MURAT TARAKCI

Behavioral Strategy

Strategic Consensus, Power and Networks

BEHAVIORAL STRATEGY:

STRATEGIC CONSENSUS, POWER AND NETWORKS

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STRATEGIC CONSENSUS, POWER AND NETWORKS

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Chapter 1

A PRELUDE TO BEHAVIORAL STRATEGY

Why do some firms perform better than others? This question remains to be the most fundamental question of strategic management (Nelson, 1991). Among the common answers provided by various strategic management theories are the market factors and market power, resource advantages, institutional setting, and innovation and entrepreneurial practices (Powell *et al.*, 2011). These theories furthermore emphasize efficient market equilibrium states with rational agents (Gavetti, 2012). As Lenvinthal (2011: 1521) rightly states "[b]usiness strategy is not a 'tic-tac-toe' environment in which explicit optimum of the real strategic context can be derived". Rather, decision makers with all their flesh and blood see the world through their respective cognitive lenses and interact with powerful others together embedded in a network of relationships. With the help of concerted use of several methods and theoretical lenses, this dissertation contributes to strategic management by illuminating research on managerial and organizational cognition, intra-organizational power, and interfirm networks from the perspective of behavioral strategy.

Firms in search of the best strategic alternatives and thus improved performance are only boundedly rational in their decisions (Tversky and Kahneman, 1981), are steered by emotions (Huy, 2012), aspirations (Baum *et al.*, 2005), power differences (Eisenhardt and Zbaracki, 1992) and cognitive frames (Reger and Huff, 1993) when making sense of their business environment (Weick, 1995a). Germane to this view, behavioral strategy, a bourgeoning area of research, calls strategy scholars for deepening our understanding of firms by connecting micro-processes such as cognition and behavior with strategic outcomes (Huy, 2012; Powell *et al.*, 2011). Powell, Lovallo and Fox (2011) have recently defined behavioral strategy as follows:

> "Behavioral strategy merges cognitive and social psychology with strategic management theory and practice. Behavioral strategy aims to bring realistic assumptions about human cognition, emotions, and social behavior to the strategic management of organizations and, thereby, to enrich strategy theory, empirical research, and real-world practice." (Powell *et al.*, 2011: 1371)

The ultimate purpose of behavioral strategy research, as indicated in the definition, is to build more integrative theories which better capture *why* some organizational phenomena occur (Sutton and Staw, 1995). Behavioral strategy can provide insightful explanations to important research questions pertaining to strategic management by using more realistic assumptions grounded on cognition, behavioral decision theory, psychology and organizational behavior. Consequently, it can advance the strategic management field forward. In that regard, this dissertation underscores the role of the behavioral perspective in strategic management research as well as in managerial practice, and attempts to refine canonical conclusions and theories along behavioral lines. Furthermore, it also contributes to behavioral strategy research by proposing tools and conceptualizations that can be readily utilized by scholars and practitioners.

Each study in the dissertation separately deals with one or more core research problems of behavioral strategy, which are summarized by Powell *et al.* (2011). First research problem highlights the need to link individual cognition with group and organizational behavior and outcomes. Any well formulated strategy can be cashed in as improved performance only when implemented successfully. It is the teams, employees and managers with various cognitive understandings of and preferences toward the strategy whose effort is needed to execute the strategy. Therefore, behavioral strategy calls for further research into understanding of strategic cognition in individual, team and between-teams levels, and cognitive processes that translate the cognition into strategic action. In this dissertation I respond to this research problem by proposing a method that enables scholars and practitioners to assess cognition simultaneously in different units of analysis, delineate its dimensions, and test longitudinal and cross-sectional differences in cognition.

Second core research problem of behavioral strategy calls for uncovering psychological foundations of strategic management. These micro-foundations allow behavioral strategy research to reformulate existing theories in strategic management along the behavioral lines. As discussed earlier, an equilibrium mindset with rational and atomic agents has dominated the field. Although this perspective has been criticized by behavioral theorists (e.g., Gavetti, 2012; Levinthal, 2011; Powell *et al.*, 2011), behavioral refinements of strategic management theories are yet to come. Such an endeavor has the prospect of marrying grounded theory with strategy practice as well (Powell *et al.*, 2011). In that regard, in this dissertation I illuminate social psychological underpinnings of strategic consensus formation among members of organizational groups, and network partner selection in interfirm networks.

A deeper understanding of complex strategic decisions constitutes the third core research problem of behavioral strategy. Firms' Top Management Teams (TMT) try to maximize their organizations' profits which requires finding the optimal solution to the multidimensional problem of, for example, determining the amount of R&D spending, the degree of penetration to new markets, the allocation of budget to marketing activities, etc. Each TMT member has his/her own understanding and preference of what the best solution might be. In addition to being boundedly rational, these individual cognitive frames influence the strategic decisions while social psychological mechanisms such as conflict and battles for power take place at the same time (Eisenhardt and Bourgeois, 1988; Eisenhardt and Zbaracki, 1992; Finkelstein, 1992). Behavioral strategy can provide necessary theoretical lenses and methodological tools to investigate executives' strategic decision-making process and associate it with organizational outcomes. For this purpose, the present dissertation offers a novel conceptualization of power and power differences followed by a characterization and modeling of strategic decision-making.

Fourth, behavioral strategy needs to provide prescriptive advice to carry out managerial practices and redesign the organizational elements to ensure effective strategic decision-making. Findings of behavioral strategy research can offer necessary tools to dig into the minds of the strategists and extract individual and team cognition, and shed light on the processes and mechanisms that facilitate or hamper group functioning. Consequently, organizations which apply these findings in practice may benefit superior organizational outcomes. Similarly, findings of the present dissertation help practitioners to assess cognition more comprehensively, guide designing strategic interventions seeking to increase strategic consensus throughout the organization more efficiently, recommend how to distribute power within organizational groups and how to select and arrange relationships with network partners.

This PhD dissertation advances strategic management by addressing all four core research questions of behavioral strategy that are identified by Powell *et al.* (2011). It contributes also to behavioral strategy research by providing novel methods, conceptualizations and models for cognition, power, strategic decision-making and networks. To do so, I employed a multitude of research methods ranging from organizational surveys to agent-based simulations, and utilized several theoretical lenses mainly from cognitive and social psychology. By using a behavioral lens, my objective is to provide a fine-tuned analysis of strategic consensus, intra-organizational power, and interfirm networks within the strategic management context. More specifically, this dissertation provides a new method to assess, visualize and link individual cognition to team and between-teams level with a strong emphasis on what cognition is consisted of, who attends to and what the extent of the sharedness is; investigates micro-processes such as power differences and psychological safety that produce shared cognition in relation to within-group; provides a novel model of strategic decision-making with respect to within-group power differences; and introduces a new behavioral construct that reformulates existing network theories along behavioral lines.

I take off on my quest in behavioral strategy by proposing a state-of-art method to comprehensively study employees' cognitive understanding of organizational goals. The method which is presented in Chapter 2 allowed me to have a multidimensional and multilevel view on strategic consensus which led in Chapter 3 to the study of investigating consensus formation in relation to power differences and psychological safety within organizational groupsChapter 4 employed a novel agent-based simulations technique to find out whether groups with high or low power differences perform better. Chapter 5 refines research in interfirm networks along a behavioral line. Last but not least, Chapter 6 concludes with future directions ahead of research on behavioral strategy.

Before going into the details of each study, in the following section, I present a brief summary of each chapter in this dissertation with an emphasis on theoretical and practical contributions.

Probing into the Minds' of Employees and Teams

The cognitive school of strategic management (Mintzberg *et al.*, 2009) states that strategy formulation and implementation takes place in the hearts and minds of the organizational members. Each individual in the organization possesses an opinion on the strategy —in the form of preferences, mental models, schemas, and cognitive frames. These individual cognitive forms enable individuals to make sense of their environment and generate action (Kellermanns *et al.*, 2008). One implication of the cognitive perspective is that employees will exert effort on executing the organizational strategy as long as their cognition is aligned with the strategy. This perspective also highlights the importance of shared cognition within a team. In the light of shared mental model theory (Mathieu *et al.*, 2008), it is argued that individuals' formation of shared understanding of the organizational goals, i.e. strategic consensus, facilitates communication (Kellermanns *et al.*, 2008) and coordination of actions and creation of synergies (Cannon-Bowers *et al.*, 1993) within a group. Furthermore, consensus between groups around the organizational strategy lowers the pursuit of subunit goals over organizational objectives through multilevel alignment between groups (Ketokivi and Castañer, 2004). Higher strategic consensus is argued to improve strategy implementation (Noble, 1999; Rapert *et al.*, 2002), and to be associated positively with group and organizational performance (Kellermanns *et al.*, 2011; Mathieu *et al.*, 2008).

In their review of cognitive school of strategic management Mintzberg, Ahlstrand, and Lampel (2009: 182) posit that "this school is characterized more by its potential than by its contributions. The central idea is valid … but strategic management has yet to gain sufficiently from cognitive psychology." We contend that the reason for strategic management not realizing the full potential of cognitive school is the lack of available methodological tools and guidelines. The main challenge is to elicit employees' view on the strategy and aggregate it to team and between team levels where scholars and practitioners can visualize and quantify cognition within and between groups while capturing also the variations in the degree and more specific content of it.

Chapter 2 proposes a set of complementary techniques titled as 'strategic consensus mapping' that is able to quantify, test and visualize multiple facets of strategic cognition (strategic consensus in particular) in a novel and systematic manner. Thereby, this study directly addresses behavioral strategy's first and fourth core research questions that emphasize a comprehensive investigation of cognition and managerial relevance, respectively. This study recognizes the role of individual cognition in strategic management and provides a solution to the aggregation problem of linking individual cognition with team cognition and overall alignment across teams towards the organization's strategy. The methods are complemented with a set of easy to grasp and intuitive visualizations of within- and between-groups understanding of shared cognition. The method is easy to absorb and easy to implement by academics as well as practitioners of strategic management. Furthermore, the methods have the ability to test longitudinal changes in cognition which is particularly relevant and important, because strategic interventions deliberately aimed at enhancing consensus are widely practiced in business yet seldom if ever quantitatively evaluated for their effectiveness (Hodgkinson *et al.*, 2006; Hodgkinson and Healey, 2008b).

Strategic consensus mapping opened a window for a finer grained assessment of strategic consensus. Chapter 3 seizes this opportunity to shed light on consensus formation process in relation to within team power differences and psychological safety.

Psychological Underpinnings of Consensus Formation Process

Despite the common positive perception of strategic consensus, i.e., the shared cognition over organizational goals, on team and organizational outcomes (Kellermanns *et al.*, 2005; Kellermanns *et al.*, 2011), equivocal findings in the literature exist. To illustrate, while some researchers found a positive relationship between strategic consensus and performance (e.g., Bourgeois, 1980; Homburg *et al.*, 1999; Knight *et al.*, 1999; Rapert *et al.*, 2002), others provided evidence in the opposite direction (e.g., Bourgeois III, 1985; West and Meyer, 1998), yet again some others did not find any relationship at all (e.g., West Jr and Schwenk, 1996; Wooldridge and Floyd, 1990).

These conflicting findings induced us to develop more into the strategic consensus formation process. As in every social setting (Anderson *et al.*, 2008), power differences emerge inevitably within organizational teams. Indeed, the power school of strategic management (Mintzberg *et al.*, 2009) identifies organizations and strategy making practice as the realm of power battles (Eisenhardt and Zbaracki, 1992). Amid power battles, employees' preferences and understanding of the strategy is constantly forged by the powerful. In addition, the work environment and culture on how to cope with power differences determine employees' reaction on power holders' influence attempts. An investigation of consensus formation with respect to power differences and psychological safety requires integrating the research in social psychology, group processes and shared mental models in line with the second core research question of behavioral strategy which underline psychological foundations and micro-processes. Chapter 3 draws attention to the hitherto neglected question of strategic consensus formation. I identify power disparity and psychological safety within a team as antecedents of strategic consensus, and focus on the lower and middle level organizational teams. Results from 143 teams in two separate organizations showed that higher power disparity is associated with lower strategic consensus within a team. As a result of interplay between psychological safety and power disparity, the findings also revealed that high consensus may emerge through imposition of the powerful team member where others do not feel psychologically safe to speak up, or through discussion of equally powerful team members in a psychologically safe team environment. I further discuss that these two high consensus conditions are likely to lead to discrepant team outcomes explaining the earlier conflicting findings in strategic consensus research.

This study emphasizes how power differences lead to higher or lower levels of strategic consensus. Then, a fundamental question arises: How should power be distributed? Next study answers this question of optimal power distribution within strategic decision-making context.

Power Differences in Strategic Decision-making

Existing power differences within organizations determine the strategic directions of organizations (Eisenhardt and Zbaracki, 1992; Finkelstein, 1992). Several researchers have demonstrated that power distribution affects organizational change and adaptation (Hannan and Freeman, 1977), causes the battles of strategic choice (Eisenhardt and Zbaracki, 1992), influences information flows and political behavior (Eisenhardt and Bourgeois, 1988), and impacts knowledge absorption processes (Todorova and Durisin, 2007) and organizational learning (Lawrence *et al.*, 2005). Despite the consensus on the importance of power in organizations (Morrison, 2010), it is often contested whether steep power differences are beneficial or not. Indeed, research on power is divided between two main research camps (i.e., functionalist and conflict theories of power) which report completely opposing findings.

In Chapter 4, I attempt to resolve the tension between functionalist and conflict theories of power by highlighting whether power is assigned with respect to past performance or not. Additionally, I propose a multidimensional conceptualization of power such that power is defined simultaneously as a relational capacity, behaviors emanating from this capacity, and exercise of power in the form of influence. The study goes beyond the formal organizational design perspective where power is confined to formal and stable hierarchies, and allows for informal power structures and evolutionary dynamics. Through agent-based simulations, the results suggest that the choice between power structures with low, high, and moderate power disparity depends on whether power is assigned endogenously with respect to individuals' past performance or not.

Do teams with steep power differences outperform the teams where power is evenly distributed? Chapter 4 responds to this grand question within the strategic decision-making context. I model the strategic search by integrating social psychology, social impact theory and strategic decision-making "to produce a social psychology of behavioral strategy" with respect to power differences (Powell *et al.*, 2011: 1376). Thereby, I address to behavioral strategy's third core research problem which underscores behavioral understanding of strategic decision-making.

Behavioral Reformulation of Network Embeddedness Theory

Having a finer-grained understanding of organizational behavior, behavioral strategy ultimately targets generating integrative theories (Powell *et al.*, 2011: 1371). This objective implies revisting existing theories and enriching them using a behavioral lens. Accordingly, the last study of my dissertation revisits embeddedness theory —a leading theory in inter-organizational network research (Kilduff and Brass, 2010) — and refines its predictions by discerning behaviors of organizations in selecting network partners.

Firms are interconnected within a social structure of ongoing relationships which facilitates, govern or hamper their economic exchanges. Which partners to select from the set of available candidates is, therefore, an important decision because the new partner influences the resources to be accessed, quality signaled to outside, and success of the firm (Jensen and Roy, 2008; Uzzi, 1996). Majority of studies in network partner selection describe and defend a purely rational firm which chooses its network partners only if the prospective partner possesses complementary resources (Eisenhardt and Schoonhoven, 1996; Gulati and Gargiulo, 1999; Podolny, 2001), reduces uncertainty (Beckman *et al.*, 2004), proposes performance aspirations (Baum *et al.*, 2005) or allows signaling higher quality to the others (Podolny, 2001).

Yet, according to behavioral theory of the firm, firms are not pure profit maximizers (Powell *et al.*, 2011); instead, they are "intendedly rational but imperfectly so" (Gavetti, 2012; Lawler, 2001: 324). Indeed, emotions, sentiment, and intrinsic attraction in social exchange between network partners are also prevalent in affecting firms' decisions (Blau, 1964; Homans, 1961; Lawler and Yoon, 1998; Lawler, 2001). This chapter looks at partner selection decision using behavioral decision theory and revisits the popular conclusion of embeddedness theory which recommends firms to balance embedded and arm's length ties. This study, hence, addresses second and third core research problems of behavioral strategy which calls for revealing psychological underpinnings of strategic management theories and of strategic decision-making.

Chapter 5 extends the structuralist view of networks by considering firms' behavioral characteristics. It introduces a new behavioral construct, network orientation, defining it as the motives for choosing network partners, and conceptualizes it as a stable behavioral characteristic of firms. Using the behavioral lens of network orientation, I revisit a strategy recommendation from network embeddedness theory: that firms cultivate a mix of arm's-length and embedded relationships within their network structure. Survey data on firm-bank lending relationships collected from 4240 U.S. firms with fewer than 500 employees validate this recommendation, but only for firms that chose their partners based on transactional motives. In contrast, such a mix of ties was detrimental to firms that selected their partners with relational motives. I also documented that these relationally motivated firms accrued lower opportunity costs from their network relationships than did firms with transactional motives.

In conclusion, this dissertation addresses and sheds light on core research questions of behavioral strategy, which underscore cognition in individual and aggregate levels, a deeper understanding of strategic decision-making, behavioral foundations of strategic management theories, and managerial impact of behavioral strategy. Four studies laid out in the present dissertation offer unique theoretical and managerial insights on cognition, power and networks. Yet this dissertation is neither the final destination for behavioral strategy nor panacea for all of its core research problems. There is a rather long, yet highly promising road ahead for behavioral strategy. After I present details of each study in the following chapters, I elaborate further on the future research directions for behavioral strategy.

Chapter 2

TESTING AND VISUALIZING STRATEGIC CONSENSUS WITHIN AND BETWEEN TEAMS

Introduction

Strategic consensus, which refers to 'the shared understanding of strategic priorities among managers at the top, middle, and/or operating levels of the organization' (Kellermanns *et al.*, 2005: 721), has been recognized as an important concept in the literature pertaining to strategy formation and implementation processes (Finkelstein and Hambrick, 1996; Markoczy, 2001) and continues to attract attention from scholars seeking to develop a deeper understanding of the concept (Gonzalez-Benito *et al.*, 2012). Several scholars have suggested the need for a multidimensional investigation of consensus (Hodgkinson and Johnson, 1994; Kellermanns *et al.*, 2005; Markoczy, 2001; Wooldridge and Floyd, 1989). These authors note that in addition to determining the degree of consensus, it is important to determine the strategic objectives on which individuals agree and identify which individuals within a team are in agreement or disagreement with respect to these objectives. The authors also highlight the importance of studying the consensus between interdependent organizational units in addition to examining within-group consensus. However, the dominant focus in strategic consensus research is the degree of within-group consensus (Gonzalez-Benito *et al.*, 2012; Kellermanns *et al.*, 2005; Kellermanns *et al.*, 2008), and the research therefore addresses only a subset of the issues related to strategic consensus.

We contend that the dearth of appropriate methods for capturing the multiple dimensions of strategic consensus at various levels and time periods is an obstacle to comprehensive analysis and integrative theory building. To address this important issue, the current study presents *Strategic Consensus Mapping* (SCM), a set of complementary procedures for probing multiple dimensions of strategic consensus and testing the cross-sectional and longitudinal differences within and between groups. SCM can be used to visualize and quantify consensus within and between groups while capturing the specific content of this consensus and variations in the degree of consensus. In addition, SCM can enable researchers to assess whether observed longitudinal and cross-sectional differences in consensus are statistically significant. We illustrate the features of our method in a field study, which we also use to test whether observed changes in consensus in a top management team following a strategic intervention are statistically significant. The ability to test such changes in consensus is particularly important not only from the perspective of theory development but also because strategic interventions aimed at enhancing consensus are widely practiced in business but are seldom (if ever) quantitatively evaluated for their effectiveness (Hodgkinson *et al.*, 2006; Hodgkinson and Healey, 2008b).

Thus, the contribution of the current study is threefold. First, SCM offers researchers the opportunity to study strategic consensus in an integrative manner that (i) allows for the quantification of multiple dimensions of consensus, (ii) enables the analysis of consensus at different levels, and (iii) visualizes consensus in an intuitive and clear fashion. Second, SCM answers the calls within the consensus literature for techniques that can facilitate the analysis of consensus between groups (Kellermanns *et al.*, 2005). Third, SCM allows researchers to test the significance of differences in consensus both over time and in cross-sections of groups, thus responding to the call in the literature for appropriate measurement systems to determine the effectiveness of strategic interventions (Hodgkinson *et al.*, 2006; Hodgkinson and Healey, 2008b).

In managerial and organizational cognition research, several scholars have also suggested that the available tools for investigating cognition must be refined to facilitate deeper analysis, which requires rigorous scientific scrutiny (Hodgkinson, 2002; Kaplan, 2011; Walsh, 1995). For instance, Mohammed and colleagues (2000: 128) argue that 'confusion over how to measure group-level cognitive structures has hindered empirical work on team mental models.' Therefore, SCM not only has the potential to uniquely advance the theory regarding strategic consensus but has the ability to contribute to the broader field of managerial and organizational cognition.

Understanding Consensus as a Multi-Faceted Concept

As Floyd and Wooldridge (1992: 27) propose, 'successful [strategy] execution means managers acting on a common set of strategic priorities,' which requires a consensus regarding those priorities. A higher *degree* of strategic consensus[1] within a group may facilitate the communication and coordination of action (Kellermanns *et al.*, 2008), create synergies (Cannon-Bowers *et al.*, 1993), and improve group and organizational performance (Kellermanns *et al.*, 2011; Mathieu *et al.*, 2008). Although it has been noted that high levels of consensus may hamper certain processes, such as change and innovation (Priem, 1990), the issue under consideration in this study is not whether or when strategic consensus has positive effects but how strategic consensus can be comprehensively studied in a manner that enables integrative theory building while generating helpful implications for managerial practice. Nevertheless, we anticipate that the study of the consequences of strategic consensus would benefit from a more integrative approach to strategic consensus.

