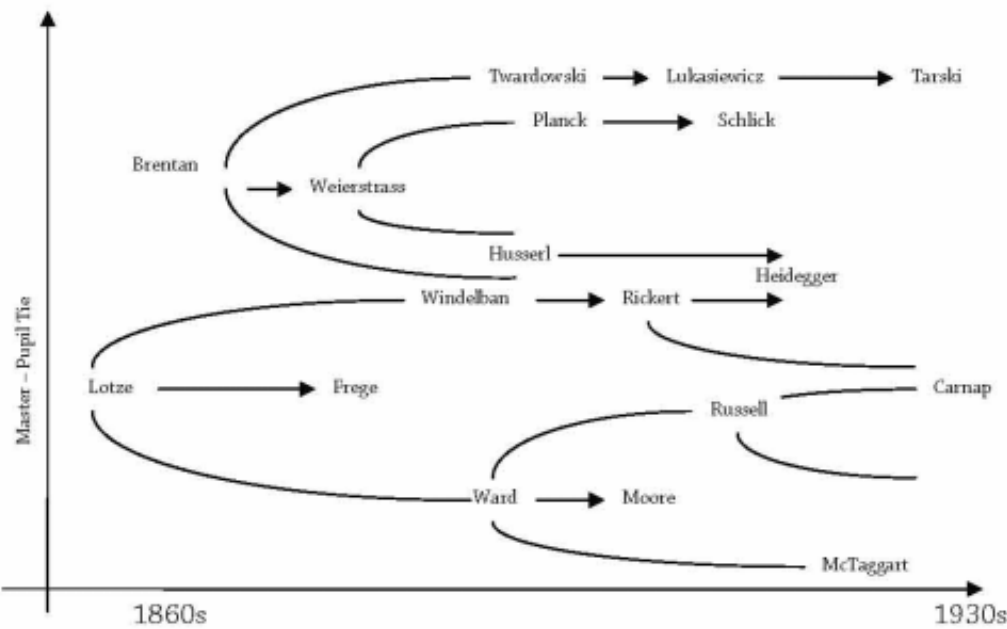
In intellectual history, one comes up with a great score of examples in which geography and related contingent factors give rise to important paradigm shifts in the evolution of ideas. The reason is: events in natural and social history operate within specific environmental settings. When environmental conditions change, the same events cease to generate the same consequences. Under such conditions, events cause spatio-temporal outcomes and the environment is the principle factor determining the outcome.

Willard van Orman Quine could not have guessed he would think differently than his supervisor, Alfred N. Whitehead, before Quine had moved to the US. The consequence of moving to another continent was so big that the small event of Quine's changing mind completely transformed the evolution of the positivist tradition.

Cambridge, the city and the university, had played an important role in John Maynard Keynes's intellectual life. The connection between the University and the political elite of England was strong. Keynes had the opportunity to attend Alfred Marshall's lectures, and spend time with many mathematicians and philosophers who were all prominent figures in their fields at the time. The intellectual life in the city beat so strongly, writes Ray Harrod (1951: 55), 'it was a privilege to be [at Cambridge].' If he

had not been there, he would perhaps not have been an eminent figure in the history of economics as he is now.

FIGURE 16: PUNCTUATED EQUILIBRIUM IN INTELLECTUAL HISTORY:
'REALIGNMENT OF NETWORKS IN THE GENERATION OF 1900'
(Simplified and adopted from Collins (1998: 718) Figure 13.3)



The figure is a simplified version of Collins (1998: 718, Figure 13.3). Collins observes that 1900s were a period of 'massive realignment' in which history of ideas was disturbed often. Within a period of 70 years, ideas received decreasing or declining attention a few times. After the latest pupils moved in new directions, ideas followed specific pathways and stasis dominated the networks for about 1/3 of a generation. '[I]ntellectual energy [was] propagated down the wires of interpersonal contacts, while the content of ideas [was] rearranged by horizontal strains of opposition reconfiguring the attention space' (Collins 1998: 718).

'Intellectual networks' are one of the most important factors of intellectual causation determining the outcome in scholarly life. While you are doing science, where you are and who you are talking to are often more important than what you are saying. Randall Collins is in search of such 'coalitions of mind' within and among intellectual net-

works in which creativity is build up in intergenerational chains. Collins (1998) argues that intellectual causation explains how solidarity groups survive the challenges of scholarly life. He shows that interaction among intellectuals is dense and it intensifies even more when participants of a scholarly community feel that they are parts of a particular community. In scholarly communities, intellectuals use specific bodily motions. They perform within certain speech acts. They also use particular metaphors to communicate. Such symbols make borders among different communities more visible, determining who is in and who is out of the scholarly conversation.

Survival of a community depends on the (re-)assembling of the participants on regular basis in terms of time and occasion. Reassembling help symbols (i.e. bodily motions, speech acts, and metaphors) constitute the genes of a scholarly community. Genes act as the 'moral force' of a scholarly conversation and determine the scope of the conversation: 'it charges up individuals like an electric battery, giving them a corresponding degree of enthusiasm toward ritually created symbolic goals [even]when they are out of the presence of the group' (Collins 1998: 23). Scholars' attachment to the symbols sets the stands for the validity of ideas within the community. Social activities of a community (such as lectures and formal debates) turn individual scholars using such symbols into members of the community. The 'truth' arises out of 'interaction rituals' of intellectuals.