The degree of within-group consensus has been the most frequently investigated facet of strategic consensus (Kellermanns *et al.*, 2005; 2011; Markoczy, 2001). Although we would not dispute the importance of these research efforts, we contend that focusing solely on the degree of consensus within groups does not suffice for integrative theory building. For instance, given that organizations can be characterized as networks of interdependent groups (e.g., Kramer, 1991), an exclusive research focus on the degree of within-group consensus may produce biased results when two teams display similar levels of consensus with regard to different content. Therefore, within-group consensus cannot be assumed to be an acceptable proxy for between-group consensus without reference to the content of the consensus. In

[1] Although the focus of this paper was on strategic consensus, different forms of shared cognition in the strategy and organization theory literature are also mentioned: Team/task shared mental models, strategic consensus, shared vision, goal congruence, shared task representations, etc. The methodology proposed in this paper, however, can easily be applied to those variations of shared cognition provided that the data are collected in a similar vein to ours. Similar to consensus, such an application can provide a comprehensive multidimensional understanding of these various forms.

fact, the degree of consensus within a group, what the consensus concerns (i.e., the content of the consensus), where it is located within the organization (i.e., the locus of the consensus), and who and how many people participate in it (i.e., the scope of the consensus) should *all* be determinants of a comprehensive strategic consensus theory.

The *content* of consensus is the strategic priorities on which people actually agree. An organization whose aim is to increase consensus regarding a new strategic direction will not be satisfied if a high degree of consensus is achieved regarding a different strategic direction. Similarly, a scholar who fails to discern differences in the content of strategic consensus may confront the risk of drawing misguided conclusions. The *locus* of consensus is where the consensus is located within an organization and which members/groups are involved in this consensus. Consensus concerning strategic priorities may also develop among members of other groups outside of the top management team (TMT) to form coalitions to advocate their common interests (Eisenhardt and Bourgeois, 1988). A consensus that is confined to a TMT may have markedly different effects than a consensus that includes other organizational actors. Thus, practitioners and researchers alike may benefit from knowing where the locus of consensus is or whether multiple loci exist within an organization if they seek to identify the organization's dominant coalition (Hickson *et al*., 1971) and logic (Prahalad and Bettis, 1986). The *scope* of consensus, which refers to the number of people who have developed this shared understanding, is significant because building consensus and commitment among a wide range of organizational members can improve strategy implementation (Wooldridge and Floyd, 1989). The scope of consensus involves more than the total number of organizational members who are in agreement. The scope also indicates who is aligned with the dominant logic and shows which actors can be positioned as change agents in the communication of organizational strategy beyond the reach of the TMT.

In addition, it is important to determine the extent to which different organizational units agree on strategic priorities because strong alignment between groups is needed to achieve organizational objectives (Kellermanns *et al*., 2005). For instance, Ketokivi and Castañer (2004) show that shared understanding throughout different levels of an organization eliminates the pursuit of subunit goals over organizational objectives. Therefore, because strategy implementation is not limited to any organizational group, it is important to study strategic consensus at multiple levels of analysis —not only within organizational groups but also between groups and for the organization at large.

One implied component of this analysis of differences in consensus is the value of detecting changes in consensus over time, for instance, to evaluate the effectiveness of an intervention that is used to foster strategic consensus. This analysis requires the testing of (longitudinal) differences in consensus within and between groups. A longitudinal assessment of consensus can also reveal when strategy implementation benefits most from strategic consensus (Kilduff *et al.*, 2000) and can provide further insight into the mechanisms of the consensus formation process (Markoczy, 2001).

Because of these theoretical and managerial benefits of a multidimensional, multilevel, and longitudinal understanding of consensus, several scholars have called for a comprehensive assessment of consensus along the lines that we discuss here (e.g., Hodgkinson and Johnson, 1994; Kellermanns *et al.*, 2005; Markoczy, 2001; Wooldridge and Floyd, 1989). However, no empirical research has sufficiently answered this call; we suspect that this lack largely exists because of a lack of methodological tools for this type of integrative approach to strategic consensus. This lack of an integrative method hinders the accumulation of findings across studies (Kellermanns *et al.*, 2011; Resick *et al.*, 2010) and the development of overarching theories (cf. Kellermanns *et al.*, 2005; Mohammed *et al.*, 2000; 2010).

Thus, further theory development in strategic consensus could clearly benefit substantially from a comprehensive method such as SCM because SCM allows researchers to assess the multifaceted, multilevel, and longitudinal aspects of strategic consensus in a comprehensive manner. First, SCM scales individual understandings of strategy to group- and between-group levels. Second, SCM captures within-group similarities and differences in strategic understanding both by identifying where consensus exists and by indicating its content. Following this process, a multilevel mapping of the locus and scope of strategic consensus can be generated. Third, SCM achieves multilevel, multidimensional, and longitudinal integration using a complementary set of methods based on the same raw data, such that the output of one method serves as an input for another method. Therefore, the distinction between within- and between-group consensus is not confounded by differences in measurement.

By combining different dimensions and levels of consensus using coherent methods, SCM bridges the gap between individual cognition and collective behavior at group levels and between-group levels (Powell *et al.*, 2011). Researchers can thereby gain the unique opportunity to explain which mechanisms form consensus, when this consensus occurs and why certain behaviors and outcomes arise at individual and collective levels (Powell *et al.*, 2011). Finally, this type of fine-grained analysis of strategic consensus within and between groups can also enable more focused and targeted strategic interventions that increase consensus and facilitate the strategic alignment of organizational units. In the following section, we compare SCM with current methods that are used not only in strategic consensus research but also in the broader area of managerial and organizational cognition. In contrast with SCM, the current methods enable the examination of only certain facets of consensus; such methods cannot provide the broader range of information that is required to build a more comprehensive theory of consensus.

Strategic Cognition Research

Both in research on strategic consensus and within the larger body of managerial and organizational cognition research in which consensus is rooted, scholars have developed a variety of techniques to study consensus and various types of cognitive structures at the individual, team, organizational, and industry levels of analysis. Most of these measures have been developed to apply to a certain theoretical frame or context, and they offer valuable insights in that respect. We reviewed the broader body of work on managerial and organizational cognition to assess the extent to which various methods can be applied to the strategic consensus realm for a comprehensive assessment of consensus. This review is important because it allowed us to build on and position our study within the larger managerial and organizational cognition domain. As we outline below, our overview supports our conclusion that prior studies do not offer a method that simultaneously captures the content and structure of consensus across multiple levels of analysis.

We focused our selection on methods that are mentioned in review articles by Hodgkinson and Healey (2008a), Mohammed and colleagues (2000), and Walsh (1995). We also considered more recent articles that refer to these methods. We sought methods that were able to capture multilevel, multidimensional and/or longitudinal analysis of cognition and selected a representative article for each method that examined some form of shared cognition at a particular collective level. We assessed each method's potential to be developed into extensions to multiple levels and dimensions (i.e., we did not limit our review to the current uses of the methods but considered their potential for broader applications). In Table 1, we present a summary of this assessment.

Table 1: Comparison of methods in managerial and organizational cognition research.

Example	**Methods**			**Dimensions**				**Analysis Level**				**Longitudinal**	**Significance testing**	**Joint-space representation**
	Elicitation	*Measurement*	*Analysis*	Degree	Content	Locus	Scope	Individual	Group	Organization	Industry			
Team mental models														
Edwards *et al.* (2006)	Pairwise similarity ratings	Closeness (C) index	Pathfinder	✓				✓	✓			✓		
Mathieu *et al.* (2000)	Pairwise similarity ratings	QAP correlations	Ucinet	✓				✓	✓			✓		
Work unit similarities														
Blackburn and Cumming (1982)	Pairwise similarity ratings	Mean similarity ratings	MDS	✓	✓				✓					
Belief structures														
Walsh *et al.* (1988)	Card sorting	Average squared Euclidean distance	MDS	✓	✓†				✓					
Competitor cognition														
Hodgkinson (1997; 2005)	Repertory grid	Euclidean distances	MDS	✓	✓					✓	✓	✓	✓	
Daniels *et al.* (1995; 2002)	Card-sorting, repertory grid, rating of maps' similarity	Mean/standard deviation of similarity ratings	Hierarchical cluster analysis, PCA	✓	✓					✓	✓		✓	
Strategic groups														
DeSarbo *et al.* (2009)	Financial measures		MDS	✓†	✓						✓	✓	✓	✓
Causal maps														
Carley (1997)	Open-ended questions	Sum of overlapping concepts	Text-based causal mapping	✓	✓	✓	✓	✓	✓			✓		
Markoczy (2001), Clarkson and Hodgkinson (2005)	Pairwise comparisons, causal maps	Average/standard deviation of pairwise distances	Interactive causal mapping	✓	✓	✓	✓	✓	✓			✓	✓	
Strategic consensus														
Bowman and Ambrosini (1997)	Rating	Standard deviation	PCA	✓	✓			✓	✓					
Strategic Consensus Mapping	Ranking/ rating	α (within group), r (between group)	PCA, MDS, permutation testing	✓	✓	✓	✓	✓	✓	✓	✓†	✓	✓	✓

† The method is compatible for such extensions in multiple levels and dimensions although it is not presented in the related study.

This table indicates whether a method is multidimensional with respect to its ability to simultaneously capture the degree, content, locus, and scope of cognition. The table also shows whether a method allows for analysis at multiple levels to indicate its ability to link individual-level cognition with cognition at the group, between-group, and/or (inter-

)organizational levels. A method enables longitudinal analysis when it can detect changes in cognition over time, and significance testing when it allows statistically testing both longitudinal changes and cross-sectional differences in cognition. In addition to its ability to test cross-sectional and longitudinal differences, a method's depth of visual representation is also assessed in the table. Finally, a method allows for joint space representation when it can visualize individual and collective cognition together with the content of cognition and offers a more thorough, content-based understanding of consensus among group members.

Table 1 depicts the rich diversity in managerial and organizational cognition research in terms of the subject of cognition, including competitors (e.g., Daniels *et al.*, 1995), strategic priorities (e.g., Bowman and Ambrosini, 1997), and team mental models (e.g., Mathieu *et al.*, 2000). A similar diversity is also observed in the unit of analysis chosen, which range from individuals, groups, or organizations to entire industries. For example, one stream of cognition research focuses on managerial perceptions of similarities and differences among competing firms in an industry to identify strategic groups (e.g., DeSarbo *et al.*, 2009), whereas another research stream investigates individuals' collective cognition of team-related factors and processes as an antecedent of team effectiveness (e.g., Edwards *et al.*, 2006; Mathieu *et al.*, 2000).

To capture different types of cognitive beliefs and structures, researchers have successfully employed a variety of quantitative and qualitative methods to elicit, measure, and compare the cognitive frames of managers, groups, and organizations. For example, principal component analysis (PCA) and hierarchical cluster analysis have been used to quantitatively analyze managers' understanding of their competitive environments (e.g., Daniels *et al.*, 1995; 2002), and multidimensional scaling (MDS) and similarity tree techniques have been employed to analyze managers' and other stakeholders' mental representations of competitors (e.g., Hodgkinson *et al.*, 1991; Hodgkinson, 1997). Some of these studies collected data using elicitation techniques, such as repertory grids, card sorting tasks, and cognitive maps (e.g., Clarkson and Hodgkinson, 2005; Daniels *et al.*, 2002; Hodgkinson *et al.*, 2004).

Despite the wide range of available techniques, Table 1 confirms our observation that an integrative approach, as required in the study of consensus (Kellermanns *et al.*, 2005; 2011), has not yet been developed in the larger domain of cognition. The existing methods primarily capture degree and content dimensions of consensus across a limited number of organizational levels. A detailed analysis of consensus via in-depth visualization, longitudinal investigation, and significance testing is seldom possible. Table 1indicates that causal mapping has advantages over other previous methods in that it captures multiple dimensions of consensus and allows for pairwise testing of cross-sectional and longitudinal differences in consensus. However, SCM moves beyond causal mapping by systematically analyzing consensus between groups and facilitating the in-depth visualization of consensus both within and between groups.

To develop overarching theories of how individuals and groups combine their understanding and determine which antecedents and outcomes are associated with these processes, as Powell *et al.* (2011) argue, one must be able to link individual- and group-level cognition, make comparisons between groups, and reveal the overall alignment within an organization. In addition, although we recognize that certain methods are superior for particular purposes, the proliferation of methods has increased the difficulty of knowledge accumulation (Kellermanns *et al.*, 2011; Resick *et al.*, 2010). SCM addresses the much-needed consolidation of methods and can enable researchers in strategic consensus and in subfields of managerial and organizational cognition to build integrative theory with a systematic assessment of cognition, as we explain subsequently in the discussion section.

Strategic Consensus Mapping

SCM relies on data that quantify how individuals (i.e., members of work groups, teams, business units, organizations, or industries) assess strategic priorities – for instance, by rating or rank ordering (potential) strategic objectives as they may be presented in a survey (cf. the assessment of strategic consensus typically found in strategic management research; Kellermanns *et al.*, 2011). SCM involves a set of methodological procedures that aim to capture the facets of strategic consensus that are discussed in the previous sections. These procedures are introduced here in the order in which they should be executed.

First, the vector model for unfolding (VMU) is employed to measure the degree of within-group strategic consensus and to visualize its content. Second, from the results of this VMU, two new measures are derived to operationalize the degree of within- and between-group consensus. Third, these quantified measures of within- and between-group consensus are used to visualize the between-group consensus using MDS. Finally, the statistical significance of the observed differences in within- and/or between-group strategic consensus, both cross-sectional and longitudinal, are assessed using permutation tests.

Visualizing the degree and the content of within-group strategic consensus

To simultaneously obtain a visual mapping of the content and a measure of the degree of strategic consensus, SCM employs a vector model for unfolding (Borg and Groenen, 2005). This approach is the same as the use of principal component analysis (PCA) with the transposed data matrix, which positions respondents in the columns (as variables) and strategy items (i.e., strategic goals) in the rows (as cases). This procedure provides a joint-space presentation that jointly plots the strategy items in relation to the preferences of respondents regarding these items for all members of a team. In multivariate analysis, the VMU is a widely used statistical dimension reduction technique that summarizes a data set using one or more uncorrelated underlying latent variables to account for a maximum amount of the variance among the respondents. Below, we explain the specifications of the VMU in greater detail and demonstrate some of its features using an example.

Let $\mathbf{H}$ be the data matrix with m rows (strategy items) and n columns (respondents). $\mathbf{H}$ must be standardized such that all of the columns have a zero mean and a variance of 1. Consequently, the VMU in p dimensions is equivalent to minimizing the sum of the squared errors $\|\mathbf{E}\|^2$ for $\mathbf{H}$ and the low dimensional representation $\mathbf{XA'}$; that is,

$$L_{VMU}(\mathbf{X},\mathbf{A}) = \left\|\mathbf{H} - \mathbf{XA}'\right\|^2 = \sum_{ij} e_{ij}^2 \ ,$$

where $\mathbf{X}$ is an $m \times p$ matrix of the object scores for the m rows of the first p components and where $\mathbf{A}$ is an $n \times p$ matrix of component loadings. $\mathbf{X}$ is standardized to be orthogonal and has a column variance of 1, and the component loadings matrix $\mathbf{A}$ contains the correlations of the n respondents with p components $\mathbf{X}$. That is, the VMU reduces the dimensionality of the data to p dimensions, the object scores in $\mathbf{X}$ contain the coordinates for each strategy item in these p dimensions, and the component loadings in $\mathbf{A}$ are the correlations between the object scores for each strategy item and the original variables.

The VMU facilitates the identification of a p-dimensional space that contains (i) a configuration of m objects that represent the strategy items (the content of the strategy, which is shown as object points on the map) and (ii) a p-dimensional configuration of n vectors that represents the respondents within the group such that the projections of all object points on each vector correspond to the individual preferences of each respondent regarding the strategy items in the data set. In two-dimensional space, the results of the VMU can be depicted using a biplot in which the rows of $\mathbf{X}$ (the object scores of the strategy items) are represented as points and the rows of $\mathbf{A}$ (the component loadings of the respondents) are represented as vectors (Gower and Hand, 1996). Figure 1 illustrates several visual features that are associated with the resulting biplot representation of the VMU solution. The raw data matrix for this example is presented in the Appendix.

First, the cosine of the angle between two respondents is an approximation of their pairwise correlation (Linting *et al.*, 2007; Rodgers and Nicewander, 1988). This interpretation is based on the eighth way of interpreting correlations proposed by Rodgers and Nicewander (1988). The authors argue that this approach is the easiest method of interpreting the magnitude of correlations and add that '[t]his inside-out space that allows [a correlation] to be represented as the cosine of an angle is relatively neglected as an interpretational tool' (Rodgers and Nicewander, 1988: 63). Respondents with small angles between their vectors have a similar opinion of the strategy items in question. For example in Figure 1, the goal prioritization of respondent 'TMT1' is similar to that of 'TMT4' but different from that of 'TMT8'. This feature can also be useful in operationalizing dyadic strategic consensus (e.g., dyadic goal importance congruence in Colbert *et al.*, 2008).

Second, the spread of all of the vectors in the biplot demonstrates the degree of within-group strategic consensus. There is a high degree of within-group strategic consensus if the vectors are grouped as a narrow bundle. By contrast, a wide distribution of vectors of the respondents in opposing directions indicates a low degree of within-group consensus.

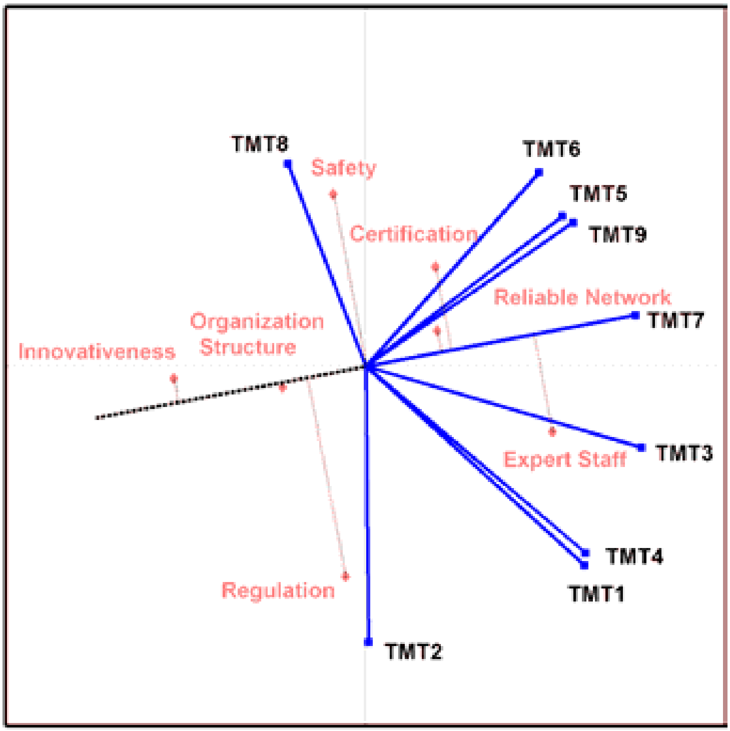


Figure 1: Example of a VMU biplot

Third, the VMU (a PCA of the transposed data matrix) biplot both provides a comparison of individuals and indicates their goals. Furthermore, the orthogonal projection of a strategy item onto a respondent's vector indicates the respondent's ranking for that particular strategy item. If the item is projected onto the vector farthest, then the respondent highly prioritizes these items, whereas strategic items that are projected in the opposite direction are not prioritized by the respondent. We illustrate the projections of the strategy items onto the vector that represents respondent 'TMT7' using dashed lines in Figure 1. The figure shows that respondent 'TMT7' assesses 'Expert Staff' as the most important, as this goal has the farthest projection onto the vector that represents respondent 'TMT7'. 'Expert Staff' is followed by 'Certification' and 'Reliable Network'. Because 'Innovativeness' embodies the farthest projection in the opposite direction, it can be inferred that 'TMT7' valued that strategy item the least. Therefore, within-group strategic consensus is visualized in a manner that captures the 'content' and 'locus' (within-group) facets of the multi-faceted definition of consensus proposed by Markoczy (2001).

Fourth, the VMU enables quantification of the opinions of groups, which can facilitate the comparison of strategic consensus across groups. The dimensions in the regular VMU are chosen to maximize the reconstructed variance, which is orthogonal to higher dimensions. However, the total variance that is explained by the two dimensions does not change with the rotation of these two dimensions, such that this freedom of rotation can be used to ensure that the average (vector) of component loadings coincides with the first dimension. As a result, the first dimension can be interpreted as the *prototypical group member* who best represents the overall group opinion. Therefore, the projections of strategy items onto the first axis represent the overall view of the group based on this prototypical group member. In Figure 1, when we make projections of the strategic goals onto the first dimension to attain the overall view of the group, we observe that the prototypical group member prioritizes 'Expert Staff' the highest, followed by 'Certified Work Process' and 'Reliable Networks', whereas 'Innovativeness' has the lowest priority. In addition, the number of people who are close to the prototypical group member represents the scope of within-group consensus.

Finally, the length of a vector indicates how well a respondent is represented, such that a length of 1 indicates perfect fit (Gower and Hand, 1996). To interpret the projections onto short vectors (indicating that low variance is accounted for) would be unwise (Linting *et al.*, 2007). Accounting for low variance must be interpreted as an indication of diverse opinions in a group and thus as indicating low consensus. The first two dimensions of the VMU solution are generally adequate to explain a large portion of the variance if the number of variables and respondents is not overly high. In the example in Figure 1, all of the respondents fit well into two dimensions because nearly all of the respondents have vectors with a length that is close to one. Indeed, 79.5 percent of the variance in this example is explained by the first two dimensions.

Quantifying the degree of within-group strategic consensus

In this section, we present a new measure for assessing the degree of strategic consensus within groups. This measure uses the VMU component loadings of the group members, therefore complementing our visualization of the content and degree of consensus. A new *a* measure of the degree of within-group strategic consensus is defined by the following:

$$\alpha = \sqrt{\sum_{s=1}^{2}\left(m^{-1}\sum_{j} a_{js}\right)^{2}} \ ,$$

where a_{js} is the s^{th} component loading for respondent j (j = 1, …, n). This a measure considers the first two principal components in accordance with the visualization in the previous subsection. The measure can be geometrically interpreted as the length of the average component loading vectors of the first and the second dimensions.

a takes values between 0 and 1. If all of the members of the group have very similar views regarding the strategy items and their vectors thus are close to each other in a narrow bundle, then the a measure will be close to 1. However, if there is a wide spread of vectors, such as a set of rays evenly distributed on a circle, then the average component loadings will be close to zero, and the a measure will be very low. In Figure 1, the a value is 0.55, indicating a moderate degree of within-group strategic consensus.

Quantifying the degree of between-group strategic consensus

When a firm wishes to strategically align people in the organization, developing a consensus regarding the strategic priorities within each group is important, but ensuring a shared understanding of strategy across groups is also essential. Kellermanns *et al.* (2005) suggest the use of a correlation-based approach to measure consensus across groups, especially when managers from several levels are part of a study. Therefore, we propose a correlational measure of the degree of between-group consensus that is derived from the within-group VMU object scores of the strategy items. Because the first principal axis can be interpreted as the prototypical member of the group who represents the aggregate measure of the entire group's overall opinion, the correlation between the prototypical members of two groups captures the between-group consensus for these two groups.

The measure that we propose, $r(A, B)$, is operationalized as the correlation of the object scores of the strategy items on the first principal component for two groups (A and B). Clearly, an r(A, B) of 1 indicates the perfect overlap of the two groups regarding the strategy items; r(A, B) ≈ 0 represents no strategic consensus between the two groups; and r(A, B) ≈ -1 reveals two opposite notions of the strategy in the two groups.

This measure can also be used to measure the overall strategic alignment in an organization when all groups in the organization have been surveyed using an aggregated index of the degree of between-group strategic consensus for all possible pairs of groups within the organization. This r_{overall} value can be operationalized as the normalized sum of the squared r-measures for all pairs such that the index ranges between 0 and 1. Therefore, r_{overall} indicates the overall degree of strategic consensus between all groups in a given organization. The r_{overall} index can also be used to compare the strategic alignment between different organizations.

Visualizing the degree and locus of between-group strategic consensus

In addition to our within-group consensus visualization that captures the content and the locus of within-group consensus, we propose a visualization technique for between-group strategic consensus. The between-group visualization is a map that represents all of the groups in the organization in a two-dimensional space according to their respective levels of between-group consensus. The visualization demonstrates which groups are located close together and share a strategic understanding, thus enabling us to determine the locus of consensus across the groups.

To obtain a mapping for between-group consensus, classical multidimensional scaling (MDS) is used, which has been proposed as a means of analyzing people's judgments regarding the similarity of the members of a set of objects (Torgerson, 1952). This technique has also been used to visualize intra- and intergroup similarities and differences in cognitive representations (see, e.g., Hodgkinson, 1997; 2005, for applications of three-way MDS; and Markoczy and Goldberg, 1995, for two-way MDS applications)[2]. The main objective of MDS

[2] MDS and related approaches have enjoyed considerable use in the analysis and comparison of intra- and intergroup cognitive representations. One potentially fruitful three-way approach, known as Procrustean Individual Differences Scaling (PINDIS), enables researchers to examine the extent and locus of consensus (and difference) among individuals and groups in terms of the relative weighting of particular dimensions and/or stimuli. In strategic management, Hodgkinson (2005) uses PINDIS to investigate the extent and locus of strategic consensus regarding actors' mental models of competition in a study of residential real estate agents' perspectives on competitor definitions. Like SCM, Hodgkinson's (2005) complementary use of PINDIS based on the same raw data does not confound measures by differences in measurement. Although Hodgkinson's one-mode (stimuli × stimuli), three-way (stimuli × dimensions × participants) Procrustean approach assists in the comparison of k multiple two- or higher-dimensional configurations that can be obtained through multiple MDS solutions (one per team), we prefer the two-way (stimuli × participants) approach that is presented in this article because it enables more straightforward comparisons without the need to first collapse one of the modes to derive a separate MDS configuration for each team. In adopting the latter approach, we would lose the ability to present both the strategic

is to represent given measures of dissimilarity for all pairs of objects as distances between pairs of points in a low-dimensional space, such that the distances correspond as closely as possible to the proximities.

As a measure of the dissimilarities between two groups, one minus the correlations between two groups' object scores is used for the strategy items (i.e., the *r* measures for all possible pairs of groups; see Borg and Groenen, 2005). Geometrically, this measure of dissimilarity is appealing because it is equal to the squared Euclidean distances between the end points of the vectors of the prototypical managers. Alternatively, other dissimilarity measures, such as Euclidean distances, city-block and Minkowski measures, can be employed. MDS finds an optimal representation of the between-group *r* measures using distance in two-dimensional space.[3] Each group is represented as a point, and the distances between the points represent the between-group consensus. Groups that more similarly value the strategy items are thus grouped closer together on the MDS map, whereas groups with opposing views are placed further from one another.

To provide a broader perspective on strategic consensus across organizational groups, we added some features to the between-group consensus maps. First, each group is not represented by a single point in the two-dimensional space, as in any MDS plot, but by a bubble whose size represents the current degree of within-group consensus (that is, the *a* measure) and by an outer circle surrounding the bubble, which indicates the potential maximum size of the bubble (and, thus, the size when there is perfect consensus within the group, $a = 1$). Second, in our representations, we preferred to position the TMT at the center of the MDS plots. Note that depending on the focal research question, other groups or stakeholders (e.g., trade unions, consumers, shareholders, and external regulators) may be chosen as the reference group. Third, to make the mappings more comparable and insightful

goals and the team members within a single plot (i.e., a joint-space representation). Furthermore, in separating the representation of strategic goals from the representation of team members, as is the case in three-way scaling procedures, we would also lose the representation of the prototypical team member for each team, which in turn forms the basis of the MDS analysis that is used to compare the various teams.

3 For dissimilarities that are Euclidean embeddable, such as $1 - r$, in classical MDS, the produced distances between points always underestimate the dissimilarity. Consequently, the resulting MDS plot is conservative and produces a lower bound for the dissimilarity or an upper bound for the correlation between two groups. Other forms of MDS exist (such as least-squares MDS, which minimises stress) that provide a two-sided approximation of the dissimilarities. However, when the number of groups is not high, the solutions tend not to differ substantially. If the number of groups is high (e.g., in an industry-wide application), then we suggest first performing a classical MDS and then using it as the initial configuration for a least-squares MDS (for instance, using the SMACOF algorithm in SPSS Proxscal, see Borg and Groenen, 2005).

with respect to the distances between the groups, we added ten circles that correspond to correlations with the TMT ranging from 0.9 to 0.

Assessing the statistical significance of differences in strategic consensus

To test changes in strategic consensus over time (e.g., before and after a strategic intervention) or differences in strategic consensus between groups, one must determine the statistical significance of the difference in the degree of consensus. To conduct significance tests of such differences, the respective α_{diff} or r_{diff} values must be defined. For instance, if we are interested in determining whether there has been a significant change in the within-group consensus of a group over time, then the null hypothesis is $\alpha_{\text{diff}} = 0$, where $\alpha_{\text{diff}} = \alpha_{\text{post}} - \alpha_{\text{pre}}$. Similarly, if we are interested in determining whether group A exhibits greater within-group consensus than group B, then the null hypothesis becomes $\alpha_{\text{diff}} \leq 0$, where $\alpha_{\text{diff}} = \alpha_{\text{A}} - \alpha_{\text{B}}$, and the alternative hypothesis is that $\alpha_{\text{diff}} > 0$.

To our knowledge, the only study that proposes a method for comparing consensus across groups is that of Pasisz and Hurtz (2009), who suggest that a series of *F* tests be used to compare within-group agreement across two or more groups. However, their procedure is parametric and thus may be sensitive to deviations from normal distribution (Markowski and Markowski, 1990). Our methods are not constrained by such assumptions, because the VMU method is a non-parametric technique without a statistical error model. As the within- and between-group consensus measures are functions of the VMU results, they do not entail any distributional assumptions. This statement also applies to the distributions of α_{diff} or r_{diff}, for which no standard statistical theory is available. Therefore, the use of the permutation test as a nonparametric method of hypothesis testing is more appropriate given our method.[4]

The permutation test yields the distribution of any test statistic for two groups under the null hypothesis that there is no difference between the two groups by rearranging the labels of

4 Hodgkinson (1998) warns against another problem associated with significance tests of MDS-related outputs and distances derived from proximities: the observations may be conditionally dependent. However, given that the α and r statistics are derived from pairs of VMU solutions rather than from MDS in our analyses, conditional dependency is not an issue. Nevertheless, our use of permutation tests is consistent with the work of Jones (1983), who recommends the use of non-parametric tests to mitigate conditional dependency problems. We would like to thank one of the reviewers for clarifying this issue.

the observed data (Good, 2000). The permutation test compares the α_{diff} and r_{diff} values of the true groups with the α_{diff} and r_{diff} values that are obtained from a large number of data sets (e.g., N = 1000) in which the grouping information is destroyed and individuals are randomly assigned to one of the groups (Hesterberg *et al.*, 2005). To ensure that the group size remains constant, the array indicating the group number of the individuals is randomly permuted, and new random group memberships are assigned for each permutation data set. To determine the significance, the *p*-value of the observed α_{diff} and r_{diff} are determined by their percentiles with respect to the permutation distribution. If the null hypothesis of no difference is rejected, then the observed α_{diff} or r_{diff} is significant at the level of the *p*-value.

Application of Strategic Consensus Mapping in a Field Study

To illustrate SCM, we collected data from a large Western European firm in the service industry. The company was composed of a top management team (TMT) and nine functional departments, each of which had several sub-departments. The head of each department directed a management team composed of four to ten managers, who, in turn, each supervised at least one sub-department. The TMT of the company included the managing director and the heads of the nine functional departments. To assess the strategic alignment of the organizational units, we focused on the management teams of these nine departments and the TMT. In the subsequent departmental analyses, TMT members were also included in their respective departments.

Rather than employing generic strategic goal statements, the TMT provided us with strategic goals specific to this company. These goal statements indicate strategic ends (where the company wished to go) and strategic means (how it planned to get there), employing a distinction that is commonly used in strategic consensus research (Kellermanns *et al.*, 2005; 2011). We presented these strategic goals to 72 top and middle managers in the organization with the following instructions: 'Please rank the following strategic goals of your company from most important to least important in order of their importance to you'. Given that the strategic priorities in the current paper were provided by the TMT and subsequently simply ranked by the respondents, the researcher intervention in the elicitation was limited, and the task performed by the respondents was relatively simple. We received 64 responses; a response rate of 89 percent. Males constituted 63 percent of our respondents, and 56 percent had master's degrees (the remainder had bachelor's degrees or comparable college degrees). The average work experience of the respondents was 18.6 years, and their average time in their current positions was 3.37 years.

We observed higher variance in the consensus regarding strategic means, which thus became our focus. To preserve the confidentiality of the respondents, some of the company-specific department names were relabeled, and the names of the respondents were anonymized. Furthermore, we used only shortened versions of the seven strategic means of the company: 'Innovativeness', 'Regulation Framework', 'Reliable Network', 'Safety', 'Expert Staff', 'Organization Structure', and 'Certification'.

Here, we present the results in a different order than in the methodology section. The firm-wide results are presented first, followed by the results for the different levels of the organization (the team and individual levels). We suggest that this approach to presenting the results provides a better understanding of the organization and enables more efficient interpretations of consensus and firm-level alignment, although the order in which the results are produced is as described in the previous section.

Locus and degree of between-group strategic consensus

Figure 2 shows the MDS plot that visualizes the strategic alignment of all of the organizational units in the organization. The distances between the bubbles represent the degree of consensus between the organizational units: a smaller distance implies greater consensus between the groups. The TMT is placed at the center of the plot to make it easier to identify the locus of the consensus. Figure 2 shows that the Sales, Strategy, and IT Departments had a high level of shared understanding with the TMT with regard to the strategic means, as all of these departments are positioned close to the TMT, whereas the views of the Operations and Business Development Departments were much less aligned with those of the TMT as they are located farther away. The degree of between-group consensus also showed these relationships: for instance, r(TMT, Sales) = 0.86 and r(TMT, Operations) = 0.41.

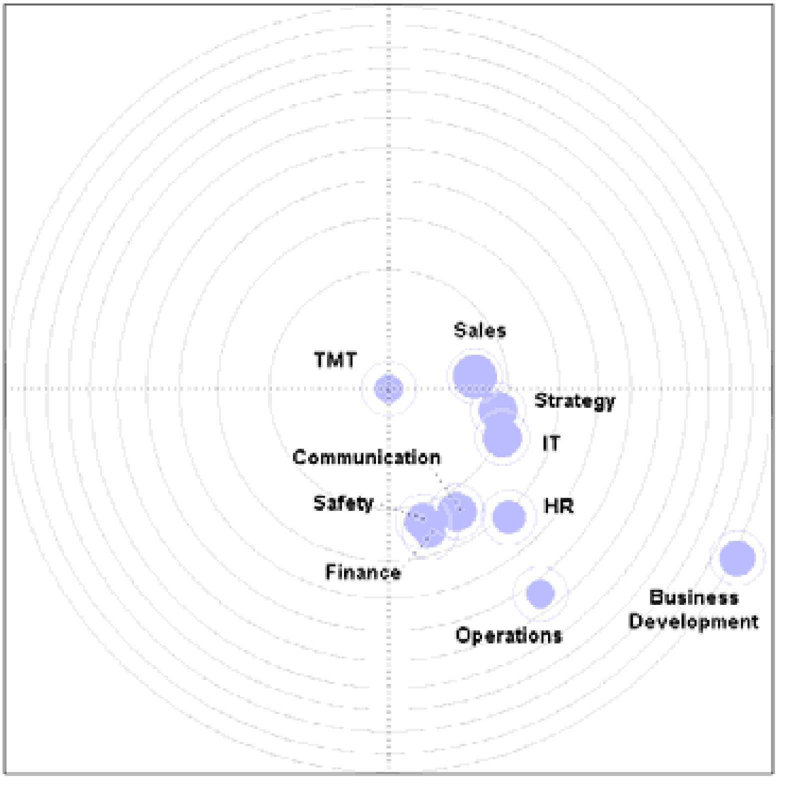


Figure 2: MDS solution depicting the locus and degree of between-group consensus

The bubbles in Figure 2 represent the degree of within-group consensus of each department, and the circles around the bubbles indicate the potential size of a bubble when there is full consensus within the group regarding the importance of all of the strategic means within the group (a = 1). The Sales, Communication, and IT Departments have relatively larger bubbles (the a measures are 0.81, 0.79, and 0.73, respectively), whereas the Operations, TMT, and Finance Departments have smaller bubbles (the a measures are 0.53, 0.54, and 0.56, respectively).

The degree of within-group consensus must be interpreted together with the distance of the departments to the center. Together, these two measures indicate the locus of consensus in the organization. If the organizational units that have high degrees of within-group consensus are clustered farther from the TMT, then the locus of the consensus in the organization is not the TMT. Similarly, the number of groups that are close to this locus indicates the scope of the consensus within the organization. InFigure 2, it is interesting to note that the TMT has a relatively low degree of within-group consensus and that some of the departments with high degrees of within-group consensus are clustered away from the TMT, which indicates that the locus of consensus was not the TMT's view of the strategic means. Each department had a unique view of the optimal means of reaching organizational goals, and these views differed from the TMT's perceptions, especially for teams such as Business Development and Operations.

Content and degree of within-group strategic consensus

To investigate the disparate views that have generated the shifted locus, we had to examine each management team more closely. The VMU step in our methods provided the biplots for each team that enabled us to observe the views of each team member regarding the strategic means. The biplot of the TMT is provided in Figure 1 as an example. Figure 3 illustrates the biplots of two teams, one closer to and one farther from the TMT: Sales and Operations, respectively[5].

[5] We investigated the stability of the results of the VMU (i.e., we determined whether slight changes in the data would lead to drastically different representations) using the bootstrap method (Efron and Tibshirani, 1997) for resampling. The results did not reveal any violations of the stability criteria. We are grateful to an anonymous reviewer for highlighting this point.

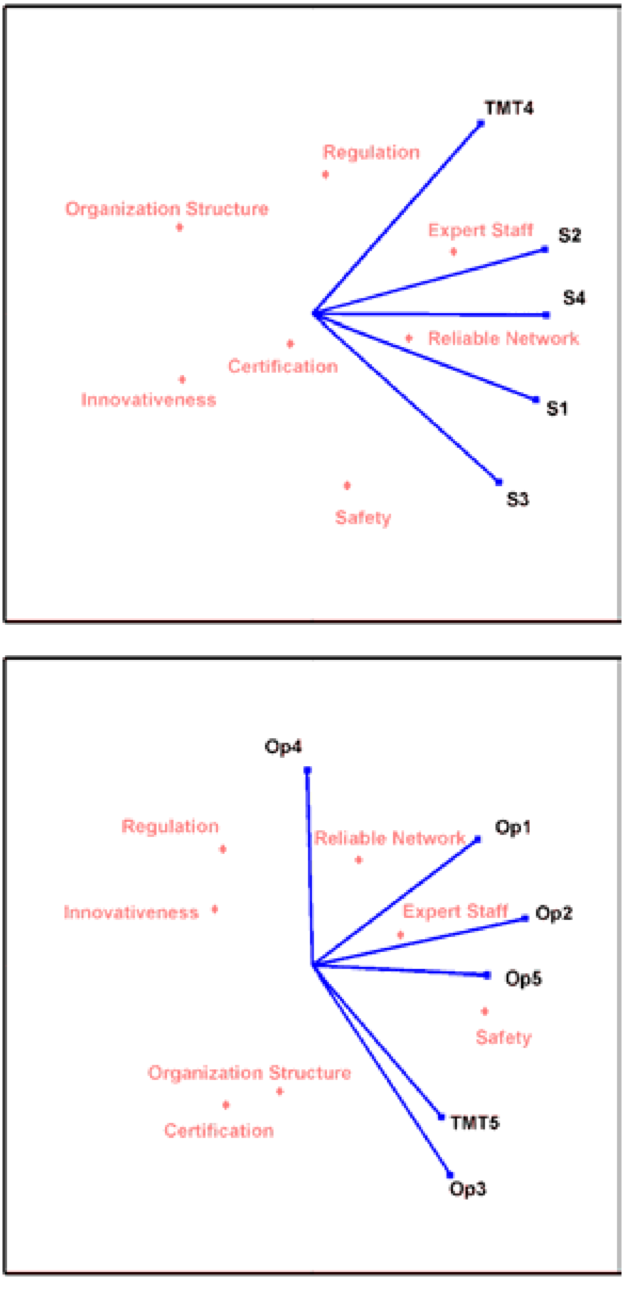


Figure 3: VMU biplots representing the degree and content of strategic consensus within the Sales (top) and Operations (bottom) departments

When we examined the individual sales and operations managers in Figure 3, we observed that the respondent vectors for the Sales Department are grouped as a narrower bundle than those for the Operations department; this result showed that the degree of within-group consensus in Sales (a = 0.81) is greater than that of Operations (a = 0.53). Consequently, we concluded that the members of the Sales Department held more similar views regarding the relative importance of the strategic means than did the members of the Operations Department.

In Figure 3, the large spread of the vectors in the Operations Department resulted from differences in the individual preferences of the department members. For instance, person 'Op4' prioritized 'Regulation', 'Reliable Network' and 'Innovativeness' as the most important strategic means, whereas person 'Op3' considered these three strategic means to be the least important and rather considered 'Safety', 'Organization Structure' and 'Certification' to be the most important. However, some team members had similar views, such as 'Op3' and TMT5' because the angle between their vectors is small. Finally, the vectors of respondents 'TMT5' and 'Op5' are slightly shorter than the remainder, all of which have a length of approximately 1. This observation indicated that their preferences are less adequately represented in the biplot compared with the preferences of the others. Indeed, two dimensions accounted for 66 percent of the variance, which indicated that the preferences of some members are not perfectly represented in these dimensions. In Figure 3, the members of the Sales Department exhibited greater shared understanding regarding strategic means, and all are represented adequately in the biplot, with lengths that are close to 1; 90 percent of the variance was accounted for by the biplot.

Assessing the statistical significance of differences in between-group strategic consensus

Both the biplot and the a measures indicated that Sales had a greater degree of within-group strategic consensus than Operations. However, we did not know whether this difference is statistically significant. We employed permutation testing to determine the statistical significance of the difference with the null hypothesis that there was no difference in the degree of within-group strategic consensus across the Sales and Operations Departments; that is, H_0 equals $a_{\text{diff}} = 0$. After 9,999 permutations, the observed difference of $a_{\text{diff}} = 0.83 - 0.53 =$

0.28 was at the 98th percentile, implying that $p = 0.02$. Therefore, the null hypothesis that there was no difference between the Sales and Operations Departments with regard to their within-group strategic consensus could be rejected at the five percent level.

Additional evidence of the validity of our *a* measure was obtained when we compared our results with those obtained using other common consensus measures, such as standard deviations, squared Euclidean distances, and correlations (see Kellermanns *et al.*, 2011 for details). Table 2 shows that the results remain qualitatively the same.

Table 2: Permutation tests for comparison of within-group consensus between Sales and Operations departments

Measures	Sales	Operations	Difference	*p*-value
a	0.81	0.53	0.29	0.020
Standard deviations	-1.22	-1.81	0.59	0.009
Squared Euclidean distance	-23.60	-47.07	23.47	0.024
Correlations	0.586	0.16	0.42	0.024

A permutation test can also be used to test whether two groups have different levels of correlation with the TMT: for example, $r_{\text{diff}} = r(\text{TMT, Sales}) - r(\text{TMT, Operations})$. The results showed that this difference was significant at the 10 percent level ($p = 0.08$) but not at the five percent level. We concluded that there was some (albeit not strong) evidence that the Sales Department was indeed more aligned with the TMT than was the Operations Department. Figure 2 also suggests that Sales is more aligned with the TMT than is Operations.

Assessing the effectiveness of the strategic intervention

The above findings were presented to the TMT of the company, and we found that the visual features of our method increased the comprehensibility of our results for the managers. These managers were especially surprised by the low within-group consensus of their own team, the TMT, concerning the strategic means. Consequently, the TMT decided to organize a semi-structured half-day strategic intervention facilitated by a professional consultant and an academic. The intervention was intended to enhance the team members' shared understanding of the strategic means of the firm.

After this strategic intervention, we re-evaluated the prioritizations of TMT members to measure the effectiveness of the strategic intervention and illustrated this particular application of SCM. The results showed that the degree of within-group consensus of the TMT increased after the intervention (α_{post} = 0.81; α_{pre} = 0.55). Consequently, we tested the null hypothesis that there was no difference between the pretest and the posttest with regard to the degree of consensus against the alternative that the consensus increased. The results showed that the degree of consensus increased significantly at the five percent level (p = 0.04).