Scholarly communities operate in repetitive patterns, reinforcing the ties between the scholars. Messages conveyed among community members in social activities are discussed, repeated, and augmented every time individuals take part in a debate. Interactional rituals generate intellectual commitments among the members and commitments constitute and strengthen the social density of the 'repertoire of symbols' that determine the depth and scope of the content of a conversation. 'Individuals are motivated to participate in rituals of highest solidarity, gravitating toward those encounters in which their repertoire of symbols and their level of emotions mesh with those of other persons so as to generate high degrees of solidarity, and away from those encounters in which they are subordinated or excluded' (Collins 1998: 30).

Symbols have a life. As symbols are circulated more and the sophistication in their meaning increase, there is a better chance that they become 'parents' to a greater number of 'offspring' symbols. Symbols reproduce across generations of conversations in which creative members of the community produce large amounts of work in which

they report novel experience and fabricate new ideas about it. Large amounts of work do not always add up to larger score of creative ideas but it means better chance for the survival of the symbols to which creative members are attached. 'Just as success breeds the ingredients of success, failure breeds intellectual failure' (Collins 1998: 35).

Survival of a symbol depends on the degree of agreement on ideas which are crystallized in a symbol. That is to say, symbols get established when ideas that are expressed in these symbols are circulated among the community widely. As ideas make they make their ways through different intellectual networks, there is better chance for a symbol to be an instrument in the creativity of the scholars. Symbols spread far and wide by way of circulating ideas that are socialized among the whole intellectual community.

Symbols signify the degree of solidarity within a community - that is, bodily motions, speech acts, and metaphors are means to communicate among the members of community and the selection of symbols are determined by the regular encounters of community members with each other in different occasions. And also, symbols are self-ish: when they become part of a community repertoire, ideas start to make sense and are used to interpret the 'outside world.' Conversations cannot occur unless symbols are generated out of interactional rituals of a community. Survival of ideas depends upon the struggle of alternatives with ongoing conversations. Selection of an idea often amounts to the extinction of another idea (unless there is a possibility of co-evolution in a particular environment). There is a limit to the reproduction of new ideas. Collins argues that scholarly life is governed by the 'intellectual law of small numbers': the number of schools of thought that reproduce ideas for one or two generation is not less than three and more than six. In other words, there is a limit to attention space. Creativity gives rise to new ideas but more important than the transmission of intellectual capital is its intensification. That is to say, in the market for ideas, there can only be a few "stars." Intellectual capital tends to be monopolized: disagreements force the differences in the intellectual problem space to narrow down. "The underlying dynamic is a struggle over intellectual territory of limited size" (Collins 1998: 81).

The flow of ideas follows a dynamic pattern. Some ideas spread fast. Popularity of some other ideas disappears too quickly. Sometimes attention space becomes overcrowded. In such processes of intellectual causation, changing environmental conditions play the most significant role. Ideas are chain connected. The patterns of creativity are structured by intellectual lineages (Collins 1998: 90).

One of the consequences of the scarcity of creativity is the following: creative philosophers do not occur frequently and new ideas do not often replace the old ones. This phenomenon has much to do with the institutional conditions in which ideas emerge, struggle for survival, and spread. The conception of creativity is the 'judgment of one generation upon another' (Collins 1998: 58). In other words, there is a historical dimension to the emergence and spread of ideas. The issue of creativity of a philosopher is not established until several generations pass. Survival of ideas depends on the long-term success of the intellectual networks that transmit ideas across generations. Ideas have descendents. Transitions across generations are often not smooth. Intellectuals are made of where they come from. 'Intellectuals make their breakthroughs, changing the course of the flow of ideas, because of what they do with the cultural capital and emotional energy flowing down to them from their own pasts, restructured by the network of tensions among their contemporaries' (Collins 1998: 60).

Epistemology, as a consequence, often turns away from answering old questions and occupies itself with its own arena of dispute. Philosophy, Collins reports, re-digs its foundations and do not always 'move forward.' In other words, ideas do not evolve by way of displacing other ideas. Problems that ideas point at are not always resolved but rather fade away before philosophers' eyes. Abstractions and sophistication of theories increase. The processes of formal debates never end. Diversity of positions increases too. Philosophy has no pre-defined endpoint to evolve towards.

Do most intellectual histories report and apply this point in their accounts? I doubt. I am curious how of the intellectual history can be re-written paying attention to 'instabilities of real history, with its strange branching and sudden turning points' (Collins *et al.*: 1999: 240). The question of 'how much?' is left out here for further research. The next chapter develops an argument on one of the reasons why intellectual history is *not* written from an evolutionary perspective. Since intellectual history is what intellectual historians make it, habits of historians about how they write the stories of intellectuals should make a difference.

The Will to (In)Dependence

Or, why people choose to be
dependent

The main reason why we have come to take the same path of evolution as our ancestors is that people develop habits of thought according to which they think, behave, and act. Many of us like reading newspapers on Sunday mornings. We use words from a specific, limited vocabulary of pet names to address our lovers. And, historians of ideas use specific sets of metaphors to explain the evolution of the phenomenon that they are interested in. Certainly, historians' use of specific sets of metaphors is not necessarily because they do not know any others. It is rather because they are *used to* doing science with those words. A good reader of Nietzsche would immediately guess which text might belong to him because Nietzsche had chosen a specific set of words to explain philosophy. It is the same in the music of *The Beatles* and the paintings of Johannes Vermeer. A path-dependency world view suggests that we are not really entitled to begin talking about intellectual and practical problems in the terms that we are accustomed to, especially when we are more knowledgeable than past generations about the shortcomings and imperfections of the constructions that