The content of the consensus is shown in Figure 4, which can be compared to the biplot in Figure 1. There was greater consensus regarding the high value of 'Reliable Network' and 'Expert Staff', and the TMT members agreed on the lower importance of 'Innovativeness'. By clarifying these results, SCM indicated that the strategic intervention was effective in increasing the degree of consensus within the TMT regarding the desired content.

Clearly, more rigorous research designs than that presented here (which is used for illustrative purposes only) are required to comprehensively assess the effectiveness of strategic interventions. For instance, a more appropriate design would be a two-group pretest-posttest design that compares the effects of an intervention in contrast with the outcome in a control group (e.g., Cook and Campbell, 1979).

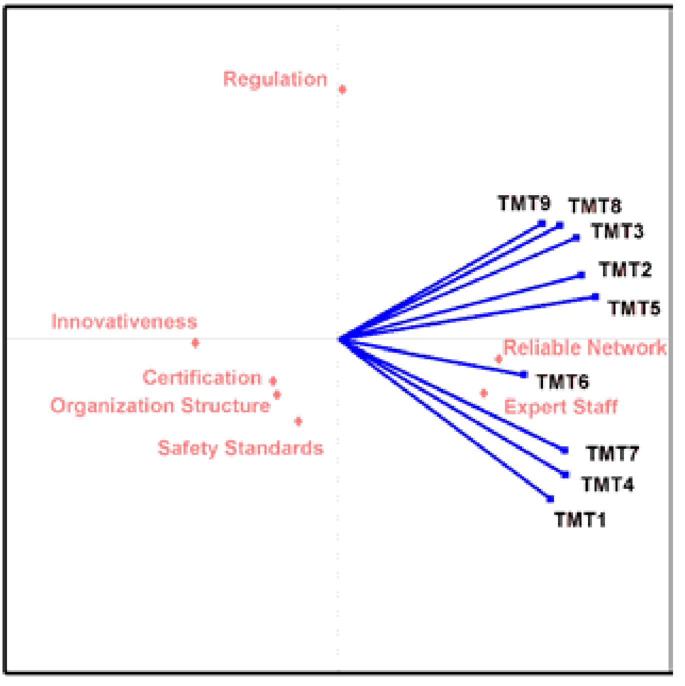


Figure 4: VMU biplot of TMT after the strategic intervention

Discussion

In the preceding sections, we proposed a set of complementary techniques that can be referred to as Strategic Consensus Mapping. Our aim of SCM was to quantify the degree of consensus both within groups and between groups and to visually represent the content of the consensus within groups. The method also made it possible to test whether longitudinal or cross-sectional differences in the degree of within- and between-group consensus were significant. The use of SCM was illustrated in a field study that also included a strategic intervention to respond to the call to advance the methodological tools that are used to test the effectiveness of strategic interventions (Hodgkinson *et al.*, 2006; Hodgkinson and Healey, 2008b).

Each step in the SCM process was complementary in that the output of one procedure became an input for the subsequent procedure. First, the vector model for unfolding (VMU) generated a within-group visualization of the degree and content of the consensus, quantified the degree of within-group consensus, and identified the prototypical group member. This information became an input for the between-group consensus measure. The between-group measure then served as an input for the multidimensional scaling procedure, which visualized the degree and locus of the between-group consensus. The final step, the permutation testing, utilized the difference between the within- and between-group measures to assess the significance of differences in strategic consensus.

The core contribution of SCM is the enhanced potential that it provides for researchers in strategic management to conduct more fine-grained and extended analyses of strategic consensus within and between groups. In this manner, the method complements earlier conceptual arguments regarding the multifaceted nature of strategic consensus (e.g., Hodgkinson and Johnson, 1994; Kellermanns *et al.*, 2005; Markoczy, 2001; Wooldridge and Floyd, 1989) by providing the methodological tools that are needed for empirical studies in this area. With the tools in place to operationalize the different facets of strategic consensus, future research can explore the antecedents of consensus formation, the link between different dimensions of within-group consensus and group performance, and the effect of between-group alignment on organizational performance. In addition, future research can derive visualizations of consensus and statistical tests of differences in consensus in an integrative approach that relies on the same raw input and thus does not confound aspects of consensus with the specifics of their measurement. In sum, SCM contributes to the development of our understanding of the role of strategic consensus in the strategy process.

Clearly, SCM was developed for the study of strategic consensus. However, the method may be applied to the study of shared cognition, which has also called for an integrative approach (Hodgkinson, 1997; 2002; Kaplan, 2011; Mohammed *et al.*, 2000; Walsh, 1995). Walsh (1995: 308), for instance, argues that 'the fundamental empirical task facing management (cognition) researchers is to identify the content and structure of a knowledge structure at both the individual and supra-individual levels of analysis.' Highlighting the need for unified approaches (Hodgkinson, 2002; Kaplan, 2011; Walsh, 1995), Hodgkinson (1997) extends Walsh's argument regarding the need for multidimensional and multilevel analysis to include longitudinal comparisons of individual and group cognition. He (1997: 930) notes that '…one of the most challenging and complex set of issues facing researchers concerned with the investigation of cognitive aspects of strategic management is related to the problem of how actors' mental models should be compared with one another, a problem which intensifies with increased numbers of research participants and levels of analysis. In the case of longitudinal studies, concerned with the cognitive assessment of multiple actors, the time dimension gives rise to even greater complexity.'

Similarly, research on intergroup relationships in organizations (van Knippenberg, 2003) may benefit from the use of SCM to visually represent shared understanding across interdependent organizational groups in areas other than strategic priorities. Likewise, in an inter-organizational context, SCM may assist researchers in identifying and visualizing strategic groups, and the within-group consensus measure may provide a proxy for the degree of strategic-group identity, which refers to the mutual understanding among the members of an intra-industry group regarding the central, enduring, and distinctive characteristics of the group (Peteraf and Shanley, 1997). SCM's contribution to these streams of cognition research lies in its ability to equip scholars to assess cognition simultaneously at different levels of analysis by decomposing different dimensions of cognition and testing longitudinal and cross-sectional differences in cognition.

On a different note, ordinal data must be treated with care when SCM is used. In such cases, 'ordinary' VMU should be replaced by categorical principal component analysis (CatPCA) in the transposed data matrix. The two techniques provide similar outputs, and the overall differences between CatPCA and PCA are negligible, but CatPCA is the more appropriate technique for use with ordinal data (Linting *et al.*, 2007). In addition, the two fundamental tools that are used in SCM, the VMU and MDS are based on the idea of representing multivariate data in lower dimensions. By their nature, these procedures involve searching for low-dimensional representations that show the most important information rather than providing all information. The advantage of such an approach is that noise and unimportant relationships tend to be removed from the representation. However, these processes may not provide important information that is visible only in higher dimensions. This issue may be particularly relevant to VMU solutions that are obtained for many strategy items or groups with many members. A large number of strategy items is unlikely in strategic consensus research, but a large number of group members may occur when large organizations with many organizational units are studied. In these cases, the two-dimensional

MDS solution that indicates the similarity between the groups becomes more of a compromise as the number of groups grows. However, poorly fitting groups can be easily detected based on the MDS diagnostics. The between-group measures and their significance can provide valuable support for an MDS map in these cases. Other options would be to apply more conventional MDS techniques to explore higher dimensional models; to derive separate subgroup models; or to rely on other established techniques, such as similarity tree analysis and hierarchical clustering (cf. Hodgkinson, 2005).

Managerial implications

This study has important implications for both practitioners considering the use of strategy workshops and those investigating consensus within their companies and/or groups. Companies invest significant resources in strategic interventions, but the effectiveness of these interventions is seldom, if ever, assessed (Hodgkinson and Healey, 2008b). SCM can be used to evaluate whether a particular strategic intervention has been effective. In addition to indicating the effectiveness of strategic interventions, the results of SCM can serve as a diagnostic tool that indicates where and on which issues a lack of strategic consensus exists. Thus, SCM can provide the starting point for an intervention that is intended to increase consensus.

In the analysis of strategic consensus within organizations, between-group visualization provides an intuitive, clear means of determining the strategic alignment of teams, which then enables firms to take action accordingly, similar to the manner in which within-group visualizations can assist firms in identifying the strategic content on which the members of a group agree or disagree. This information can then be used to better inform employees of strategies via newsletters or workshops. The ability to identify these issues enables organizations to generate policies that increase strategic consensus in a more targeted, cost-effective, and productive manner.

Conclusion

Strategic consensus has become a prominent concept in strategy process and strategy implementation research. The strategic consensus mapping (SCM) technique proposed here is closely aligned with the conceptual analysis of strategic consensus and will assist researchers in breaking new ground through more fine-grained and extended analyses of the multifaceted and multilevel nature of strategic consensus. Thus, the current work extends a clear invitation to researchers in strategic management to adopt this new approach in the study of strategic consensus.

Appendix

Table A 1: Data matrix underpinning the VMU biplot reported in Figure 1. Higher numbers indicate higher prioritization

	Respondent								
Strategic Priority	TMT1	TMT2	TMT3	TMT4	TMT5	TMT6	TMT7	TMT8	TMT9
Safety	1	2	3	2	5	6	4	7	5
Certification	4	1	4	3	6	5	5	2	7
Expert staff	7	6	7	7	7	4	7	3	6
Regulation	6	7	5	6	1	2	3	1	2
Reliable network	5	3	6	5	3	7	6	6	3
Organization structure	3	5	2	4	4	3	1	4	4
Innovativeness	2	4	1	1	2	1	2	5	1

Table A 2: Distance matrix between departments used for MDS solution in Figure 2

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. TMT	1.00									
2. Strategy	0.72	1.00								
3. HR	0.71	0.78	1.00							
4. Sales	0.86	0.96	0.81	1.00						
5. Operations	0.41	0.74	0.84	0.62	1.00					
6. Finance	0.74	0.82	0.88	0.80	0.82	1.00				
7. IT	0.79	0.91	0.95	0.94	0.76	0.85	1.00			
8.Business Development	-0.03	0.33	0.58	0.27	0.60	0.30	0.46	1.00		
9. Communication	0.77	0.88	0.95	0.87	0.87	0.96	0.94	0.40	1.00	
10. Safety	0.86	0.71	0.87	0.78	0.72	0.90	0.81	0.31	0.91	1.00

Chapter 3

HOW IS STRATEGIC CONSENSUS FORMED? THE ROLE OF POWER DISPARITY AND PSYCHOLOGICAL SAFETY

Introduction

Organizations more and more rely on teams to achieve organizational goals (Cohen and Bailey, 1997; Greer *et al.*, 2011; Mathieu *et al.*, 2008). Several areas of research emphasize creation of shared understanding over team and organizational goals, tasks, and processes (see Mathieu *et al.*, 2008 for a review). For example, at lower levels of an organization, shared mental models, "an organized understanding or mental representation of knowledge that is shared by team members" (Mathieu *et al.*, 2008: 38), are shown to be related to team effectiveness (Cannon-Bowers *et al.*, 1993). Meanwhile at the higher echelons, strategic consensus, the shared understanding of organizational goals (Kellermanns *et al.*, 2005), is found to be associated with the strategic actions, interpretation of the strategic issues, and organizational performance (Dutton and Dukerich, 1991; Iaquinto and Fredrickson, 1997; Kellermanns *et al.*, 2011; Thomas *et al.*, 1993). The underlying reasoning at both levels are very similar: when team members share similar views of goals and/or task relevant processes and outcomes (i.e. technology, task, importance of strategic priorities), they are more likely to understand one another's perspectives, to communicate more easily, to integrate distributed knowledge, and to coordinate more effectively which, in turn, will improve team and organizational performance (Cannon-Bowers *et al.*, 1993; Cronin and Weingart, 2007; Kellermanns *et al.*, 2005).

Depending on the content and context of the shared understanding, scholars have used various similar terms to coin shared understanding such as team mental model (Mohammed *et al.*, 2000), collective cognitive map (Axelrod, 1976), dominant logic (Prahalad and Bettis, 1986), goal congruence (Colbert *et al.*, 2008), collective cognition (Mathieu *et al.*, 2008), and strategic consensus (Kellermanns *et al.*, 2005). Here we focus on a particular form of shared understanding: strategic consensus. Kellermanns et al., (2005: 721) defines strategic consensus as "the shared understanding of strategic priorities among managers at the top, middle, and/or operating levels of the organization". Strategic consensus has been particularly highlighted in the organizational context in terms of its positive relation with team and organizational performance as well as the strategy implementation (see Kellermanns *et al.*, 2005 for a review; and Kellermanns *et al.*, 2011 for a recent meta-analysis). Similarly, Cronin and Weingart (2007) argue that unless teammates have similar prioritization of goals, they will work toward different directions which results in poor information processing, coordination failures, conflict, and thus poor team performance.

Associating the degree of shared understanding to organizational and team outcomes has been the main premise in the research. Yet, little emphasis has been placed on the processes leading to its formation. Earlier research examining formation of consensus, however, predominantly focused on which mechanisms and decision schemes result in sharedness. To illustrate, Priem, Harrison and Muir (1995), Sandberg and Ragan (1986), and Schwenk and Cosier (1993) compared different mechanisms such as consensus seeking, dialectic inquiry and devil's advocacy in terms of their effectiveness to build consensus. As an exception, Knight et al. (1999) look at the relationship between the group diversity and consensus within Top Management Teams (TMT). Similarly, social decision schemes in small groups research analyzes which decision schemes can represent the team shared understanding the best (see Laughlin, 2011; Tindale *et al.*, 2003 for reviews) rather than uncovering the processes leading to consensus.

We present a model of consensus formation in the lower and middle levels organizational teams incorporating the within-group power differences, psychological safety and the interplay between them. Our main premise is that degree of consensus is not an exogenous characteristic of teams, instead team members form consensus through their interactions. And their interactions are affected by existing power differences and interpersonal risk taking within the team. Do teams with evenly distributed power (i.e., low power disparity) accumulate higher shared understanding than the teams having power concentrated in one member (i.e., high power disparity)? How does group members' psychological safety interact with power differences and lead to consensus? To answer these questions, we integrate the research in social psychology, group processes and shared mental models. With the help of data collected from 143 teams in two organizations that operate in distinct industries, we found that groups where there was low power disparity at the same time group members felt safe to disagree with groups' decisions had higher degree of strategic consensus.

The contribution of this study is three fold. First, we show that as a result of the interplay between psychological safety and power disparity "different" consensuses with the same degree may emerge which are likely to lead to discrepant outcomes. That is, we contend that higher consensus can be achieved either by imposition of the powerful member where team members do not feel safe to speak up, or by interactive dialogue and discussion of equally powered members in a safe environment. This finding provides not only a deeper understanding of consensus formation, but also may explain why some of the previous researchers found conflicting results when investigating the relationship between consensus and performance (see Kellermanns *et al.*, 2005; 2011 for reviews). To illustrate, some researchers found a positive relationship between strategic consensus and performance (e.g., Bourgeois, 1980; Homburg *et al.*, 1999; Knight *et al.*, 1999; Rapert *et al.*, 2002), whereas others found evidence on the opposite direction (e.g., Bourgeois III, 1985; West and Meyer, 1998) and again some others did not find any relationship at all (e.g., West Jr and Schwenk, 1996; Wooldridge and Floyd, 1990). Second, we illuminate the effect of group dynamics in consensus creation in an organizational setting by extending the strategic consensus research beyond the upper echelons view, and contribute to the growing body of research in strategic consensus which takes the middle and lower levels into account (Wooldridge *et al.*, 2008). Our third contribution is to the research in power. By empirically showing psychological safety as a boundary condition for power disparity, this paper integrates approach/inhibition theory and conflict theory of power which propose opposing views on power disparity-consensus relationship.

Power Disparity in Strategic Consensus Formation

Strategic consensus research has mainly focused on top management teams within the context of strategy formulation while other organizational actors who execute the strategy are often neglected (Kellermanns *et al.*, 2005; Wooldridge *et al.*, 2008). In the light of shared mental models theory, researchers found that individuals' formation of consensus over the organization's strategic priorities reduces the pursuit of subunit goals over the organizational goals (Ketokivi and Castañer, 2004) where they can coordinate their actions and join forces to create synergies (Cannon-Bowers *et al.*, 1993). Hence, a high degree of consensus over the strategy leads to a smoother implementation of the strategy (Kellermanns *et al.*, 2011; Rapert *et al.*, 2002). Consequently, the advantages attributed to having a higher degree of strategic consensus may be important not only for the TMT, but also for other organizational groups in the lower and middle levels since they are the ones who implement the strategic goals. Thus, strategic consensus is needed not only within the TMT but also within other organizational groups (Guth and MacMillan, 1986; Kellermanns *et al.*, 2005; Wooldridge and Floyd, 1989; Wooldridge *et al.*, 2008).

As in every social setting (Anderson *et al.*, 2008), power differences emerge inevitably within those lower and middle level organizational teams as well. Power holders in those teams influence and forge perceptions, cognitions and preferences of other members (Lukes, 1974; Magee and Galinsky, 2008). Hence, we propose that existing power differences within a team is expected to influence the team's consensus over the strategic goals of the organization (cf. Pitcher and Smith, 2001). Despite its prominence, to our knowledge, the effect of power distribution on consensus formation has been much less answered (Pitcher and Smith, 2001).

Note that our interest lies more in the effect of power on others' strategic preferences. Therefore, we focus on the realization of power and use here the definition of power as the ability to influence others to bring about desired outcomes (Magee and Galinsky, 2008; Overbeck and Park, 2006; Pfeffer, 1981). Power disparity is then defined as 'the differences in the concentration of power among group members' (Greer and van Kleef, 2010: 1032). According to this definition, power disparity reaches its highest level when power is concentrated in the hands of only one group member (Harrison and Klein, 2007).

When power disparity is low, there are not steep power differences within the group. Each group member has the opportunity to influence the group decisions. Such an opportunity to influence motivates individuals to contribute, effectively integrate the distributed knowledge, collaboratively search for new knowledge, and engage in group learning (Bunderson, 2003; Edmondson, 2002; Rulke and Galaskiewicz, 2000). For example, in her thorough case study of 12 organizational teams, Edmondson (2002) observed that teams reflect and act on group decision only when power differences are absent or at the minimum level. Furthermore, in groups with low power disparity, teams' decisions are steered by the expertise rather than social category differences (Bunderson, 2003; Eisenhardt and Bourgeois, 1988; Pitcher and Smith, 2001).

In contrast, teams where power disparity is high witness power battles. To illustrate, Eisenhardt and Bourgeois (1988) report for top management teams with high power disparity (i.e. when CEO's power is absolute compared to others) that the CEO employs his/her attention more on strengthening the control and preserving the information while others are more inclined towards silence and acquiescence. That is, team members seem to comply with the CEO as a result of her/his influence, but do not identify with or internalize the decisions to implement (Kelman, 1958). Rather, team member pursue secret agendas and self-interest serving goals that substitute organizational goals (Edmondson, 2002; Eisenhardt and Bourgeois, 1988; Pitcher and Smith, 2001). Moreover, such high power disparity situations lead group members to employ metaphors and abstract language which avoids misunderstandings and disagreements to be resolved (Edmondson, 2002).

In sum, several areas of research underscore the relation between the power disparity and group processes. For example, research on distributed leadership (e.g. Mehra *et al.*, 2006), social cognition (e.g. Bunderson, 2003), and team learning (Bunderson and Reagans, 2011; e.g. Edmondson, 1999; 2002) argue that steeper power differences within a group undermine group functioning through higher competition, conflict and political behavior, and lower team learning, trust, and collaboration (Anderson and Brown, 2010; Bourgeois, 1980; Greer and van Kleef, 2010; Harrison and Klein, 2007; Siegel and Hambrick, 2005). Because higher power disparity inhibits a group's capabilities of participation, information sharing, learning and helping behavior, we pose that it in turn can negatively affect reaching consensus.

Hypothesis 1: *All else being equal, higher power disparity is associated with a lower degree of strategic consensus within a group.*

Psychological Safety: Bridging Power Disparity and Strategic Consensus

In addition to the power differences within a group, group processes also play an important role in formation of consensus (Mathieu *et al.*, 2008). For instance, Knight et al. (1999) showed that agreement seeking group behavior is associated with higher group consensus while interpersonal conflict lowers consensus. We propose psychological safety, "a shared belief that the team is safe for interpersonal risk taking" (Edmondson, 1999: 354), in explicating strategic consensus formation and in moderating the relationship between power disparity and consensus.

A recurring communication and discussion facilitates the creation of shared understanding of strategic priorities within a group. For example, Rapert *et al.* (2002) found that increased communication results in higher consensus between the CEO and marketing head. Similarly, Ketokivi & Castañer (2004) showed that communication of goals aligned the subunit interests with those of the organization. For such healthy communication between group members to occur, it is necessary that employees feel safe to speak up. Research performed by Edmondson (1999; 2002; 2003) and anecdotal evidence provided by Bourgeois & Eisenhardt (1988) underline that in groups with high psychological safety, group members are more inclined towards interaction and exchange of information and knowledge. Low psychological safety, then, may undermine the consensus formation. We therefore hypothesize the following

Hypothesis 2: *All else being equal, higher psychological safety is associated with a higher degree of strategic consensus within the group.*

Several studies have emphasized the interplay between power disparity and psychological safety (e.g. Anderson and Brown, 2010; Edmondson, 1999; 2002; 2003; Eisenhardt and Bourgeois, 1988). For example, Edmondson (2003) observed that learning and implementation of a new medical practice was higher when the surgeons who reduced the power differences and promote speaking up in the operating room. Yet the empirical investigation of this interplay in consensus formation is missing.

According to Walsh (1995: 290) "the struggle for power in an organization is often a struggle to impose and legitimate a self-serving meaning for other". Similarly approach/inhibition theory in social psychology (Keltner *et al.*, 2003) argue that high power individuals are more likely to influence others and less likely to be influenced, whereas attitudes and opinions of low power individuals are affected by the individuals with high power (Brinol *et al.*, 2007; Galinsky *et al.*, 2008).

The power holder's influence may be alleviated when the group members can generate resistance against and disagree with the power holder. This is possible if there is a high level of psychological safety. When an individual is exposed to influence attempts, s/he can resist against these attempts within her/his potential. Having a safe environment within the group allows individuals to unleash their capacity to resist. If individuals feel safe to speak up, they can produce counter arguments to what is being dictated by the power holders.

When power is concentrated in the hands of only one individual (i.e., high power disparity), the power holder will influence others' understanding. If there is not a sufficient amount of psychological safety within the group, this influence will not be challenged or experience any resistance from other group members. As a result, a high degree of consensus will be formed such that its content is constructed around the opinion of the power holder. Social decision schemes theory, for instance, postulated that group consensus is formed around the preferences of "cognitively central" members (Kameda *et al.*, 1997; Tindale *et al.*, 2003).

When the power disparity is low and group members feel safe to voice their opinions, it is the quality of arguments which influences the consensus formation rather than the power battles. In this line, Edmondson (2002) observed explicit learning of group members toward organizational goals for the groups where the group feels psychologically safe and power disparity is absent or mitigated. When psychological safety is high, we contend that higher power disparity is associated with lower consensus due to increased resistance to the influence attempts or conflict stemming from the power battles. Hence, we propose the following

Hypothesis 3: *All else being equal, psychological safety moderates the relationship between strategic consensus and power disparity. That is, when psychological safety is high, power disparity is negatively related to consensus. On the other hand, higher power disparity is positively related to consensus when there is low psychological safety.*

We analyze the consensus formation in relation to psychological safety and power disparity for middle and lower organizational groups. By doing so, we respond to the calls in the strategic consensus literature for taking lower organizational levels into account as well as integrating small-group research within a strategic context. In the following subsection, we explicate the methods we utilized to investigate the proposed hypotheses.

Method

Research on strategic consensus highlighted that the outcomes of strategic consensus might differ with respect to the dynamism or stability of the industry in which an organization operates (Kellermanns *et al.*, 2005; 2011; Priem, 1990). Consequently, we collected data from two Dutch companies which operate in two separate industries. Organization 1 is a utilities company which operates in a rather stable environment. The industry is highly regulated and due to high entry costs the competition is limited. Conversely, Organization 2 is an IT solutions and consulting firm experiencing highly changing industry dynamics and competition. The sample in Organization 1 included 110 teams (871 employees). The average age was 45.6 years, and 23% of the employees were female. The average group contained 7.91 (SD = 5.35) members. Organization 2 is composed of 43 teams (402 employees). The average age of employees was 40.9 years and 15.5% were female. The average group was composed of 7.47 (SD = 4.87) members.

The research in strategic consensus suggests framing the content of consensus in terms of strategic priorities when the middle and lower levels are in the focus (Kellermanns *et al.*, 2005; 2011). Through a series of meetings, the strategic priorities of each organization were provided by their TMTs. These priorities are not presented here due to the confidentiality reasons. Note that since the TMTs in each company actually involved in the formulation of the strategic priorities on which strategic consensus will later be measured, we excluded the TMTs from further analyses. This is also consistent with our middle and lower levels perspective.

Supplementary archival data including employees' age, gender, tenure from both organizations, and salary scale only from the first organization were retrieved through the company records. The rest of the data were collected via an online survey. In both organizations, the survey was announced by the CEOs, and by the researchers one week after the CEOs' communication. Participation in the study was voluntary. Both on the invitation emails and the survey's first page, anonymity and confidentiality of responses were emphasized. The response rate was 74% in Organization 1 and 82% in Organization 2. Independent samples t-test revealed no difference between respondents and non-respondents with respect to age, gender and tenure in both organizations, and salary scale in the first organization. In addition to TMTs in both organizations, six groups in Organization 1 and two in Organization 2 were dropped because only one group member responded to the survey resulting in a sample of 143 teams.

Measures

This study relies on existing measures which are employed with five-point Likert-type scales unless noted otherwise.

Degree of consensus. Each respondent was asked to rate the strategic priorities to the importance s/he attaches to each priority. The degree of consensus is then calculated by average standard deviation across the group members. Scores are multiplied by -1 so that a higher value indicates a higher consensus. This methodology is widely applied in the consensus literature (e.g. Bourgeois, 1980; Colbert *et al.*, 2008; Dess, 1987). Further analyses using another commonly used measure of consensus, average squared Euclidean distances, and the *a* measure introduced in Chapter 2 yielded qualitatively similar results.

Power Disparity. In a high power disparity team, only one or a few team members influence team decisions, whereas in a team with low power disparity, all or most team members has the opportunity to exert influence (Bunderson, 2003). As suggested by Harrison and Klein (2007), we measured power disparity by the coefficient of variation of individual power scores within a group. To calculate the individual power of each member within the group, we relied on the statements provided by multiple group members. Respondents were given a roster of co-workers in their groups and asked to answer the following question: "Please rate the influence of your group members listed below regarding the decisions related to your group". The scale varied from 'Not influential at all' to 'Very Influential'. The scores provided by all group members were averaged to derive the individual power of each member. Such an operationalization of individual power in terms of influence is frequently applied in the literature (see, e.g. Anderson *et al.*, 2008; Greer *et al.*, 2011; Venkataramani and Tangirala, 2010). We discuss the reliability of the measure and an alternative operationalization in the next section.

Psychological Safety. We used five items adapted from Edmondson (1999) to measure psychological safety within the group. A sample item reads as "It is safe for me to speak up during my interaction with my team".

Control variables. As well as being an individual characteristic, power has long being recognized as a cultural element (Hofstede, 1986). Therefore, we control for *power distance orientation* of the group as the willingness to accept inequalities of power in society. Power distance orientation is measured by seven items adapted from Kirkman *et al.* (2009). A sample item reads as 'In work-related matters, supervisors have a right to expect obedience from their subordinates'.

Salancik & Pfeffer (1974: 472) argue that interdependency of the activities imposes additional limitations on individuals' "contest for power and resources". Furthermore, the evidence from network theory shows that network density of a group enables more information flow and shared meanings (Zaheer *et al.*, 2010). Thus, we controlled for *task interdependence* using a network perspective. Respondents were asked the following question that was adapted from Ibarra (1993), 'Please indicate the names of your colleagues from whom you depend on for materials, means, information, etc. in order to carry out your work adequately'. Task interdependence within group is then measured as network density of the group using Ucinet 6.

The goal-transformation hypothesis of identification argues that group identification makes personal and collective goals interchangeable (Van Vugt and De Cremer, 1999). Via five items adapted from Mael & Ashforth (1992), we controlled also for the level of *group identification*. A sample item is 'When I talk about my team, I usually say we rather than they'.

Greer & Van Kleef (2010) noted that battles for power vary in low and high power teams. High power teams such as managerial teams (e.g., TMTs) are more sensitive to inequities in power (Eisenhardt and Bourgeois, 1988; Greer and van Kleef, 2010; Greer *et al.*, 2011; Siegel and Hambrick, 2005). That is, group interaction may likely to occur differently within the factory-line teams which are composed of the entry level employees than the *managerial teams*. Therefore, we controlled if a team is composed only of managers or not.

Preliminary Analyses

Regarding the decision to pool the data that were collected from Organization 1 and 2, we performed Chow break test which tests whether regression coefficients differ between two samples. The test results did not reveal any significant differences of coefficients between these organizations ($F(8,127) = .57$, p = ns.). Therefore, we pooled the samples from Organization 1 and 2.

Convergent and discriminating validity. Cronbach alpha values for psychological safety and team identification were higher than the conventional cut-off point of .75. However, for power distance orientation Cronbach alpha value was .57. Despite the low Cronbach alpha value, we kept power distance orientation since it was validated and used by earlier studies (e.g., Kirkman *et al.*, 2009).

We used confirmatory factor analysis to assess the discriminating and convergent validity of psychological safety, power distance orientation and team identification scales. We first tested a model in which all items loaded on the three corresponding latent constructs. The overall fit of the model to the data was adequate ($\chi^2 = 395.07$, $p < .001$, SRMSR = 0.07, RMSEA = .06 [.05, .08], CFI = .88). The factor loading of each item was significant at .001 level indicating the convergent validity. Furthermore, chi-square difference tests indicated that this model was a better fit than the alternative models where the following variables were combined: (a) psychological safety and power distance orientation ($\Delta\chi^2(2) = 314.16$, $p < .001$), (b) all the three variables as a single factor ($\Delta\chi^2(3) = 613.35$, $p < .001$), indicating the discriminating validity for those variables.

Interrater agreement and reliability. All of the variables were conceptualized at group level. Power distance orientation, psychological safety and team identification were measured via individual responses. In order to justify aggregation of the individual responses to the group level, we calculated the interrater agreement coefficient (r_{wg}). r_{wg} values were .90 for power distance orientation, .92 for team identification and .90 for psychological safety suggesting that team members strongly agreed in their ratings of these variables.

In addition, we would expect variation between-groups difference and within-group similarity in the ratings of psychological safety, team identification, and power distance orientation. We calculated the interclass correlation coefficients (ICC[1] and ICC [2], Bliese, 2000) to confirm these expectations. One-way analyses of variance suggested that the team member ratings of these constructs differed significantly between teams for psychological safety ($p < .001$) and team identification ($p < .05$), but not for power distance orientation. The ICC(1) was .06 for team identification, .09 for psychological safety and .02 for power distance orientation. The reliability of the group means was examined by calculating the ICC(2) coefficients. The ICC(2) values were .27 for team identification, .36 for psychological safety, and .13 for power distance orientation. Together with r_{wg} values, these results support the aggregation of individual team member responses to create team-level variables.

The measurement of power through influence rather than relying on the individuals' formal positions stems from our definition of power as the ability to influence. We contend that one's influence on others' strategic preferences may not be limited to hierarchical level although they may be related (Ibarra, 1993). Finkelstein (1992) reported positive and significant correlation between objective and subjective measures of individual power. Pay differences are often reported as objective measures of status and power in organizations (Anderson and Brown, 2010; Siegel and Hambrick, 2005). Therefore, we took the salary scales obtained from the Organization 1 as an objective proxy for individual power. Consistent with Finkelstein (1992), we found that salary scales are highly correlated with individuals' ratings of their peers (r = 0.55). These observations suggest that our measure is a good operationalization of individual power.

Individual power was measured via a single item asking all the other group members to rate an individual's influence. Such a dependence on a single item is common in the literature (see Anderson *et al.*, 2008; Venkataramani and Tangirala, 2010). Additionally, the research shows that team members in general have a shared perception over their group members' influence (Anderson and Brown, 2010). This is supported also in our data with an average interrater reliability index (r_{wg}) of .94, and interclass correlations of ICC(1) = .37 and ICC(2) = .81.

Table 3: Descriptive statistics and correlations between model variables

	Variable	Mean	SD	1	2	3	4	5	6	7	8
1	Strategic consensus	-0.62	0.13	1							
2	Power disparity	0.67	0.25	-0.133	1						
3	Psychological safety	3.95	0.33	-0.009	0.025	1					
4	Power distance orientation	2.44	0.24	-0.07	0.063	-0.046	1				
5	Managerial team	0.17	0.38	0.166*	-0.057	0.259**	-0.227**	1			
6	Team identification	3.67	0.32	0.263**	-0.002	0.178*	-0.084	0.348**	1		
7	Interdependence	0.2	0.2	-0.071	0.2*	0.328**	-0.075	0.218**	0.245**	1	
8	Company	0.28	0.45	-0.138	0.282**	0.263**	0.32**	-0.127	-0.198*	0.173*	1

N = 143, * p < .05 ** p < .01 (two-tailed)

Common method bias. Our dependent variable, degree of strategic consensus, and one of the independent variables, power disparity, is measured by the ratings collected from multiple respondents. Therefore, we do not suspect common method bias in our analyses. Nevertheless, we checked for the common method bias using Harmon's single factor test which is composed investigation of unrotated factor analysis (Podsakoff and Organ, 1986). The common factor had an eigenvalue of 2.6 accounting for only 32.5% of the variance which is far below the recommended 50% threshold (Podsakoff and Organ, 1986). Rest of the loadings with an eigenvalue above 1 accounted for an additional 29.1% of the variance. These results provide support against the common method bias.

Multicollinearity. Means, standard deviations, and pair-wise correlations are reported in Table 3. Strategic consensus was significantly correlated with team identification and managerial teams have higher consensus over strategic priorities. High correlations among the main variables of interest are not observed signaling that multicollinearity is not a potential problem.

Results

The hypotheses were tested using multiple regressions where all the continuous independent variables were standardized within each organization to eliminate the effects of organizational membership (Anderson *et al.*, 2008) and to increase the interpretability (Hayes and Matthes, 2009). Variance Inflation Factor indexes were far below commonly used cut off value of 10 revealing no multicollinearity problems.

Table 4: Results of Multiple Regression Analyses on Strategic Consensus

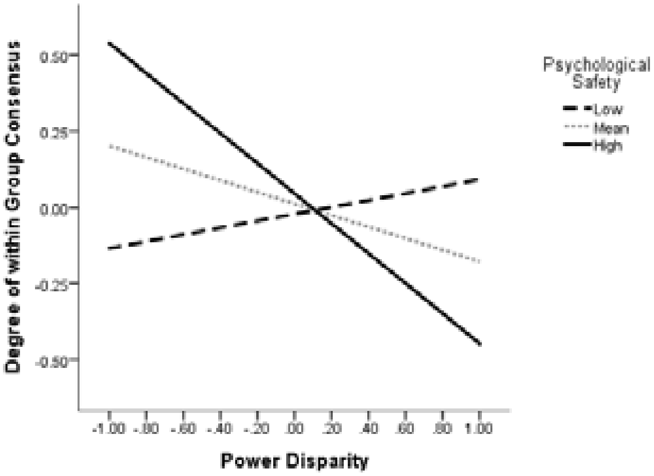
Variables	Model 1		Model 2	
	Beta	S.E.	Beta	S.E
Power distance orientation	-0.033	0.012	-0.043	0.011
Managerial team	0.082	0.031	0.067	0.029
Team identification	0.269**	0.012	0.288**	0.011
Interdependence	-0.16	0.012	-0.124	0.011
Company	0.003	0.028	0.057	0.026
Power disparity	-0.095	0.011	-0.191*	0.011
Psychological safety	-0.017	0.012	0.032	0.011
Interaction			-0.398**	0.008
R^2	0.114		0.258	
Adjusted R^2	0.068		0.214	
Change in R^2	0.114*		0.144**	
Overall F	2.482		5.822	
Df	7,135		8,134	
Maximum VIF	1.441		1.462	

† $p < .1$ * $p < .05$. ** $p < .01$, Standardized coefficients are reported.

Regression results are presented in Table 4. In Hypothesis 1, we argued a negative association between power disparity and the degree of strategic consensus. This hypothesis was supported because the coefficient is significantly negative when the interaction is included (see Preacher *et al.*, 2006). We can conclude that the higher power disparity among group members is the lower consensus they are going to have with their team mates. On the other hand, relationship between psychological safety and strategic consensus at the mean power disparity was positive but not statistically significant. Hence, Hypothesis 2 is not supported.

In support of our moderation hypothesis (i.e., Hypothesis 3), explanatory power of the regression significantly increased when the interaction term was included. Furthermore, the coefficient for the interaction effect was negative and significant. We found significant evidence for the moderating effect of psychological safety on the relationship between power disparity and strategic consensus. This finding provides support for Hypothesis 3.

Figure 5: Interaction Effect between Power Disparity and Psychological Safety



The interaction is visualized in Figure 5. When psychological safety is high in the group, an uneven distribution of power resulted in lower amount of consensus. On the other hand, under low psychological safety condition, higher power disparity led to higher degree of strategic consensus which is in line with the propositions of approach/inhibition theory. Moreover, the interaction was analyzed by simple slope tests according to the guidelines and tools provided by Hayes & Matthes (2009). For the simple slope one standard deviation above the mean was significant for high (β = -.493, p < .001), but not for the low psychological safety condition (β = .113, p = ns.).

Discussion

The research agrees on the importance of strategic consensus in the strategy and small group literatures (Finkelstein and Hambrick, 1996; Markoczy, 2001; Mathieu *et al.*, 2008). Yet, empirical investigation of how consensus is formed has been limited to mechanisms and schemes, rather than understanding the processes leading to consensus. The first contribution of this study is to respond to this lacuna. The data from 143 teams in two organizations operating in distinct industries underlined that power disparity is negatively associated with the amount of consensus. Additionally, we documented that the effect of power disparity and strategic consensus is contingent on the level of psychological safety.

An immediate theoretical implication emanating from the findings of this study is that different types of consensuses can emerge, depending on the level of psychological safety and power disparity. We find that higher consensus can be achieved either when power is concentrated and group members do not feel psychologically safe, or when power is evenly distributed and group members feel safe. Strategic consensus formed due to enforcement of a powerful member in low psychological safety condition is likely to be different than the consensus formed as a result of open discussion of strategic priorities between equally powered individuals in a safe environment. That is, different levels of safety and power disparity may result in different consensuses with the same degree, yet they may have discrepant outcomes.

Theoretical implications of this difference may explain equivocal findings in the literature regarding the consensus-performance relationship. To illustrate, some researchers found positive relationship between strategic consensus and performance (e.g., Bourgeois, 1980; Homburg *et al.*, 1999; Knight *et al.*, 1999; Rapert *et al.*, 2002), whereas others found evidence on the opposite direction (e.g., Bourgeois III, 1985; West and Meyer, 1998) and again some others did not find any relationship at all (e.g., West Jr and Schwenk, 1996; Wooldridge and Floyd, 1990). Indeed, those inconsistent findings are predicated on the non-linearity of the consensus and performance relationship by Priem (1990) and Kellermanns *et al.* (2005), who both call for taking additional moderators into account. Moreover, the managerial implications of this difference may direct organizations to consider power disparity and the amount of psychological safety before attempting to construct strategic consensus, say via strategic interventions.

Second, we extended the strategic consensus literature to the lower and middle organizational levels. This literature has been predominantly circumscribed to top management teams (Gonzalez-Benito *et al.*, 2012). For successful implementation of the strategy, several researchers have pointed out vitality of having consensus across the organizational levels (Kellermanns *et al.*, 2005; Macmillan, 1989; Wooldridge and Floyd, 1989; 2008). We contribute to this direction of research by shedding light on consensus formation in the lower and middle levels.

Third, this study suggests theoretical implications for the research in power by proposing psychological safety as a significant boundary condition in studying power disparity within a group. Qualitative studies and reviews frequently discussed the relationship between power disparity and psychological safety (e.g., Anderson and Brown, 2010; Edmondson, 1999; 2002; 2003; Eisenhardt and Bourgeois, 1988). We conceptualized psychological safety as a means to resist power holders' influence attempts. Our empirical investigation showed that psychological safety is a significant moderator for power disparity. This finding can explain conflicting proposals in the literature posed by the conflict and functionalist theories of power. Additionally, the findings highlight psychological safety as a potential mitigating factor of power disparity's detrimental effects (see Bunderson and Reagans, 2010).

Limitations and Future Research

One of the limitations of this study is its limited conceptualization of power as realized power in terms of influence. Conversely, Greer and Van Kleef (2010) formulated power with one's formal hierarchical position. Our measure of informal power was significantly correlated with formal power, and this correlation was consistent with the similar studies (e.g., Finkelstein, 1992). We do not argue whether researchers should favor one dimension of power over another. We rather call for future studies with a multidimensional conceptualization of power such that both informal and formal power bases as well as the realization of power as ability to influence are investigated simultaneously.

Second, this study focused on the groups only in two organizations both of which operate in the same country. In order to ascertain the generalizability of the findings, replications in different settings and culturally different organizations are needed. Third, French & Raven (French and Raven, 1959: 150) investigate 'power in terms of influence, and influence in terms of psychological change'. However, the data in this paper were cross-sectional. Thus, another limitation is that casual inferences can only be seen as suggestive. Future studies with longitudinal data are encouraged to observe the change in different time periods and attribute it to the power differences.

Last but not least, this study showed that different types of consensuses with the same degree may emerge due to the differences in psychological safety and power disparity within the group, and suggested that their outcomes may likely to differ. Future studies can test this prediction via a mediated moderation model where the consensus-performance link is investigated in the light of psychological safety and power disparity as antecedents.

Chapter 4

POWER STRUCTURES AND ADAPTATION: HOW TO DISTRIBUTE POWER WITHIN A GROUP

Introduction

Upper echelons of organizations (i.e., top management teams) continuously search for the optimal strategy that solve the multidimensional problem of increasing organization's performance by determining amount of R&D spending, degree of penetration to new markets, allocation of budget to marketing activities, etc. Each top management team (TMT) member has his/her own understanding of what the best strategy is. In their search for the optimal strategy, members are affected by their own previous findings and those found by other group members. Additionally, they can influence others in the team by exercising power. Consequently, existing power differences in upper echelons determine the strategic directions of organizations (Eisenhardt and Zbaracki, 1992; Finkelstein, 1992).

While power differences prevail in higher echelons, it is often contested whether steep power differences or egalitarian distributions of power offer higher organizational performance. On the one hand, the functionalist theory of power argues that teams with steeper hierarchies perform better (e.g., Lammers and Galinsky, 2009; Magee and Galinsky, 2008; Parsons, 1964) because a steep hierarchy creates a structure where the roles are clearer, uncertainty is reduced, and a race for promotion creates a psychologically rewarding environment (Halevy *et al.*, 2011). Recently, He and Huang (2011) found that organizations with steeply stratified boards perform better than organizations with egalitarian boards. On the other hand, conflict theory of power argue the contrary such that steep power differences within a group undermine group functioning through higher competition, conflict and political behavior, and lower team learning, trust, psychological safety and collaboration (Anderson and Brown, 2010; Edmondson, 2002; Eisenhardt and Bourgeois, 1988; Greer and van Kleef, 2010; Harrison and Klein, 2007; Siegel and Hambrick, 2005). For instance, Siegel and Hambrick (2005: 262) report that "CEO autocracy is a common precursor to corporate failure."

While both perspectives undoubtedly have merit, they fail to provide a dynamic understanding of power. Although structure of power differences (i.e., level of disparity) is likely to be more stable over time (Pfeffer, 1981), individuals' relative power may change. Simply, individuals can be promoted or fired causing a reallocation of power within the existing power structures. Furthermore, individuals deliberately attempt to change their power positions (van Dijke and Poppe, 2003), or external shocks such as implementation of a new information system may also lead to redistribution of power (Jasperson *et al.*, 2002). While a dynamic perspecive can capture the reality better, it also bridges discrepant theories of power (i.e., functionalist and conflict theories). We propose that the relationship between power disparity and performance is contingent on whether power is static or individuals gain power according to their competence.