we continue to construct. Historians of economics are within the same circle: we do not need a depiction of economics expressed in the terms (and the ideology) introduced by *Utopia*. We do not need *one* theory of economics providing us with solutions to *all* the worldly problems of human societies that have existed in history and all around the globe. There should also have been no presumption that corrections in the history of economics would cure all the imperfections in and of the past (thus irreversibility). In other words, markets would often fail to fully reverse the consequences of errors because of a complex set of reasons that we have tried to set out in this book. We should underline, additionally, that errors *and* corrections, considered together, are two of the non-eliminable constituents of the evolutionary history of human institutions. The relationship between the two is complex and, as they interact upon each other, they generate further irreversible and unpredictable outcomes. The history of the 'Coase Theorem' requires historians of scholarly economics to pay special attention to this case. Stigler and other authors, pointing at the error in its history, (Coase 1991, McCloskey 1998, Buttler and Garnett 2003) have already caused several irreversible consequences in its evolution. Historians of economics should not report such authors as magicians touching upon simple wounds and curing them away fully. In other words, the 'Coase Theorem' won't be destined toward a (fictive) stage of perfection even after various contributions correct the error and delete the negative effect of Stigler on Coase (1960). Historians of ideas should record Stigler as an important figure who played significant roles in the formulization and popularization of Coase's contribution of the 1960s. Stigler is the one who has caused numerous irreversible consequences for the economic science.

The publication of *Utopia* some 500 years ago, of course, did not necessarily cause the entire community of thinkers to adapt the metaphor without question into their prose and conversation. Examples such as the 'Coase Theorem' only show that there are numerous metaphors out there upon which sciences, philosophy, and arts have long been dependent. Path dependency worldview shows that we live with, in Nietzsche's words, 'illusions which we have forgotten are illusions, ... metaphors that have become worn out and have been drained of sensuous force, [and] coins which have lost their embossing and are now considered as metal no longer as coins' (Nietzsche 1873a). *Utopia* is just one of the metaphors that we have forgotten are metaphors. The common element here is that we today cannot break free from those metaphors. The metaphor of *Utopia* and many other works is certainly among the group that has held us psychologi-

cally and intellectually captive. For the same reason that institutions matter in social life, metaphors matter in scholarly life. (For further argumentation about 'metaphors as institutions,' see Lanteri and Yalcintas 2006.)

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Consider the following question: would it be correct to talk about the watery depths of a culture? If there is at least one single case that such an inquiry is meaningful, it would be the Dutch case. As Simon Schama tells the story in his *The Embarrassment of Riches: An Interpretation of Dutch Culture in the Golden Age* (1997), it is the moral geography of Low Lands in which Dutch identity had crystallized itself. The primal Dutch experience is the fight against the rising waters. He writes:

And these 'patients,' [those who were sent to the drowning cell at Amsterdam House of Correction], once recovered, were meant to recognize the peculiar sort of moral geography that would certify them as Dutch. To be wet was to be captive, idle, and poor. To be dry was to be free, industrious, and comfortable. This was the lesson of the drowning cell ... It is sometimes forgotten by the political historians that the war for national independence took place at the same time as a particular fierce in the struggle against sea (Schama 1997: 24 and 37).

Schama argues that the Dutch battle against water has determined the moral pattern and institutions of Dutch society; from secularization to *hoogheemraadschappen* (the governing councils of each of the *waterstaat* region), from tax collecting to crime punishment, from humanist philosophy to the defense against the Spanish tyranny. It has created the political culture, economic structure, and ethical pattern of the economic activity. Deirdre McCloskey, too, acknowledges this point. She says:

Flooding of water figures repeatedly in worries about an over-flood of riches ... To be deprived by riches of the necessity to work was bad, not good, because these were bourgeois, work-admiring people ... The Netherlands' 'fear of drowning in destitution and terror [from water] was,' [in Schama's words], 'exactly counterbalanced by their fear of drowning in luxury and sin [from wealth]' (McCloskey 2006: 74).

This is one of the reasons, Schama and McCloskey argue, why the Dutch society has been so sensitive about a balancing of virtues. This is not to say, of course, that the moral effort was especially Dutch. But *de Nederlanders* were nevertheless the first bourgeois society in the North-Western Europe, an early instance, and therefore a privileged reference and historical case study. In a sense, balance of virtues is what forms

the background of Dutch culture. The implication here is that the moral situation of the Dutch society was a condition for the performance of the Dutch economy for ages.

Now, consider an economic historian trying to persuade his colleagues that the history of democracy and democratic institutions in Holland has a lot to do with the contingent way the Dutch have built dykes over ages. Building dykes calls the entire community to be responsible to others. In such enterprises, there is no room for a single mistake. People behind the dykes are safer only when everybody is engaged in the maintenance of every particular unit of the dyke. Any carelessness may cause disastrous consequences for the entire community. The solution becomes effective only if larger numbers of people engage in the same problem and solution. That is to say, just like in democratic systems. Democratic systems operate properly only if more people engage in the system. Institutions malfunction when citizens substitute anti-democratic behavior for democratic ones. The Dutch are scared of the consequences of a system in which political institutions do not function democratically because they are scared of a possibility similar to the one that took place in 1400s on Saint Elisabeth's day in which 100,000 people died in one night.