This proposition requires a comprehensive definition of power that also includes its evolutionary dynamics. To do so, we first provide a comprehensive conceptualization of power which simultaneously integrates the various dimensions of power identified in the literature. Second, we go beyond the static understanding of power which has been dominant in both conflict and functionalist theories. Instead, we introduce endogenous power assignment where individuals' power may change dynamically according to their past performance. A dynamic understanding requires longitudinal and controlled observations of both power and performance where nonlinear and complex interactions emerge throughout the group process of finding the best strategy. As often employed in such complex theory building studies (Davis *et al.*, 2007; Harrison *et al.*, 2007), we employ agent-based simulations.

The advantage of our framework supported with agent-based simulations is its ability to discern differences in power that arise from positioning within formal and informal structures and to attribute these distinctions to longitudinal change in an individual's power attribute. Consequently, we make a number of contributions to power research. First, we reconcile and provide a finer-grained comparison of functionalist and conflict theories of power. Our findings demonstrate that comparisons between functionalist and conflict theories of power very much depend on whether power is assigned endogenously with respect to past performance. Second, we propose a conceptualization and an analytical operationalization that brings distinct but intertwined dimensions of power together. This enables scholars to advance the power research from a multidimensional perspective which has so far remained fragmented (Astley and Sachdeva, 1984). Third, we contribute to the organizations and strategy literature that utilize agent-based simulations. We advance earlier studies that defined power and power disparity in terms of formal authority (i.e., hierarchical position) and considered power as a static concept (e.g., Mihm *et al.*, 2010; Rivkin and Siggelkow, 2003; Siggelkow and Rivkin, 2005). Our multidimensional conceptualization of power captures both formal and informal power as well as the cases where individuals' power is endogenously changed with their past performance. While doing so, we propose a simulation technique that can model a group search for the best solution in line with three traditional paradigms of strategic decision making -the paradigms of bounded rationality, power, and garbage can (see, Eisenhardt and Zbaracki 1992).

Conceptualizing and Modeling Power

Determining the most suitable configuration of power differences that helps the TMT members in their 'intellective task' (Laughlin 1980) of finding the best strategic solution and adapting to its environment is the core research question of the present paper. To investigate this research question, we model the TMT's strategic search by integrating social psychology, social impact theory and strategic decision making "to produce a social psychology of behavioral strategy" with respect to power differences (Powell *et al.*, 2011: 1376). Note that our aim is not to derive an aggregated decision of the group as in social decision scheme theory (Laughlin and Adamopoulos, 1980; e.g., Laughlin, 2011; Tindale *et al.*, 2003), but model the group's search for finding optimal strategic solutions. In the following subsection, we begin constructing our model by conceptualizing power, examining the dimensions of power, and investigating the performance of various power structures.

Conceptualizing of power

Research on power is fragmented (Astley and Sachdeva, 1984), and conceptualizations of power range from the institutional, resource-based, and outcome-based perspectives of power to the interpretive, neo-structural, radical (such as Lukesian, Gramschian or Habermasian), and Foucaultian views of power (Clegg, 1989; Clegg *et al.*, 2006). This variation makes it difficult to provide a single comprehensive definition that incorporates different perspectives on power simultaneously (Fiske and Berdahl, 2007; Göhler, 2009). Despite this variety, most conceptualizations include one or more of the following dimensions: power as a relational individual capacity, behaviors emanating from having low or high power, and exercise of power as influence on others (Göhler, 2009; Lawler and Proell, 2009).

First, the researchers who conceptualize power as a *capacity* define power as the capability to do or achieve desired outcomes (Berdahl and Martorana, 2006; Brinol *et al.*, 2007; Keltner *et al.*, 2003; Overbeck and Park, 2006). This capacity can be due to multiple power bases such as control over resources (Emerson, 1962), network position (Astley and Sachdeva, 1984), or hierarchical position (see French and Raven, 1959 for an early discussion on power bases). Second, other researchers are interested in the *behavioral* mechanisms that stem from the power an individual has. For instance, studies on approach/inhibition theory pointed out that "high-power individuals talk more, interrupt more, are more likely to speak out of turn, and are more directive of others' verbal contributions than lower-power individuals" (Keltner *et al.*, 2003: 277). This research concludes that powerful individuals exert more force to influence low power members within the group and stay immune to influence attempts (Brinol *et al.*, 2007; Galinsky *et al.*, 2003; Halevy *et al.*, 2011; Magee and Galinsky, 2008). Third, some scholars are interested in the exercise of power. Power then is defined as the *ability to influence* other people within the group to bring about desired outcomes (French and Raven, 1959; Magee and Galinsky, 2008; Pfeffer, 1981; Yukl *et al.*, 1996).

The view of power as 'ability-to-influence' is associated with a rather causal and mechanic relationship within the social power structure such that power is exercised as a force to change people's cognitive and/or physical positions in the desired direction. For instance, French & Raven (1959: 150) define "power in terms of influence, and influence in terms of psychological change". For Weber (1978: 53), however, power is a potential that needs to be translated into influence, that is "power is the probability that one actor within a social relationship will be in a position to carry out his own will despite resistance". The causal relationship from power as a capability to its realization as influence is a vicious question: "[power] first has to exist before it can be exercised; but is it really power if it is not exercised over others?" (Göhler, 2009: 31). Therefore, we consider these dimensions of power as three separate but intertwined dimensions to conceptualize power.

Formalizing power

In this subsection, we formally model all three dimensions (i.e., capacity, behavior, and exercise) of an individual's power. Our aim is to derive the cognitive movement of an individual. This movement is due to the forces s/he is exposed to stemming from the power differences within the group.

Formal and computational approaches in strategy and organization research have benefited from models from natural sciences (e.g., NK modeling which is based on evolutionary biology). Similar to those studies that emphasize allegories between physics and organization science (e.g. McCarthy *et al.*, 2010: 606), we employ Newtonian mechanics to conceptualize power. For similar conceptualizations of power based on Newtonian mechanics see March (1966), Lewin (1951) and French (1956). Such an approach furnishes the necessary tools to capture all three dimensions of power simultaneously in a dynamic manner. More importantly, this choice is in line with the conceptualizations of early scholars in power research such as Hobbes, Locke, and Dahl who use the analogy between power and mechanical forces (Clegg, 1989).

For example, according to Hobbes, power is an "extension and elaboration of metaphors drawn from Galilean mechanics", and similarly Locke illustrates power in terms of mechanics exemplified by the motion of billiard balls (Clegg, 1989: 41). Dahl (1963: 7) argues that power is "very similar to those on which the idea of force rests in mechanics". These ideas are still traceable in the contemporary discussions of power. For instance, to Foucault (1990: 92) power is the "multiplicity of social force relations" where an individual is oppressed by the forces of social discourse and practices; at the same time s/he resists these forces within her/his potential. Moreover, Kanter (1979: 66) argues that "power in organizations is analogous in simple terms to physical power". Built upon these views, we model power in terms of Newtonian Laws. This approach enables us to cover the three dimensions of power: An individual's power as her/his capacity is represented by the mass of the individual, and the behavior as result of this capacity is expressed as the attraction and resistance in terms of Newtonian forces. Then, exercise of power can be expressed as the change on an individual's position.

Let an individual j be located at a point with its coordinates given by $D \times 1$ vector $\boldsymbol{x}_j$ where D is the dimensionality of the cognitive space that defines the domain of all solutions in which individuals search for the best solution. S/he has a mass m_j (power as capacity). The individual exerts a force in relation to her/his power on another individual at $\boldsymbol{x}_i$ whose mass is m_i (behaviors using the power capacity). This force acts along $\boldsymbol{x}_i$ and $\boldsymbol{x}_j$ and causes a change in the position of i such that the individual at $\boldsymbol{x}_i$ is accelerated toward the individual at $\boldsymbol{x}_j$ (exercised power). That is, the power embedded in the size of the mass is exercised through the gravitational force and brings out the desired change in the other individual's position. This force is proportional to the product of their mass and inverse proportional to the distance between individuals. This principle is known as Newton's Law of Universal Gravitation. In mathematical terms, the size of the force f_{ij} acting on individual i by j is

$$f_{ij} = G\frac{m_i m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^2}, \tag{1}$$

where $\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^2$ is the squared Euclidean distance between points $\boldsymbol{x}_i$ and $\boldsymbol{x}_j$, and G is the constant of proportionality that can be set without loss of generality to 1 in our context. The force, f_{ij}, on individual i due to j points from $\boldsymbol{x}_i$ toward $\boldsymbol{x}_j$. The direction of the force is given by

$$\boldsymbol{u}_{ij} = \frac{\boldsymbol{x}_j - \boldsymbol{x}_i}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|}. \tag{2}$$

Then, the directed force vector, $\boldsymbol{f}_{ij}$, is obtained by multiplying (1) and (2), that is,

$$\boldsymbol{f}_{ij} = f_{ij}\boldsymbol{u}_{ij} = \frac{m_i m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^2}\frac{\boldsymbol{x}_j - \boldsymbol{x}_i}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|} = \frac{m_i m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^3}(\boldsymbol{x}_j - \boldsymbol{x}_i). \tag{3}$$

In a group of N individuals, an individual's movements is accelerated or decelerated toward the total force exerted on him/her by $N-1$ individuals in the group. Within a system of N-individuals interacting only under mutual gravitation, the total force on an individual is expressed as

$$\boldsymbol{f}_i = \sum_{\substack{\boldsymbol{j=1} \\ \boldsymbol{j \neq i}}}^{\boldsymbol{N}} \boldsymbol{f}_{ij} = \sum_{\substack{j=1 \\ j \neq i}}^{N} \frac{m_i m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^3} \left(\boldsymbol{x}_j - \boldsymbol{x}_i\right) . \tag{4}$$

Acceleration as a result of the total force exerted on an individual is derived by utilizing Newton's Second Law of Motion. It states that the sum of the forces on an individual is equal to the product of his/her mass times his/her acceleration. For the individual *i*, using (3) and (4) yields

$$m_i \boldsymbol{a}_i = \sum_{\substack{j=1 \\ j \neq i}}^{N} \frac{m_i m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^3} \left(\boldsymbol{x}_j - \boldsymbol{x}_i\right) = m_i \sum_{\substack{j=1 \\ j \neq i}}^{N} \frac{m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^3} \left(\boldsymbol{x}_j - \boldsymbol{x}_i\right) \tag{5}$$

with $1 \leq i \leq N$. Dividing both sides by m_i gives the acceleration

$$\boldsymbol{a}_i = \sum_{\substack{j=1 \\ j \neq i}}^{N} \frac{m_j}{\left\|\boldsymbol{x}_j - \boldsymbol{x}_i\right\|^3} \left(\boldsymbol{x}_j - \boldsymbol{x}_i\right) . \tag{6}$$

Going back to the example of a TMT trying to find best solutions that maximize the profits, (6) states that a TMT member is attracted more toward cognitively closer and powerful members than to distant individuals with low power. The Newtonian approach to dynamic behavior in (6) can also be found in social decision schemes and social influence literatures. To illustrate, according to Latane's (1981: 344) first principle of social impact, the amount of impact experienced by an individual due to others is proportional to the power of a given influence source, its closeness, and the number of sources which is basically a restatement of (6). Similarly, social decision schemes theory also argues that the closer an individual's position to another, the more s/he will be influenced (Tindale *et al.*, 2003).

Although we conceptualized the movement of individuals in cognitive space, recent empirical studies argue that (6) is a relevant abstraction also in spatial space. For example, Koene et al. (2002) showed that leaders' influence is attenuated with increasing spatial separation. Note that the movement of an individual in (6) is defined in continuous space. The influencing and influenced individuals can meet at another in-between point which may have a different performance outcome. As a result, this formulation still leaves room for the discovery of new solutions as a result of group interaction.

The formalization of power outlined above is closely aligned with early conceptualizations of power, and is able to capture the multidimensional nature of power. To put this formalization and conceptualization to work, we define a set of power models. These models are categorized not only with respect to their disparity level, but also if power is assigned endogenously or not. This important feature extends earlier research on power which has been circumscribed to a static understanding of power. Using agent-based simulations, we aim to compare these models and to provide further insights into question of within-group distribution of power as posed by functionalist and conflict theories of power.

Models of power differences

This study investigates the performance of various power distribution scenarios within a group categorized according to the level of disparity and how power is appointed. *Power disparity* is "the differences in the concentration of power among group members" (Greer and van Kleef, 2010: 1032; Harrison and Klein, 2007). Additionally, we consider whether power is assigned exogenously or endogenously. A power model called *exogenous* if power is assigned to an individual ex-ante and does not change over time. A power model is *endogenous* if the initial power changes from one time period to another based on an individual's relative performance in the previous period. Table 5 summarizes the six power disparity models, ranging from the egalitarian to the autocratic model.

Table 5: Models of Power Differences Based on the Level of Disparity and Endogeneity

Power Model	Disparity Level	Description
Exogenous power models		***Power is assigned to an individual ex ante and does not change over time.***
Autocratic	High	There is only one powerful individual in the group. The rest of the group has low power.
Bureaucratic	Moderate	Individuals are ranked linearly between high and low power.
Egalitarian	Low	Every individual has low power.
Endogenous power models		***Power is assigned based on an individual's performance in the previous period.***
Meritocratic	High	The individual who achieves the best performance in the previous period receives high power in the following period. The other group members have low power.
Diarchic	[Moderate, High]	In addition to an exogenously assigned powerful individual, in each period the best performing individual in the previous period has high power. The rest of the group has low power.
Evolutionary	Moderate	Individuals are ranked according to their performance in previous period. The individual with the best solution becomes the most powerful in the next period, whereas the worst performer has low power, and rest of the group is ranked in between.

In the *egalitarian* model, each individual in the group has low power and the power structure is stable over time. The level of power disparity is low, and power assignment is exogenous. This model is similar to what Clegg et al. (2006) call a collectivist democracy where there is no social control or authoritarian hierarchy. Examples of this structure include voluntary associations and peer problem solving groups.

In the *autocratic* power model, which is called as "monocratic" by Weber (1978: 272), there is a single individual with high power, the 'powerholder', and rest of the group members have low power. Power is concentrated at a central body. As in the egalitarian model, power is exogenously assigned ex ante and does not change with time. Yet, disparity is high. Eisenhardt and Bourgeois (1988) document examples of this model with firms in the US microcomputer industry led by autocratic CEOs.

In the *evolutionary* model, each individual's power is assigned to his/her performance relative to others. In this model, power is not distributed according to a formal rank or position, nor is it concentrated in one individual, but formally equal individuals are stratified according to their expertise on a special topic. The evolutionary model is also called as neo-Weberian bureaucracy (Clegg et al., 2006) or collegial organization (Lazega, 2001). Examples of this model include law, architecture, and advertisement firms. The evolutionary model defines the power of individuals endogenously and dynamically with the following formulation: At time $t \in \{1, \dots, T\}$, let $\psi(\boldsymbol{x}_i^t)$ be the performance (fitness) of individual i located at $\boldsymbol{x}_i^t$, $\max_j \psi(\boldsymbol{x}_j^t)$ be the best performance, and $\min_j \psi(\boldsymbol{x}_j^t)$ be the worst performance of the group. Furthermore, let m^{high} and m^{low} indicate predetermined mass sizes of the individuals with the highest and lowest power. Then, the power of individual i is endogenously assigned as

$$m_i^{t+1} = \frac{\psi(\boldsymbol{x}_i^t) - \min_j \psi(\boldsymbol{x}_j^t)}{\max_j \psi(\boldsymbol{x}_j^t) - \min_j \psi(\boldsymbol{x}_j^t)} (m^{high} - m^{low}) + m^{low}, \qquad \forall i, j \in \{1, \dots, N\}. \quad (7)$$

According to (7), an individual obtains the highest power m^{high} if s/he finds the best solution in the previous period, and low power m^{low} if s/he is the worst performer. Since having zero power is neither meaningful nor realistic in organizational contexts, the minimum level of power is denoted with $m^{low} > 0$. The rest of the group receives a mass between m^{high} and m^{low}, which results in a moderate level of power disparity (Harrison and Klein, 2007).

In the *bureaucratic* model, ranking between high and low power is performed exogenously, and does not change over time. At period $t = 0$, we randomly rank the individuals, and assign power to each individual between m^{high} and m^{low} such that there is equal space between each individual. If an individual is appointed as the second most powerful individual at the beginning, s/he keeps this power status over time. This model is similar to Weber's (1978) rational-based bureaucracy that can be exemplified by hierarchically stratified governmental or military offices.

In the *meritocratic* model, the individual with the best solution in the previous period is assigned high power, while the rest of the group has low power. As a result of endogenous assignment of power, the disparity level remains high while the individual with high power may change from one period to another. Meritocracy can be found in firms where a CEO is succeeded internally by the 'star' performer. The meritocratic model implies the more competent (in the form of past performance) an individual becomes, the more influence s/he will exert on others. This implication is in line with the status characteristics theory which states that an individual who demonstrated high performance previously forms high performance expectation for the future and s/he will obtain more opportunities for participating in and influencing group decisions (Berger *et al.*, 1972; 1977; Bunderson, 2003).

Finally, the *diarchic model* denotes a hybrid model between the autocratic and the meritocratic model. In this model, there is still an exogenously assigned power holder whose rule does not change over time. However, there is another individual with high power who is endogenously assigned because s/he found the best solution in the previous period. The rest of the group members have low power. The disparity level of the diarchic model is slightly lower than that the autocratic and meritocratic models. Examples of diarchic model can be found in the firms where the founder and the CEO coexist or in the firms with strong a CEO and a chairman.

Simulation Model

Gathering empirical data for a detailed comparison of power models is a demanding task (see Harrison *et al.*, 2007). First, such a comparison requires longitudinal and controlled observations. For example, to compare the evolutionary and meritocratic power models, we need to observe each individual's power and ensure that individuals are assigned a power level that is a function of their performance. Second, nonlinear and complex interactions may emerge throughout the group process of finding the best solution. For such complex phenomena, agent-based simulation methods are regularly applied as powerful theory building tools in the organization and strategy literature to study behavior of groups and systems (Davis *et al.*, 2007). The essence of the agent based simulation method in this paper is to define the strategic decision making in terms of a search and group interaction with simple rules rather than directly imposing the outcome. The outcome of the process is then not self-evident, but emergent (Harrison *et al.*, 2007). Moreover, we draw the rules from extant literature to define group interaction and search.

Despite the rich opportunities offered by simulation methodology, simulation studies investigating power differences confined their focus mostly to formal hierarchies, decision rights, and control over resources (e.g. Mihm et al. 2010, Rivkin and Siggelkow 2003, Siggelkow and Rivkin 2005). However, today's organizations are increasingly characterized by formal and informal networks that surpass hierarchical layers, by transformational relationships replacing the carrot-and-stick coordination mechanisms and incentives, and by flatter organizational structures with capabilities and interconnected processes (Daft and Lewin, 1993; Siggelkow and Rivkin, 2005). Hence, an investigation of power structures in contemporary organizations should go beyond the 'formal design perspective' and take evolutionary dynamics and informal power structures into account. The present study does so.

The particle swarm optimizer

Several simulation methods are applied in the literature, such as system dynamics, NK modeling, cellular automata, genetic algorithms, and customized stochastic processes (Davis *et al.*, 2007). In this paper, we employed an agent-based simulation approach using an evolutionary computation technique called the particle swarm optimizer algorithm (PSO) introduced by a social psychologist Kennedy and an electrical engineer Eberhart (Kennedy and Eberhart, 1995). We chose the PSO as our agent-based simulation method because it first offers a formal representation of the group dynamics. Its representation of group search is in line with the three traditional paradigms of strategic decision making (i.e. the bounded rationality, politics and power, and garbage can paradigms) identified by Eisenhardt and Zbaracki (1992: 32) which are summarized as '[m]ost scholars believe that people are boundedly rational, that decision making is essentially political, and that chance matters'. Second, it models a group of individuals that are heterogeneous in terms of power, and forces of attraction and repulsion of these individuals via the law of gravitation. In this way, the interaction between individuals due to power differences is embedded in the search process.

The objective of the PSO is to search for the optimum of a fitness function over a *D*-dimensional search space through a group of several individuals. Note that our aim is not to develop a superior optimization algorithm, but to simulate group interaction and to compare the performance of different power disparity models from a search perspective. See Mihm et al. (2010) for a discussion between optimization and search in organizational design. In the PSO, each individual moves with a velocity which is updated in each period, and remembers the best position s/he has ever visited. Individuals in the search space are attracted towards the best location they have found so far individually, and the best location found by any of the group members. The success of the PSO depends on the number of individuals enrolled in the search, the complexity of the landscape, and a few tuning parameters (Kennedy and Eberhart, 1995).

Let us briefly formalize the PSO. The reader is referred to Clerc and Kennedy (2002) for further details. At time period (iteration) $t \in \{1, \dots, T\}$, the best performance reached by individual *i* so far due to her/his local search is defined as $pbest_i^t$ and the location of $pbest_i^t$ is $\boldsymbol{p}_i^t$. The value of the best performance found by the group so far is denoted as $gbest^t$ at position $\boldsymbol{g}^t$. For the maximization of $\psi(\boldsymbol{x})$ over $\boldsymbol{x}$, $pbest_i^t$ and $gbest^t$ are non-decreasing since they are updated only if a better solution is found. Individual *i* changes her/his position according to the velocity vector $\boldsymbol{v}_i^t = (v_{i1}^t, v_{i2}^t, \dots, v_{iD}^t)$. In the PSO, the velocity and location of each individual is updated at the time period $t + 1$ according to

$$\boldsymbol{v}_i^{t+1} = \phi \boldsymbol{v}_i^t + c_1\varphi_1(\boldsymbol{p}_i^t - \boldsymbol{x}_i^t) + c_2\varphi_2(\boldsymbol{g}^t - \boldsymbol{x}_i^t), \tag{8}$$

$$\boldsymbol{x}_i^{t+1} = \boldsymbol{x}_i^t + \boldsymbol{v}_i^{t+1}, \tag{9}$$

where ϕ is the inertia weight set to some predefined value. The second term on the right hand side of (8) indicates the acceleration due to the local search by individual *i,* and the third term is the acceleration due to the global search. Parameters c_1 and c_2 are the acceleration constants for local and global search, respectively. To add randomness to the group search, φ_1 and φ_2 are independent uniformly distributed between 0 and 1. Together with c_1 and c_2, they govern the strength by which an individual is attracted to his/her best location $\boldsymbol{p}_i^t$, and to the overall best location $\boldsymbol{g}^t$ found by the group so far. At iteration *t*, the velocity is updated according to its current velocity affected by the inertia and to the previously found best positions by the individual and the group which is multiplied by the acceleration constants and random terms. The individual's position is then updated using her/his current position and newly updated velocity. The selection of parameters is discussed in a later section.