Some economic historians would refuse to pay attention to the idea. They would find it bizarre. They would argue that there is democracy in Holland because educated Dutch citizens today have drawn lessons from the events in the Second World War and they have now concluded that democracy is the best system for human societies. The political system in Europe, they would argue, has been evolving in a cumulative fashion so much so that past experiences, without any discontinuities, have shaped the institutions of modern societies through time and helped them to get its most mature form till now. They would disagree that contingent events, like the principle of building dykes so long ago, can have such big consequences as democratic systems today.

Niles Eldredge and Stephan Gould, quoting a passage from G. L. Jepsen (1949: v), write that 'habits of thought in the tradition of a science are not readily changed, it is not easy to deviate from the customary channels of accumulated experience in conventionalized subjects' (Gould and Eldredge 1972). Indeed, a new idea in academia should first of all prove itself to be fitter than its alternatives. This applies to path dependence research as well: the idea that small contingent events in the past may have big indeterminate consequences in the future should perform better than Condercet's influential idea of 'human perfectibility.' Although the number of cases in which path

dependent patterns shape the way institutions evolve is increasing, skepticism about the role of the historical small events has not yet disappeared (see Appendix.) It was to Condorcet's merit, Sydney Pollard argues, 'that in his vision of history as a sequence of types of society, each arises logically and necessarily from the preceding one, and each inevitably carries within itself the seeds of the next one to come. The sequence as a whole, moreover, obeys a logical order and the past stages can therefore be used to forecast' (Pollard 1971: 90). According to this worldview, there is only one pathway of evolution and no place for historical small events. Condorcet wrote thus: 'our hopes for the future of mankind can be reduced to three important points: the destruction of inequality between nations, the progress of equality within nations, and finally the perfecting of man' (Condorcet 1795 quoted by Ginsberg 1953: 19).

In order for a new idea to spread broad and fast, it should survive the 'selective pressures' in the scholarly lives of intellectuals operating against any novelty. In fact, this is quite natural. 'We should adopt a defensive and negative attitude towards every new opinion concerning something on which we have already an opinion of our own' (Schopenhauer (1851) 1970: 124, quoted by McCloskey 1996: 52). This worldview bears a risk, though: habits fossilized in scientific disciplines may become counter-productive over time. So the question is: why do habits fossilize? Or, differently put, why do people choose to be dependent?

Many thinkers oppose the idea that randomness plays a big role in our daily and intellectual lives. They hold the strong belief that behind their success in life lays their skill, strategy, planning. An entrepreneur, according to her or his belief, should, first of all, have 'vision' or a tradesman should be 'talented' and this is the factor that wins them a fortune in the marketplace.

Nassim Nicholas Taleb makes a point to the contrary. Taleb argues that luck and randomness in the business world are disguised as skill and determinism. There is a strong conviction among those doing business in the marketplace that success is only the outcome of utilizing personal skills, such as foresight and leadership. Past events that opened them the path to success would appear to them less random and more determinate. In other words, although they benefited from a 'disproportionate share of luck,' they would attribute their success to some other more precise reason under their own control. History books are thus filled only with success stories of mere reason and determinism, leaving no room for the role that randomness often plays in such stories.

Profitable traders would never think of the possibility that they could be 'lucky fools.' 'The degree of resistance to randomness in one's life,' writes Taleb, 'is an abstract idea, part of its logic counter-intuitive, and, to confuse matters, its realization non-observable' (Taleb 2004: 27). Such people would be disturbed by the idea that stochasticity or contingency might have played roles in their achievement. But if you're so rich, asks Taleb, why ain't you smart?: 'we tend to think that traders were successful *because* they were good. Perhaps we have turned the causality on its head; we consider them good just because they make money. One can make money in the financial markets totally out of randomness' (Taleb 2004: 93).

The irony here is that the opposite is not necessarily true. That is, many would reject that their failure was because of their lack of skill and talent and attribute it rather to some unfortunate random events. His business was sound, his insights intelligent. He had the talent, heading up to higher classes of 'great traders.' Life is unfair, however. And only when life is unfair does non-linearity rule. Only then a small disadvantage can translate into a disproportionate destruction. The straw can only then break the camel's back (Taleb 2004: 172-173).

The present state of doing things - doing economics, reading art history, asking philosophical questions - is basically determined by our commitments in the past - commitments which are not completely in accord with the requirements of the present. The way parents approach issues related to the education of their children, the way professors lecture at universities, and the way graduate students read economic textbooks today are inherited from, if not determined by, their history. The fact that we inherit our habits of behavior from the past is a factor disallowing us to free ourselves from dissatisfactory outcomes in the present; it forces us to do things in the way we are accustomed to doing them. Veblen once said:

Institutions are products of the past process, are adapted to past circumstances, and are therefore never in full accord with the requirements of the present ... At the same time, men's present habits of thought tend to persist indefinitely, except as circumstances enforce a change. These institutions which have thus been handed down, these habits of thought, points of view, mental attitudes and aptitudes, or what not, are therefore themselves a conservative factor. This is the factor of social inertia, psychological inertia, conservatism (Veblen 1889: 190-191).

Social inertia and conservatism do not always help solve the difficulties in our daily

lives. Sometimes change is necessary. If change does not come about when it is needed, it is *us* who do not ask for change. We sometimes just do not have the *will* to change things, although we clearly see that many things can work out for us if we work at them. Why do we not have the will to change things? Why not take another path that would make all the difference - as it does in Robert Frost's famous poem? Why not find a new job? Why not move to another city? Why not read a new book? (Or, why not stop reading at all?) Why not try to see things from another viewpoint? Why not change the constitutive metaphors in our fields of inquiry?

Politics of obedience from an economist's perspective

'What then,' Etienne de la Boétie in his short 1548 essay, *Discourse on Voluntary Servitude*, asked 'if in order to have liberty nothing more is needed than to long for it, *if only a simple act of the will is necessary*, is there any nation in the world that considers a single wish too high a price to pay in order to recover rights which it ought to be ready to redeem at the cost of its blood, rights such that their loss must bring all men of honor to the point of feeling life to be unendurable and death itself a deliverance?' (de la Boétie 1548: 46). The point in his question is important. In fact, the 'willers' have done their best to achieve their purpose. Intellectuals of the *will to perfection*, too, have made every possible move in their lifetimes in order to reach the perfect state of scholarly life. Economists have provided proofs for the existence of a general equilibrium of markets; social engineers have designed fictive societies in which the problem of scarcity doesn't exist; philosophers have hoped that the truth will soon come out as human knowledge accumulates. But most of them have not succeeded - nearly none. Their attempts have failed one after another.

When the objective is to change the order of things, what matters most is the act of will itself. 'From all these indignities,' de la Boétie writes, 'such as the very beasts of the field would not endure, you can deliver yourselves if you try, not by taking action, *but merely by willing to be free*. Resolve to serve no more, and you are at once freed. I do not ask that you place hands upon the tyrant to topple him over, but simply that you support him no longer; then you will behold him, like a great Colossus whose pedestal has been pulled away, fall of his own weight and break in pieces' (de la Boétie 1548: 49).

De la Boétie's concern is to understand how tyrants get the power, and how they maintain it. His attempt is, in fact, to illustrate how 'so many men, so many villages,

so many cities, so many nations, sometimes suffer under a single tyrant who has no other power than the power they give him' (de la Boétie 1548: 42). He concludes that all servitude is voluntary. That is, servitude is the consequence of the will of individuals imprisoning them to tyranny - the individuals who do not have the courage and interest to defeat the power that governs them and drives them to servitude.

The question is therefore the following: why have thinkers chosen voluntary servitude instead of, say, the will to independence? Why is it that, in other words, individuals wittingly accept being tyrannized? Let us ask ourselves: what is it that encourages people to be dependent on a path of evolution that produces underachieving consequences? Why is it that we are locked in a path that yields us undesired results? Is path dependence inevitable? Or, is it *the will of the dependees* that generates servitude to the tyranny of institutions in general? And, in line with de la Boétie, what is there to be done if, in order to have path independence, nothing more is needed than to long for it, *if only a simple act of the will is necessary*?

Below are some possible answers to the questions. One should not proceed with the idea, however, that all the writers mentioned here argue their point so perfectly as to provide an exclusive understanding for the politics of obedience. The ideas presented below are nevertheless illuminating. Research on path dependence should be able to advance answers to the psychology of 'the will to bondage' although such issues call for further investigation. But one should mention them in the hope that they will shed some light on the present confusion.

One possible response to our confusion would be to simply ignore the problem. As a matter of fact, the attitude that 'refusing to notice' is better than 'knowing the problem,' and thus 'acting to solve it,' is very common among the community of scientists. An examination of the personal correspondence between McCloskey and Orley Ashenfelter provides convincing evidence of just how widespread this attitude is. An email sent to McCloskey on October 12, 2004 suggests that the approach of 'refusing to notice' can quickly become a big problem and solving that problem is not easy be easy.

(The email message below is quoted here with the permission of Ashenfelter and with the advice and permission of McCloskey.)

Ashenfelter tells McCloskey that he had long been interested in her *The Secret Sins of Economics* (2002) but not had the time to read it thoroughly. At last now he has fi-

nally read the book and reports this to McCloskey in his message: '[it was] great fun to read, just as I expected, and I think I understand all your points, including the two sins, *which I tend to agree with, by the way.*' (*Italics added.*)

'However,' writes Ashenfelter in the next paragraph of his message:

I don't think (I'm using economic analysis now) that explaining what the problem is will change this. The problem is incentives have also increasingly been quantified, and they are not quantified using significance in either form [he refers to economic and statistical significance which McCloskey mentions in her book as one of the sins]! *After all, the young need to make a living and get ahead, and doing good work* (which is what I would call 'not committing' the sins) *is not rewarded with enough certainty.* (*Italics added.*)

Neglect is sometimes the principle factor that generates path dependence. Neglect is the condition in which actors are indifferent among dissimilar outcomes which may emerge when actors do not behave in a particular way. Neglect is not a consequence of incomplete information or conceptual imprecision or indeterminacy of the conditions in which actors ought to behave. Neglect is the lack of an attitude against a condition where a great degree of compromise may be necessary for an actor to prevent a specific outcome. (Compromise can be giving up personal habits or disobedience against institutional principles and rules.) It sometimes refers to inertia in which actors resist reasons that call for change. Certainly, neglect is not always a vice and it does not at all times give rise to undesirable results within a particular context. But it may lead to conditions in which actors may fail to foresee the positive consequences of their behavior. Neglect of the possibility of cumulative results, each of which feed back upon another, is sometimes one of the most important factors generating path dependence. In other words, when scholars neglect (or simply do not care about) the consequences of not behaving in a particular way, it is not unlikely that intellectual pathologies generate significant consequences over the evolution of the scholarly lives of intellectuals.