Equation (8) shows that the movement of an individual is determined by the current velocity and position, the best solution found due to his/her local search, and the best solution by the group. To include power and power differences to the search, we extend the standard PSO with a third element, which is the total gravitational force exerted on an individual due to power differences as formulated in (6). Hence, when (6) and (8) are inserted into (9), the displacement in the PSO algorithm becomes,

$$\underbrace{\boldsymbol{x}_i^{t+1} - \boldsymbol{x}_i^t}_{\text{Displacement}} = \underbrace{\phi \boldsymbol{v}_i^t}_{\text{Inertia}} + \underbrace{c_1 \varphi_1 (\boldsymbol{p}_i^t - \boldsymbol{x}_i^t)}_{\substack{\text{Attraction} \\ \text{towards the} \\ \text{personal best}}} + \underbrace{c_2 \varphi_2 (\boldsymbol{g}^t - \boldsymbol{x}_i^t)}_{\substack{\text{Attraction} \\ \text{towards the best} \\ \text{found in the group}}} + \underbrace{c_3 \varphi_3 \sum_{\substack{j=1 \\ j \neq i}}^{N} \frac{m_j}{\|\boldsymbol{x}_j - \boldsymbol{x}_i\|^3} (\boldsymbol{x}_j - \boldsymbol{x}_i)}_{\substack{\text{Attraction due to} \\ \text{the gravitational} \\ \text{force exerted by} \\ \text{others}}}, \tag{10}$$

where c_3 is the acceleration constant of the acceleration due to the total gravitational force exerted on an individual, and φ_3 is uniformly distributed between 0 and 1. Parameters c_1, c_2 and c_3 have real behavioral interpretations such that they serve as weights for personal, social, and power cues. They affect the how much each cue affects individual search.

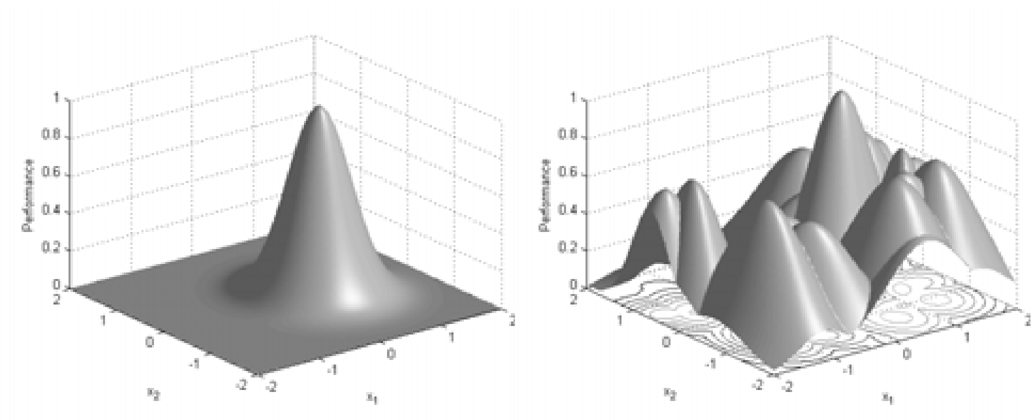
Note that (10) is in line with the strategic decision making paradigms proposed by Eisenhardt and Zbaracki (1992): the movement of an individual is influenced by (a) the best solution s/he has found so far as a result of his/her personal search and the best solution found by any member of the group (i.e., the bounded rationality paradigm), (b) social influence due to power differences which is proportional to the power and disproportional to the distance (i.e., the politics and power paradigm), and (c) there is still room for pseudo-randomness in the search (i.e., the garbage can paradigm). We have argued that equation (6) resonates with Latane's social impact theory. Similarly, (10) is in line with dynamic social impact theory (Nowak *et al.*, 1990) where the social impact emerges through recursive and iterative group interactions. We extend this line of research such that an individual's and thus the group's strategic direction is not solely influenced by the sum of total forces but also by the individual and group search for the best strategic alternatives which together with power better captures strategic decision making process (Eisenhardt and Zbaracki, 1992).

Fitness function and the landscape roughness

Anderson and Brown (2010) emphasized that relative performances of different power distributions are contingent on the environmental complexity. Hence, we compare the power models under different complexity levels. Various meanings have been attributed to complexity in strategy and organization design literature (Siggelkow and Rivkin, 2005: 103). We support the view that a complex problem is one which "has many plausible solutions although it is difficult at the outset to judge which approach will yield good results" (Lazer and Friedman, 2007: 673). For example, 'complex' problems with many plausible solutions include strategic management of a team or an organization, new drug or software development, and new product design.

Figure 6: Example Landscapes Created Using the Gaussian Landscape Generator[6]

a. b.



For each level of problem complexity, we need to "produce an arbitrarily large number of statistically identical problems for the simulated agents to solve" (Lazer and Friedman, 2007: 673). A problem is then a fitness function $\psi(\boldsymbol{x})$ representing, for example, performance, profit, or innovations that individuals maximize for collective group performance. For this task, we utilize the Gaussian landscape generator (Gallagher and Yuan, 2006). One of the advantages of using this landscape generator compared to classical test problems is that complexity is captured

[6] The optimum is assigned to 1, and the highest local optimum is 0.75. Figure 6a (left) is created using γ =1 components, and the Figure 6b (right) is generated with γ =30 components.

by a single parameter (i.e., number of Gaussians). Another is that a large number of landscapes with similar structure can be generated. A third important advantage is that it allows the creation of a continuous problem space. For a more comprehensive discussion on the merits of the Gaussian landscape generator compared to other commonly employed generators such as the NK landscape generator and bit-string multimodal landscape generators, we refer to Gallagher & Yuan (2006).

The landscape generator consists of a preselected number of multivariate normal distributions (i.e., Gaussian functions) with uniformly distributed means over a fixed *D*-dimensional space and varying covariance matrices. The height of each Gaussian is also random except the best one, whose value is set to ψ^* and the ratio *r* between the best and the second best is $r\psi^*$. Then, this landscape generator is simply defined as the maximum value over all Gaussians. The main parameter of interest is the complexity level of each landscape γ defined as the number of Gaussians. Note that when $\gamma = 1$, a rather simple unimodal landscape (only one global optimum with no local optima) is created. The number of peaks, that is, the number of local optima, increases with γ such that the actual number of local optima will be less than or equal to γ due to the possibly overlapping Gaussian components. Figure 6a illustrates a landscape created with $\gamma = 1$ and Figure 6b with $\gamma = 30$ Gaussians in a two dimensional space within the range of [-2, 2]. Clearly, finding the optimum in Figure 6a is much easier than doing so in a complex landscape, such as the one depicted in Figure 6b where there are many local optima and irregular ridges.

Experimental Setting

To compare the six power models summarized in Table 5, we set up a main simulation experiment and three follow up experiments for robustness checks. We begin with explicating the setting in Experiment 1.

Simulation experiment 1 compares power models under varying complexity levels with respect to two outcome variables: Performance and convergence. Performance of a power model is defined as the best function value $gbest^T$ reached by the group at the final iteration *T* of a simulation run. We alternatively measured group performance as the mean and median of individual performances, and obtained qualitatively similar results. Similarly, the convergence t^*, is defined as the iteration number when the group converged to this performance level, $gbest^T$. To be able to see the whole trajectory of the individuals for each of the power models, we allowed the algorithm to continue after achieving convergence at t^*, and only to stop when the maximum number iterations T is reached.

A landscape was created for a given complexity level by using the Gaussian landscape generator between [-2, 2]. Complexity levels of the landscapes varied from low (γ = 1) to high (γ = 30). Global optimum ψ^* and the highest second best $r\psi^*$ were set as 1 and 0.75 respectively. Then, individuals were randomly positioned in the landscape and random initial velocities drawn from the uniform distribution were assigned. Each power model was run on the same landscape, with the same initial positions and velocities. Hence, any observed difference in performance and convergence can be attributed to the power models only. To smooth out random variations, we created S = 2000 landscapes for each complexity level.

Group size was set at 10 individuals. Regarding the values of power, m^{high} was defined as a mass of 2, whereas low power individuals had m^{low} of 0.1. The maximum number of iterations T was set to 1000. Additionally, we focused only on a D = 5 dimensional space. Note that in NK modeling, the dimensions of the landscape complement each other and thereby determine the roughness (complexity) of the landscape. In contrast, complexity in this paper is controlled through the number of components γ in the Gaussian landscape generator. Furthemore, in the PSO the relationship between dimensions of the landscape is sustained only through the objective function as the locations of the best solutions (Trelea, 2003).

Table 6: Parameters Used in Simulation Experiments

Parameters	Experiment 1	Experiment 2	Experiment 3	Experiment 4
Varying factors				
Range of number of complexity levels (γ)	1,2,…,30	5, 15, 25	5, 15, 25	1,2,…,30
Number of individuals (N)	10	5, 10, 25, 40	10	10
High power (m^{high})	2	2	0.2, 0.8, 1.4, 2	2
Acceleration coefficient (c_3)	2	2	2	0, 0.4, 0.8, 1.2, 1.6, 2, 2.4, 2.8, 3.2, 3.6, 4
Fixed factors				
Number of landscapes per complexity level	2000	2000	2000	2000
Low power (m^{low})	.1	.1	.1	.1
Dimensionality (D)	5	5	5	5
Range of search space	[-2,2]	[-2,2]	[-2,2]	[-2,2]
Value of global optimum (ψ^*)	1	1	1	1
Value of highest local optimum (r)	.75	.75	.75	.75
Number of landscapes per complexity level	2000	2000	2000	2000
Number of iterations (T)	1000	1000	1000	1000
Maximum velocity (v^{max})	2	2	2	2
Acceleration coefficients (c_1, c_2)	1.494	1.494	1.494	1.494
Inertia weight (ϕ)	.729	.729	.729	.729

PSO parameters are usually either determined empirically or set equal to widely used default values (Bartz–Beielstein *et al.*, 2004). We employed the latter approach and followed the guidelines suggested by Clerc & Kennedy (2002) on how PSO parameters can be chosen (see also Trelea, 2003). These authors suggest taking acceleration coefficients for local, c_1, and global search, c_2, equal. Similarly, we set the acceleration coefficient for the gravitational attraction, c_3, to be equal to the other two acceleration coefficients. The equal acceleration coefficients enable a balance between exploitation due to individual search, exploration due to group search, and movement due to gravitational forces.

In addition to simulation experiment 1, we performed simulation experiments 2, 3 and 4 as robustness checks to investigate the effect of group size, difference between high and low power, and acceleration coefficient for gravitational attraction. See Table 6 for the full list of selected parameters used in each simulation experiment.

Next section presents the results of simulation experiment 1. Robustness analyses performed in simulation experiments 2, 3, and 4 are presented in the appendix.

Results

The primary interest is to see whether the overall means between power models indicate differences on the two outcome variables: performance and convergence. Table 7 presents deviations from the overall mean and standard deviation of the means per power model. These descriptives show that the meritocratic and bureaucratic power models are the highest and lowest performers. Moreover, the evolutionary model on average requires the shortest time to converge whereas the meritocratic model takes the longest. To test whether these means statistically differ, and to study the differential effects for specific conditions or their interactions, we performed MANCOVA by using power models as factors and complexity levels as covariates. Under the assumption that the error terms of the two dependent variables (performance and convergence) are independent, each dependent variable could be analyzed separately by running two ANCOVAs. However, in this case the covariation of performance and convergence measures cannot be taken into account and the probability of making a Type I error becomes higher. Therefore, we preferred MANCOVA.

Table 7: Descriptive Statistics[7]

	Model	N	Performance Deviation from the Overall Mean	SD of Mean	Convergence Deviation from Overall Mean	SD of Mean
Exogenous	Autocratic	60000	.003	.0034	20.58	.0081
	Bureaucratic	60000	-.015	.0034	-19.80	.0074
	Egalitarian	60000	.001	.0034	-1.80	.0077
Endogenous	Meritocratic	60000	.015	.0035	29.68	.0082
	Evolutionary	60000	-.009	.0034	-33.30	.0072
	Diarchic	60000	.004	.0034	4.62	.0078
	Total	360000	0	.0014	0	.0013

[7] 2000 landscapes were created for each of 30 complexity levels.

Table 8: Pairwise Comparisons of the Power Models with Respect to Performance and Convergence[8]

		Performance						Convergence					
	Model	1	2	3	4	5	6	1	2	3	4	5	6
Exogenous	1. Autocratic	0	.018*	.003*	-.011*	.012*	.001	0	40.38*	22.38*	-9.11*	53.88*	15.96*
	2. Bureaucratic	-.018*	0	-.016*	-.030*	-.006*	-.019*	-40.38*	0	-18.00*	-49.48*	13.50*	-24.42*
	3. Egalitarian	-.003*	.016*	0	-.014*	.010*	-.003*	-22.38*	18.00*	0	-31.49*	31.50*	-6.42*
Endogenous	4. Meritocratic	.011*	.030*	.014*	0	.024*	.011*	9.11*	49.48*	31.49*	0	62.98*	25.06*
	5. Evolutionary	-.012*	.006*	-.010*	-.024*	0	-.013*	-53.88*	-13.50*	-31.50*	-62.98*	0	-37.92*
	6. Diarchic	.001	.019*	.003*	-.011*	.013*	0	-15.96*	24.42*	6.42*	-25.06*	37.92*	0

[a]

[8] Model in the row minus model in the column, †$p < .01$; *$p < .001$.

Wilk's Lambda was significant for the main effects and the interaction effect (p < .001). Results showed that there are significant differences between power models, and complexity is a significant covariate on performance (F(5, 359998) = 184.27, p < .001; F(1, 359998) = 36.16, p < .001) and convergence (F(5, 359998) = 86.71, p < .001; F(1, 359998) = 1110.63, p < .001). We also found a significant interaction effect of the power model and complexity on performance (F(5, 359998) = 51.73, p < .001), and on convergence (F(5, 359998) = 4.27, p = .001.).

Table 8 summarizes the results of multiple comparisons of the differences of the main effects of the power models. Similar to our observations in Table 7, the meritocratic model has a better performance than the others, however together with the autocratic model it takes the longest time to converge to a solution. Conversely, the bureaucratic and evolutionary models perform worse than the others, but the evolutionary model requires shorter time to converge compared to all the other models.

One of the drawbacks of statistical approaches in randomly generated large data sets is that even the smallest effects can turn out to be significant as the standard error becomes very small due to the large number of points sampled (Harrison *et al.*, 2007; Rardin and Uzsoy, 2001). To complement the statistical analyses and to provide further insights, the results are visually presented in terms of a modified version of performance profiles (Dolan and Moré, 2002). Let $\psi_{s,\omega}$ be the performance for simulation run s and power model ω. Then, the performance ratio is defined as

$$\tau_{s,\omega} = \frac{\psi_{s,\omega}}{\max\limits_{\omega} \psi_{s,\omega}}. \tag{11}$$

This ratio provides a comparison of each power model with respect to the best performing power model on a given simulation run. In case of comparison with respect to convergence, minimum expression is replaced by maximum. To get an overall comparison of each power model over all simulation runs, we define Φ_{ω} as the proportion of power model ω of being within λ% range of the best performing power model, that is,

$$\Phi_{\omega} = \frac{1}{S} \#\{\tau_{s,\omega} \geq 1 - \lambda;\ s = 1, \ldots, S\}, \tag{12}$$

where λ is the range to the best performing model and S is the total number of landscapes created, and thus is the number of simulation runs. In our case, we limit our focus to the 5%

range of the best performing model by setting λ to .05. For convergence, the term $1 - \lambda$ changes to $1 + \lambda$, and direction of the inequality is reversed. Figure 7 shows the percentage of cases that a power model obtains the best performance, or if it is within the 5% range of the power model with the highest performance for all six power models under varying complexity levels. Power models with larger proportion Φ_{ω} are preferred over the rest (Dolan and Moré, 2002).

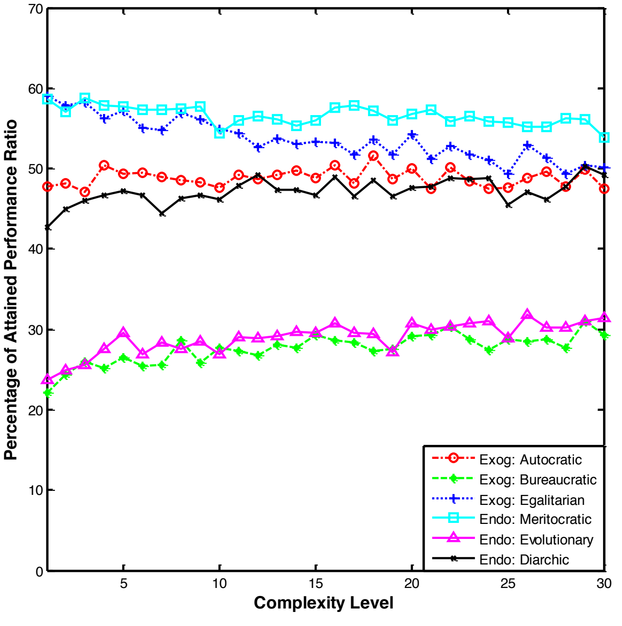
When power is assigned exogenously, in Figure 7 we observe a main effect of the power models and an interaction effect between the power models and complexity in terms of performance. The autocratic and egalitarian models outperform the bureaucratic model. The egalitarian model, having a low level of disparity, performs better than the autocratic model for low and moderate complexity levels; however, this difference disappears as the landscapes become more complex. The results suggest that the relationship between group performance and level of disparity is not linear in terms of the level of disparity. The relationship between complexity level and convergence of exogenous power models does not reveal any clear differences between the six power models.

When power is assigned endogenously, we observe a large main effect of the power models and a slight interaction effect between the power models and complexity on performance, and a main effect on convergence. The diarchic and meritocratic models, which have a higher degree of power disparity, perform better than the evolutionary model for all complexity levels. However, the evolutionary model outperforms the other two models in terms of convergence. The meritocratic model, which has a higher degree of disparity than the diarchic model, has a better performance. The relationship is reversed with respect to convergence.

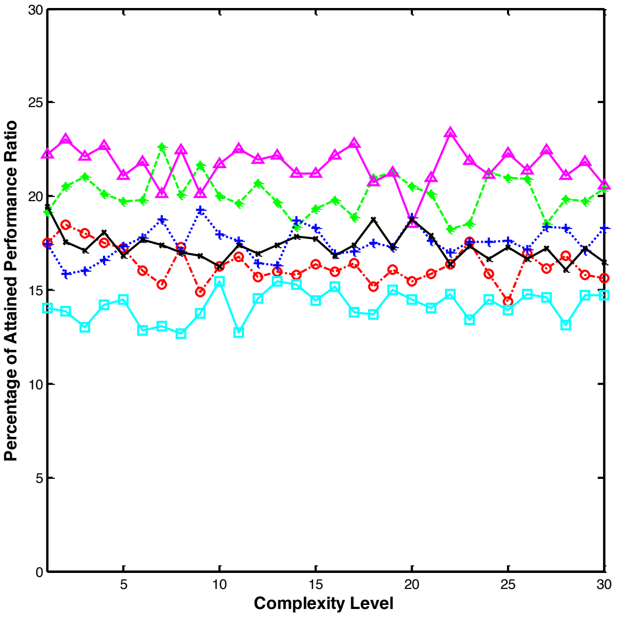
Figure 7 also compares all the power models simultaneously. When the environmental complexity is low, the meritocratic model, which has endogenous power assignment and high power disparity, performs the same as the egalitarian model where power disparity is the lowest. However, the meritocratic model outperforms all the others as the landscape becomes more complex. Furthermore, the difference between the diarchic, autocratic, and egalitarian models disappears with complexity. In all cases, the models with moderate disparity levels (e.g., bureaucratic and evolutionary) performed the worst. Finally, the results do not show a clear distinction between the six models in terms of convergence.

Figure 7: Comparison of Power Models in Terms of Performance and Convergence

a. Performance



b. Convergence



Let us reconsider the earlier example of a TMT searching the idea space for the optimal solutions. TMT members' strategic search is affected by their past solutions, solutions found by the group, and power differences. Imagine that a TMT member, Mary, is located near the strategic solution that gives the global optimum. If Mary is the CEO, i.e. the most powerful, she can influence others in finding the optimal solution quickly. This is a very desirable situation for the group. However, no one is always right. There may be cases where Mary is located at a local optimum. In these cases, Mary will derail others from the right direction of finding the solution towards herself. In case of low and moderate complex landscapes where the optimum solution is easier to be discovered by the other group members, this is basically why the egalitarian model performs better than the autocratic model when power is assigned exogenously, i.e. Mary stays as the CEO throughout out the search.

The meritocratic model avoids the cases in which incompetent individuals harness power. A meritocratic model ensures that at each decision moment powerful individual steers the TMT toward the right strategic direction. Although the merits of such a model are clear when the problem landscape is complex, the meritocratic model does not add value in case of low complexity. Because the problem space is simpler, Mary and every other group member can find the best strategy rather easily by themselves. Hence, there is no need to depend on the most competent group member. These results show that power can be both beneficial and detrimental depending on the competency of the powerholder. On the one hand, if power is concentrated in the hand of an incompetent group member, the results will be destructive to the group performance. On the other hand, a competent group member with power can enhance the group performance. Hence, it is important to recognize that meritocracy means not only giving all the power to the most competent, but also doing so dynamically.

The main mechanism in our results is how much Mary and other group members are influenced by power differences. As the group size increases, relative power of the most powerful individual is reduced. Simulation experiment 2 compared power models with respect to varying group size. Results of simulation experiment 1 remained qualitatively similar except for the large groups. When groups were large, the egalitarian model provided superior results than the meritocratic model under low complexity, and performed equally well under high and moderate complexity. Furthermore, by definition, the difference between m^{high} and m^{low} measures the relative power. The steepness of the power disparity was allowed vary in simulation experiment 3. In line with our expectations, as the steepness of the power disparity decreased the differences between power models became smaller. Lastly, the weight of cue on power differences, c_3, in relation to personal and group search cues, c_1 and c_2, determines how much an individual is influenced by the power differences. Simulation experiment 4 checked the robustness of the findings in simulation experiment 1 by varying c_3. Since c_3 affects all power models equally, we did not observe relative performance differences between power models. Detailed discussion of and results from these experiments are presented in the electronic companion.