Another reason why individuals choose to be dependent is perhaps the 'emulation effect' of the society over individuals. The originator of the term is Thorstein Veblen who argues that failure to consume freely and of the best quality of food, drink, narcotics, and so forth, becomes a 'mark of inferiority and demerit,' and is discredited as 'moral deficiency' or 'elements of indecency' while some manners of life turn into norms of reputability within society. In every society, some jobs are credited as noble and others discredited as ignoble. 'Customary expenditure' provides considerable pe-

cuniary reputability and relative economic success for the leisure class. Emulation is manifested in several ways - and the will to get the attention and admiration of other fellows is just one of its ways. Veblen writes:

In order to stand well in the eyes of the community, it is necessary to come up to a certain, somewhat indefinite, conventional standard of wealth; just as in the earlier predatory stage it is necessary for the barbarian man to come up to the tribe's standard of physical endurance, cunning, and skill at arms. A certain standard of wealth in the one case, and of prowess in the other, is a necessary condition of reputability, and anything in excess of this normal amount is meritorious (Veblen 1889: 30).

Does Veblen's emulation explain the dependence of intellectuals? Yes, to a certain extent, it does, because scientists, philosophers, and artists, too, struggle to attain status within intellectual circles. The psychological motivation of intellectuals provides an explanation for the case because people's will to be like some others somehow grants intellectuals considerable reputability. Instead of exploring a new path of ideas that would perhaps yield *rhetorical satisficing*, scientists, philosophers, and artists keep exploiting the same worn paths - i.e. they choose to stay path dependent - which will surely yield them reputation but 'predatory inefficiency,' too. Predatory inefficiency, for Veblen, is deeply ingrained in our *habits of thought* (Veblen 1889: 29). Coase (1994a: 31) makes a similar point:

'In the long run, [writes Paul Samuelson (1962)] the economic scholar works for the only coin worth having - our own applause.' The professional position of an economist depends on work that could not even be understood by the ordinary person. Samuelson does not owe his reputation to those of his writing that are read by the public but to papers that would be completely incomprehensible to them.

Another evolutionary approach to the puzzle, thirdly, is by the 1978 Nobel Prize winner Herbert Simon. Simon reflects upon altruism and docility in order to advance an evolutionary understanding of the (weak and strong forms of) 'unrequited sacrifice of fitness for the benefit of other organisms' (Simon 1983: 57). He describes the 'kinship model' and 'structured deme' which, he argues, explain why and how societies reward individual behavior that has no relation to the fitness of the individual in the short run. Such behavior is 'selected for' because 'the long term survival of the behavior may be determined by the fact that it contributes to the fitness of the whole society, hence is rewarded by the society' (Simon 1983: 64).

'Docility,' Simon argues, 'may be defined as the propensity to behave in socially approved ways and to refrain from behaving in ways that are disapproved.'

Docility, like any other trait, is presumably developed under the influence of the processes of natural selection. That is, the level of docility will tend to rise if docility contributes positively to individual fitness, and to decline if it damages fitness. Remember though, that docility is a propensity to behave not in specific ways but in ways defined as appropriate by the society. Hence some of the behaviors imposed on the individual this mechanism may increase his fitness; others may decrease it (Simon 1983: 65).

Simon's approach certainly contributes to the resolution of the puzzle. He quite clearly develops a tool to understand why children enjoy a long period of dependence as well as voluntary servitude. It applies to adults, as well. His point is that 'obeying behavior,' which causes the individual to sacrifice fitness in the short run, is 'selected for' by virtue of the compensation that the individual receives in the form of long run rewards. Then, on balance, the individual equalizes the marginal cost of his voluntary servitude or the will to dependence in the short run to the marginal benefit of docility in the long run. Any specific form of behavior is 'fitter,' according to Simon, although social dependence causes immediate sacrifice. His approach suggests that individuals calculate the consequences of their behavior beyond time horizons. Individuals have a capability to look ahead - in contrast to a myopic kind of rationality - that help them see the ways in which they should behave. Individuals choose voluntary servitude because they think they can easily convert short run disadvantages into long run advantages.

His explanation is illuminating in a number of respects. I have sympathy for his approach especially in his statement that 'evolutionary theory is anti-utopian' (Simon 1983: 73). I, however, don't think the consequence of his explanation for the individuals is a happy one. For, as Keynes famously said, in the long run we'll all die. This suggests that path dependence can be interpreted as a dismal metaphor. Perhaps it was Keynes, back in the 1930s, who first recognized the significance of path dependent structures in the economy and society - or so it can be hypothesized.

Last but not least, I will consider Nietzsche's writing on the issue. Path dependence, as has already been emphasized, means that history matters. It is now widely accepted without question among economists, even by the critics of path dependence theory, that institutions matter and historical inquiry is a crucial component of social research. One might have the impression, however, that, in line with Nietzsche, there seems to

be a borderline here - a borderline that demarcates between two different manners of interpreting the phrase 'history matters.'

'The degree of history,' according to Nietzsche, is important for understanding individuals and cultures but '*the unhistorical and the historical are equally essential [In] an excess of history the human being stops once again; without that cover of the unhistorical he would never have started or dared to start*' (Nietzsche 1873b). Individuals are historically committed to past habits and patterns of behavior, but they also have the capacity to will to overcome dependence on the past, the will to forget the burden of the past, and so forth. And this quality is equally essential. 'The unhistorical' is what allowed Johannes Vermeer to paint *The Girl with a Pearl Earring*. It is what allowed Joan of Arc to resist the British and win victory for her country. It is what allows the Palestinians to fight for freedom. True, a painter, and a general, and a people are dependent on the past; the past is what determines their present circumstances. They achieve success, however, only when they cure themselves of taking the past excessively seriously. It is, in other words, their own will that holds them dependent on the past. 'I believe, in fact,' wrote Nietzsche, 'that we are all suffering from a *consumptive historical fever* and at the very least should recognize that we are afflicted with it' (Nietzsche 1873b).

To my view, the line that demarcates between the styles of interpreting the phrase 'history matters' also distinguishes between two different conceptions that I find important for understanding the critical point that the approach of path dependence brings forth. The consequence of the evolution of an institution can be two-fold. In the first case, which we can call *path dependence*, locking in the same old problem could yield undesirable and underachieving results, although (technological or analytic) efficiency at each and every single stage of evolution could have been actualized. The argument for path dependence, however, is not complete if we overshadow the achievements of the past. That is to say, we shouldn't call every kind of institutional evolution path dependent. In the second case, which we can call *past dependence*, becoming dependent upon, or even locking into a particular path of evolution is of no great importance. Path dependence means 'history matters,' but the significance of past dependence would be that arguing for the consciousness of the institutional dependence on the past - just like the institutional economists have kept mainstreamer economists warned - would be nonsense and useless. It would be irrelevant, too, to insist on the significance of historical knowledge in understanding today's institutions. For sometimes history doesn't matter much.

Nietzsche argues that there are different ways of reading history. About what he calls 'antiquarian history' he writes the following lines:

Antiquarian history knows only how to *preserve* life, not how to generate it. Therefore, it always undervalues what is coming into being ... antiquarian history hinders the powerful willing of new things; it cripples the active man, who always, as an active person, will and must set aside reverence to some extent. The fact that something has become old now gives birth to the demand that it must be immortal, for when a man reckons what every such ancient fact, an old custom of his fathers, a religious belief, an inherited political right, has undergone throughout its existence, what sum of reverence and admiration from individuals and generations ever since, then it seems presumptuous or even criminal to replace such an antiquity with something new and to set up in opposition to such a numerous cluster of revered and admired things the single fact of what is coming into being and what is present (Nietzsche 1873b).

Nietzsche in the above quote seems to formulate the conservative reading of history. Antiquarian history praises the traditional, the inherited, and antiquity, whereas it damns any novelty or digression from what has already been established. Antiquarian history calls for continued dependence on the past - despite the possibility of the will to independence. Nietzsche thinks, however, that it is an *abuse of history*. For dependence on past institutions makes sense and is useful if institutions keep producing solutions today. We are using combustion engines and are dependent on petroleum; however, automobiles still allow us to travel long distances. Antiques look good on bookshelves. No problem here, either. In the past, we developed numerous techniques to solve many social and economic problems, and we are now fine with using such techniques even today. We then don't find it problematic to be dependent on the past because we think it can still be useful.

Dependence is not necessarily a bad thing. Humans and institutions, in one way or another, evolve through time in different moral geographies. It is almost inevitable that we belong to - and are thus dependent upon - a past determined by the social and cultural features of a particular geography. The problem, however, is not determined by the past. It is not dependent on it. The problem is that we lock into one particular path of institutional evolution and lose the ability, equipment, and desire to switch to another path when institutions previously constructed by a society do not meet present-day requirements.

William James writes that 'the history is to a great extent that of a certain clash of human temperaments' (James 2000: 8). I completely agree. People believe in friendship and love. People have faith in a better future, so that they struggle for it. People also have faith in perfect beings who they think can care for their loved ones and make things better for everybody, even if there is no conveniently recognized reason for it. Path dependence is not an argument against any of these. The lesson to be drawn from the metaphor and the story that the metaphor plays the key role in is that we should develop new vocabularies and metaphors. We should do this not because we wish to break with the old. We should do this primarily because we *can* do it. It is pragmatically possible and definitely fruitful.

Appendices

Appendix A:

Some top ranking articles in economics

	Article	Number of citations
1	Jansen MC and WH Meckling 1976 'Theory of Firm'	4420
2	Ronald Coase 1960 'The Problem of Social Cost'	2757
3	GA Akerlof 1970 'Markets for Lemons'	1977
4	Alchian and Demsetz 1972 'Production, Information Costs, and Economic Organization'	1975
5	Herbert Simon 1980 'Verbal Reports as Data'	1152
6	Kenneth Arrow 1962 'The Economic Implications of Learning by Doing'	1106
7	Oliver Williamson 1979 'Transaction Cost Economics'	1030
8	Milton Friedman 1968 'Role of Monetary Policy'	920
9	Paul Krugman 1991 'Increasing Returns and Economic Geography'	847
10	Paul David 1985 'Clio and the Economics of QWERTY'	799
11	Brian Arthur 1989 'Competing Technologies, Increasing Returns, and Lock-in by Historical Events'	759

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* Only the works that appear in ISI Web of Knowledge are considered

Appendix B: Total Number of Citations of the Works of Ronald Coase

	TITLE	YEAR OF PUBLICATION	NUMBER OF CITATIONS
1	THE PROBLEM OF SOCIAL COST	1960	2757
2	DURABILITY AND MONOPOLY	1972b	288
3	THE FEDERAL COMMUNICATIONS COM- MISSION	1959	216
4	LIGHTHOUSE IN ECONOMICS	1974b	155
5	THE INSTITUTIONAL STRUCTURE OF PRODUCTION	1992b	141
6	MARKET FOR GOODS AND MARKET FOR IDEAS	1974c	58
7	THE COASE THEOREM AND THE EMPTY CORE - A COMMENT	1981	31
8	THE NEW INSTITUTIONAL ECONOMICS	1998b	30
9	SMITH, A VIEW OF MAN	1976	28
10	THEORY OF PUBLIC UTILITY PRICING AND ITS APPLICATION	1970	28
11	THE 1987 MCCORKLE LECTURE - BLACK- MAIL	1988a	27
12	ADVERTISING AND FREE SPEECH	1977a	27
13	THE ACQUISITION OF FISHER BODY BY GENERAL MOTORS	2000	25
14	LAW AND ECONOMICS AT CHICAGO	1993a	16
15	PAYOLA IN RADIO AND TELEVISION BROADCASTING	1979	16
16	ECONOMICS AND CONTIGUOUS DISCI- PLINES	1978	18

17	LAW AND ECONOMICS AND A. W. BRIAN SIMPSON	1996	15
18	CHOICE OF INSTITUTIONAL FRAME- WORK - COMMENT	1974a	13
19	ECONOMICS OF BROADCASTING AND GOVERNMENT POLICY	1966	12
20	COASE ON POSNER ON COASE	1983	8
21	EVALUATION OF PUBLIC-POLICY RELAT- ING TO RADIO & TV	1965	7
22	THE INTERDEPARTMENT RADIO ADVI- SORY-COMMITTEE	1962	7
23	APPOINTMENT OF PIGOU AS MAR- SHALLS SUCCESSOR	1972a	6
24	COMMENT ON THOMAS W. HAZLETT	1998a	5
25	ACCOUNTING AND THE THEORY OF THE FIRM	1990	5
26	MARSHALL ON METHOD	1975	5
27	THE BRITISH POST-OFFICE AND THE MESSENGER COMPANIES	1961	5
28	MARSHALL, ALFRED MOTHER AND FA- THER	1984	3
29	SYMPOSIUM ON THE NEW INSTITU- TIONAL ECONOMICS	1993b	2
30	CONTRACTS AND THE ACTIVITIES OF FIRMS	1991	2
31	WEALTH OF NATIONS	1977b	2
32	THE CONDUCT OF ECONOMICS	2006	1
33	THE REGULATED INDUSTRIES - DISCUS- SION	1964	1
TOTAL			3960

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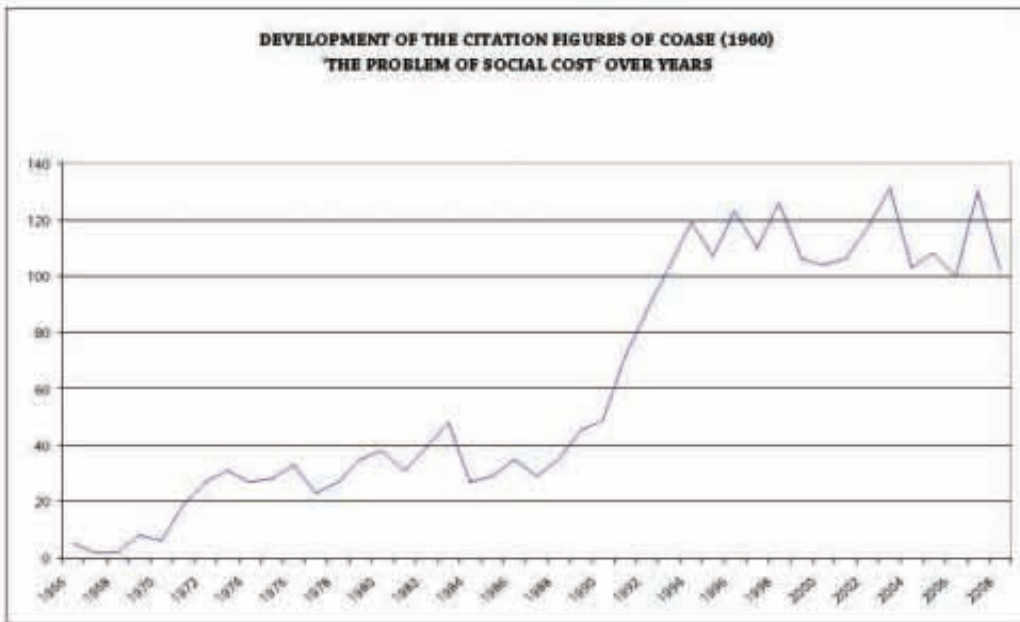
* Only the works that appear in ISI Web of Knowledge are considered

* No data is available on Coase's 'The Nature of the Firm' (1937) as ISI Web of Knowledge reports publications after 1940s only

* The table does not include all the publications of Coase but only those which have been cited at least once

Appendix C: Coase (1960) ‘The Problem of Social Cost’

	PUBLICATION YEAR	RECORD COUNT		PUBLICATION YEAR	RECORD COUNT
1	1966	5	23	1988	35
2	1967	2	24	1989	45
3	1968	2	25	1990	49
4	1969	8	26	1991	71
5	1970	6	27	1992	88
6	1971	19	28	1993	103
7	1972	27	29	1994	119
8	1973	31	30	1995	107
9	1974	27	31	1996	123
10	1975	28	32	1997	110
11	1976	33	33	1998	126
12	1977	23	34	1999	106
13	1978	27	35	2000	104
14	1979	35	36	2001	106
15	1980	38	37	2002	117
16	1981	31	38	2003	131
17	1982	39	39	2004	103
18	1983	48	40	2005	108
19	1984	27	41	2006	100
20	1985	29	42	2007	130
21	1986	35	43	2008	102
22	1987	29			



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