Discussion

Despite the high consensus on the importance of power (Bunderson 2003, Fiske 1993, Keltner et al. 2003, Lammers and Galinsky 2009, Russell 1938, Winter 2009), there is less agreement on how to conceptualize it (Astley and Sachdeva 1984, Jasperson et al. 2002). Using the analogy between Newtonian mechanics and power, which was frequently mentioned by early scholars in power research, we conceptualized power as (1) a relational individual capacity (2) the behavior that emanates from this capacity, and (3) the exercise of this capacity in the form of influence on others (Göhler, 2009; Lawler and Proell, 2009). This conceptualization does not only bring together different dimensions of power (i.e., power as a capacity, behaviors emanating from this capacity and exercise of power as influence), but also widens up the avenues for comprehensive analytical investigations. We benefited from an agent-based simulation design which allowed for a longitudinal analysis and for the detection of complex interactions and nonlinearities. We were able to present a comparative investigation of power differences in terms of their disparity level and endogenous assignment of power.

As a result of advancing power research through a multidimensional conceptualization of power and consideration of endogenous power assignment, this study has added further insights into the contradictory results in the literature proposed by functionalist and conflict theories of power (see Anderson and Brown 2010, Lammers and Galinsky 2009 for reviews). When exogenous power models are considered, our results provided further evidence against the functionalist theory which favors high power disparity over egalitarian distribution of power, and contributed to the growing literature in contingency theories of power (e.g., Anderson and Brown 2010). We found that low power disparity leads to better performance except in highly complex environments. Additionally, functionalist theory argues in favor of competency based assignment of power. When power was assigned endogenously, we found support for the functionalist argument that high power disparity leads to high performance.

When endogenous and exogenous power models are considered together, our results showed that under moderate and highly complex landscapes, the egalitarian model was outperformed by the meritocratic model which has high power disparity. However, we observed no significant differences when the complexity of landscape was low. These results advise concentration of power only if the organization is capable of successfully detecting the 'stars'. If there is no such capability and the environment is not complex, our results show that the egalitarian power model yields similar outcomes as the meritocratic model. Another interesting result was that models with a moderate level of power disparity (i.e., evolutionary and bureaucratic models) led to the least performance, regardless of the problem's complexity level and whether power was assigned endogenously or not. However, models with moderate power disparity demonstrated slight benefits in terms of faster convergence. All in all, this study suggests that research on distribution of power should consider both the level of power disparity and the evolutionary dynamics of power appointment.

Our study has implications for formal approaches in organizational and strategic management research. Studies that implemented agent-based simulations were limited to a formal design perspective where power and power differences were only analyzed with respect to hierarchies. In today's organizations, informal forms of power are pervasive, and an individual's power may change from one period to another as a function of his/her past performance. Such an evolutionary understanding of power has not been sufficiently addressed in this body of research. We contribute by considering cases with static hierarchical structures as well as those where power is allowed to be informal and dynamic.

Studies in formal organizational design perspective presented divergent findings in terms of convergence times of various power models. For instance, some studies using formal approaches in the organizational design noted that a fully centralized hierarchy converges to a solution faster than a decentralized hierarchy, in expense of lower performance (Rivkin and Siggelkow 2003, Siggelkow and Rivkin 2005). By contrast, Mihm et al. (2010) recently showed that a decentralized hierarchy, where decision making is delegated to the lowest levels in the hierarchy, yields faster convergence as well as better performance. Sting et al. (2011), on the other hand, did not find any significant differences in terms of convergence among leaders with varying knowledge under a collaborative search setting. We found slight convergence differences between six power models with respect to complexity, only when power was endogenously assigned. In case of exogenous power assignment, the results did not reveal clear distinctions with regard to convergence. These results call for future research to further examine the relationship between convergence and organizational forms.

Lastly, this paper contributes to formal approaches in organization and strategy research by proposing a novel agent-based simulation technique, namely the particle swarm optimizer (PSO). To our knowledge, this paper is one of the first studies that apply the PSO in strategy and organization literature (see Poli et al. 2007 for taxonomy of studies that use the PSO). We modified the original PSO technique, so that it formally presents strategic decision making. While doing so, the PSO takes into account three traditional strategic decision making paradigms (see, Eisenhardt and Zbaracki 1992). Developing tools such as the PSO increases the alternatives readily available to the scholars in strategic management, organization design and power fields.

Limitations

Given the fact that this study utilizes agent-based simulation methodology, a natural limitation is the external validity of the findings. Inherent in this approach is the trade-off between parsimony and accuracy (Davis *et al.*, 2007). That is, the endeavor of crafting a complex phenomenon like power into a rather simple model may cause deviations from the reality. For instance, we utilized the laws of nature to analyze power, which is a social phenomenon. The propositions of this study as well as the premise that the laws of nature are applicable to organizations need to be tested empirically in laboratory and field settings.

Additionally, any simulation model is an abstraction, yet a useful tool to understand complex real-world phenomena such as power. Agent-based simulations are limited in providing a sterilized investigation of group interaction. For example, we did not consider acquiescence of individuals (Kelman, 1958) or commitment to or implementation of the found solutions. That is, we did not consider cases where a manager, for example, complies with a solution as a result of the influence of other managers, but does not identify with or internalize this choice to implement. Moreover, individuals may differ in their willingness to accept inequalities of power. Hofstede (1986) raised this point by arguing that power is a cultural element. Similarly, powerholders can vary in their attitudes towards individuals with low power (Halevy *et al.*, 2011).

To sustain the parsimony of the simulation model, we overlooked these aspects.

We considered a dynamic framework where individuals' power can change with their past performance. We assume that performance is observable with certainty. First, an individual may have high power not necessarily only because s/he has been a 'star' performer, but because s/he has other competencies such as leadership and managerial skills. Nevertheless, the status characteristics theory, for instance, argues that power in a decision making group is distributed according to the 'performance expectations' that individuals hold about themselves and other members (Berger et al. 1972, Bunderson 2003). That is, in such groups, an individual's influence in the group is derived from the group members' belief that s/he is going to perform higher and to help achieve the group's goals which is signaled by his/her past performance. Second, knowing the outcome and performance of a task with certainty may not be always true. Nevertheless, there is still a subset of tasks where the outcome and performance is known. For example, Laughlin (1980) defines a continuum of tasks ranging from intellective to judgmental tasks. In the former there is a demonstrably correct answer, whereas in the latter no such solution exists or is immediately available.

Future studies can extend our model in various directions by relaxing some of its assumptions as well as by adding new futures in the model. For example, various network structures can be embedded in the group. The group interaction in our model assumes that once a better performance level is reached, this level and its location is common knowledge. However, in an organization which is organized in prototypical pyramidal hierarchy, information from lower levels needs to move to the top until it reaches the leader (Anderson and Brown, 2010; Mihm *et al.*, 2010; Siggelkow and Rivkin, 2005). Such a flow may cause information delays and distortions. Additionally, the friction and speed of transmission between bottom-up and top to bottom information flows is likely to differ. Various power models can be compared under different network structures varying in terms of the centrality of the leader, and where the speed of information flow is also manipulated. Moreover, individuals in our model are assumed to perfectly recall their past performance and the locations they visited. The model can be extended by introducing individuals with imperfect recall. Lastly, in this paper once a landscape is created, it does not change during the simulation runs and individuals are able to calculate the performance of a point on the landscape with certainty. However, in real organizational settings, external shocks may occur which in return change the landscape, and uncertainties in assessing the performance of a location exist. Therefore, the model in this paper can be further extended by introducing shocks, landscape changes and uncertainty.

Last but not least, future research can investigate the applicability of the power models. For example, our results favored the meritocratic model in high and moderate complexity levels. Yet, Castilla and Benard (2010) showed that meritocracy in the workplace causes gender biases where male employees were unfairly rewarded compared to females. The authors concluded that implementation of meritocracy can be more difficult than expected, and unforeseen side effects may emerge. Therefore, in the light of the findings of this study, a potential avenue for future research is to investigate the conditions that are necessary to implement and to utilize the benefits of respective power models.

Conclusion

The present study provides further insights into the discussion of power in the context of degree of disparity and endogenous power assignment where informal power structures and evolutionary dynamics are present. This study clarifies the contingencies between functionalist and conflict theories of power such that the choice between different levels of power disparity depends on the ability to assign power according to past performance. Furthermore, the analytical and multidimensional conceptualization of power proposed here can help research break new ground in more fine-grained and extended analyses of power.

Appendix

In this appendix, we investigate whether group size, the difference between high and low power, and magnitude of acceleration coefficient of attraction due to power difference influence the comparisons between the six power models. For parsimony, we narrowed our focus to three complexity levels, low, moderate and high, where landscapes were created by 5, 15, and 25 number of Gaussian components.

Experiment 2: The effect of group size

We ran a MANOVA with 6 (power models) × 3 (low, moderate, and high complexity) × 4 (group size of 5, 10, 25, and 40 individuals) where performance and convergence were the two outcome variables. Wilk's Lambda for the main effect of group size, and two-way interactions of group size with power models and complexity was significant ($p < .001$), but not for the three-way interaction (p = n.s.).

Results revealed significant main effects of group size, our main variable of interest, both on performance and convergence ($F(3, 143928) = 6253.03$, $p < .001$; $F(3, 143928) = 465.44$, $p < .001$). Furthermore, the interaction effects between the power models and group size on performance ($F(15, 143928) = 6.37$, $p < .001$) and convergence ($F(15, 143928) = 59.06$, $p < .001$), and between complexity and group size on performance ($F(6, 143928) = 11.00$, $p = < .001$) were significant. We found non-significant effects for the three-way interaction between power model, group size, and complexity on performance and a slightly significant effect on convergence ($F(30, 143928) = .59$, p = n.s.; $F(30, 143928) = 1.36$, $p < .1$), the two-way interaction between the power models and complexity on convergence ($F(15, 143928) = .92$, p = n.s.), and the two-way interaction between complexity and group size on convergence ($F(6, 143928) = .55$, p = n.s.). In Figure A. 1, the results are summarized using performance profile representation. We used only moderate complexity to investigate convergence since the interaction effect of complexity and group size on convergence was not significant.

When power is assigned exogenously, under low complexity the egalitarian model performs better than the autocratic and bureaucratic models overall. However, in moderate and highly complex environments, the egalitarian and autocratic models perform similarly when group size is small. The difference in convergence between the power models is distinguishable only in small groups. When power is endogenously assigned, the meritocratic model leads to better performance than the evolutionary and diarchic models for all group sizes. The evolutionary model provides superior convergence except when the group size is large enough.

Note that bigger groups span larger areas on the landscape, which is likely to increase performance as shown in Figure A. 1. Such dispersion of individuals on the landscape is likely to cause a decrease in the relative influence of high powered individuals on each of the low powered individuals, since the gravitational force is inversely proportional to the distance. Despite a reduction in the steepness of the power disparity due to the increasing group sizes, the meritocratic and egalitarian models are still better performers. When groups are large, the egalitarian model outperforms the meritocratic model under low complexity, and performs similarly under high and moderate complexity.

Experiment 3: The effect of the difference between high and low power

Here, we investigate the effect of the difference between high and low power by varying the magnitude of the high power, m^{high}. We ran a MANOVA with 6 (power models) × 3 (low, moderate and high complexity) × 4 (m^{high} of .2, .8, 1.4 and 2) where performance and convergence were the two outcome variables. Wilk's Lambda was significant for the main effect of power magnitude and two-way interactions of group size with power models and complexity ($p < .001$), but not for the three-way interaction (p = n.s.).

The results indicated a significant main effect of power size on performance and convergence ($F(3, 143928) = 5.56$, $p = .001$; $F(3, 143928) = 11.25$, $p < .001$), power size's two-way interactions with complexity ($F(6, 143928) = 4.66$, $p < .001$; $F(6, 143928) = 2.07$, $p < .1$), and power model ($F(15, 143928) = 5.85$, $p < .001$; $F(15, 143928) = 8.48$, $p < .001$) on performance and convergence respectively. The results are summarized below using performance profile representation for low, moderate, and high complexity levels. We used only moderate complexity to investigate convergence since we did not find strong support for the interaction effect of complexity and power size, and three-way interactions were not significant.

Figure A. 2 compares the power models with respect to varying power size (m^{high}). When power is assigned exogenously, there is an observable performance difference between the autocratic and egalitarian models only in low complexity conditions. As the magnitude of high power decreases, the difference between the power models disappears. Furthermore, the bureaucratic model performs the least, but it outperforms the others in terms of convergence for moderate levels of power sizes. When power is endogenously assigned, the meritocratic model outperforms others when there is a moderate and high power difference between low and high powered individuals. The relationship is reversed in terms of convergence. As in the exogenous case, all models perform equally well when power size is low. Since differences are not observed in the case of low power size, this observation indicates the reliability of our results in comparing the six power models.

Experiment 4: Weights of personal, social, and power cues

In our analyses so far, we considered weights of personal, social, and power cues (c_1, c_2, and c_3) to be equal. Studies in social decision schemes argue that individuals most often weight different cues equally and group strategy is closest to the case when cue weights are equal (Dawes, 1979; Hastie and Kameda, 2005). Nevertheless, we performed additional analyses for the cases where the movement of an individual is governed (a) only by power differences ($c_1 = c_2 = 0$), and (b) by different levels of c_3. The first case implies that only the gravitational forces are active in (10). This case resulted in lower overall performance for each power model. For example, the exogenous models consistently performed the worst since there was no movement affected by personal and group search, or by power differences fed by past performance as in evolutionary models. Although the model with only power differences is simpler, it lacks elaboration of strategic search, and thus diverges from reality.

In the second case, we varied the levels of c_3. We ran a MANOVA with 6 (power models) × 3 (low, moderate, and high complexity) × 11 (c_3 of 0, 0.4, 0.8, 1.2, 1.6, 2, 2.4, 2.8, 3.2, 3.6, 4) where performance and convergence were the two outcome variables. Wilk's Lambda for the main effect of group size, and two-way interactions of c_3 with power models and complexity was significant ($p < .001$), but not for the three-way interaction (p = n.s.).

Both for performance and convergence, all main effects and two-way interactions were significant except the interaction between power models and complexity on convergence. Furthermore, as in Experiments 2 and 3, three-way interaction was not significant for performance or convergence. Figure A. 3 summarizes the results using performance profile representation. When $c_3 = 0$, there is 'no power' influence in the group. Consequently, we observed no performance difference between power models. Furthermore, we observed that the conclusions of the first experiment remain valid for performance. We found hardly any convergence differences between power models in terms of varying levels of c_3.

Figure A. 1: Comparison of Power Models with Respect to Varying Group Sizes

Performance

Convergence

a. Low Complexity

b. Moderate Complexity

c. High Complexity

d. Moderate Complexity

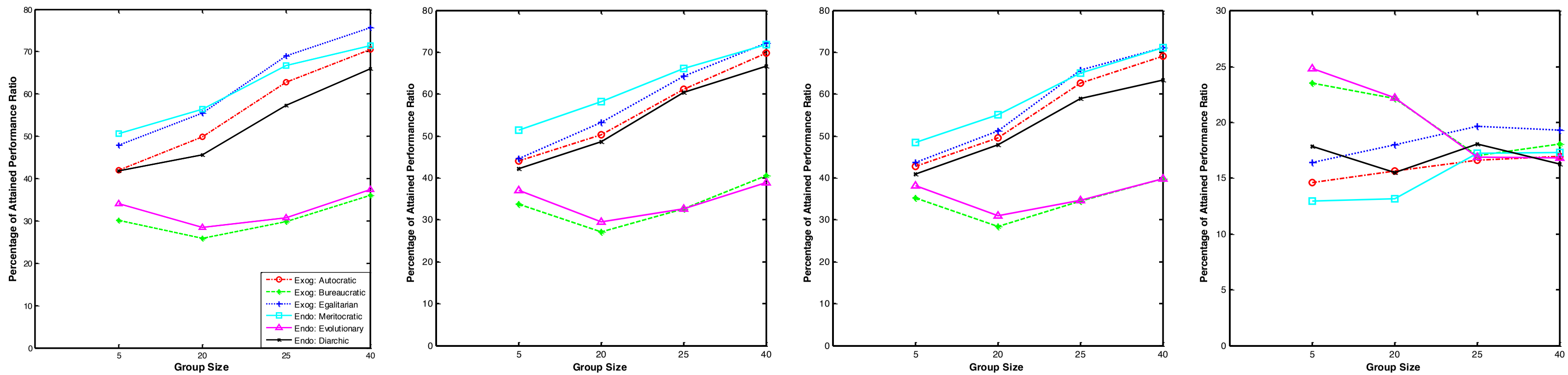
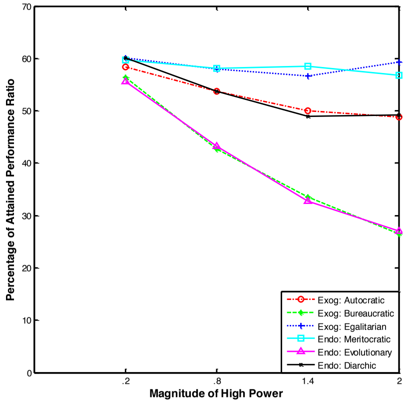


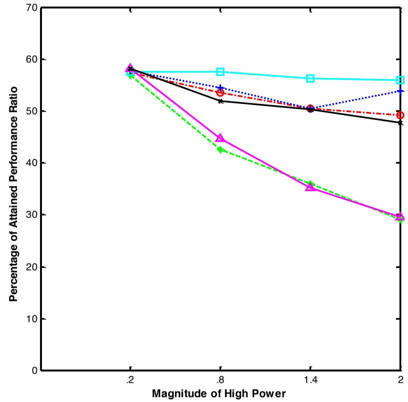
Figure A. 2: Comparison of Power Models with respect to Varying Sizes of High Power

Performance

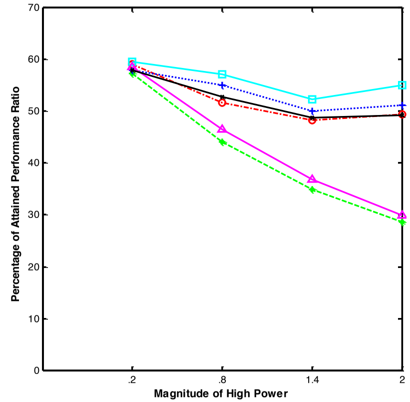
a. Low Complexity



b. Moderate Complexity



c. High Complexity



Convergence

d. Moderate Complexity

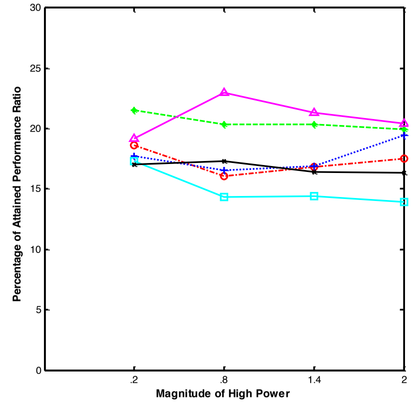
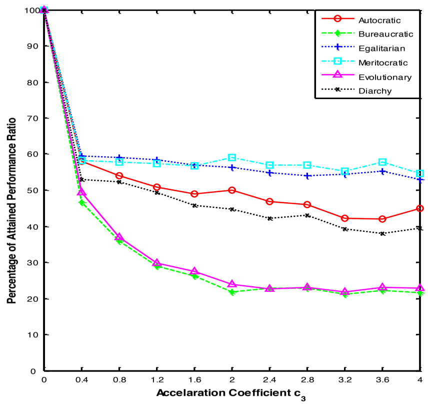


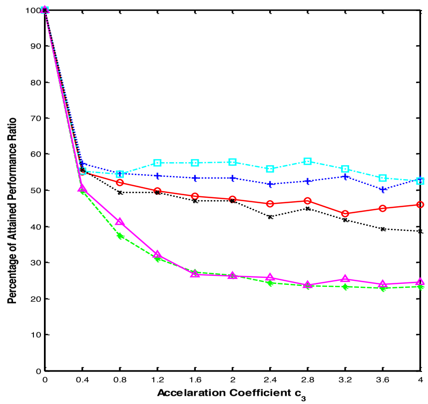
Figure A. 3: Comparison of Power Models with respect to Varying Magnitudes of c_3

Performance

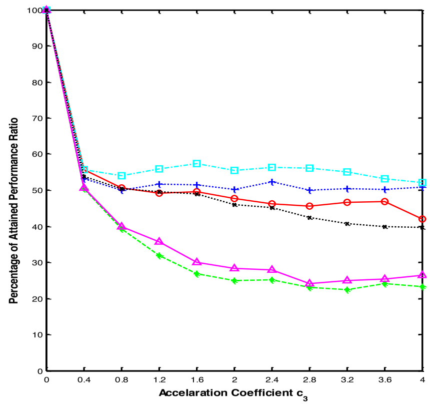
a. Low Complexity



b. Moderate Complexity

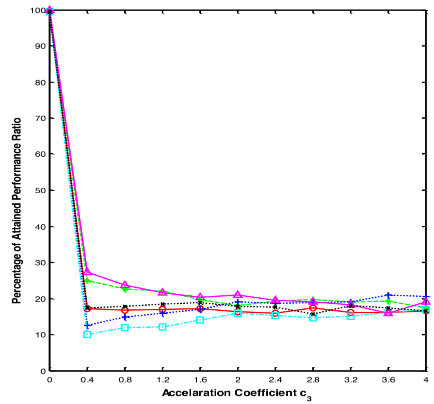


c. High Complexity



Convergence

d. Moderate Complexity



Chapter 5

NETWORK ORIENTATION AND OPPORTUNITY COSTS: SHOULD FIRMS BALANCE ARM'S LENGTH AND EMBEDDED TIES?

Introduction

A firm's network structure can leverage benefits beyond the reach of its organizational capabilities. Although the majority of network scholars have associated those network benefits with structural network properties such as density (sparse vs. dense networks), tie strength (weak vs. strong) and position (centrality, brokering) (Burt, 1992; Coleman, 1988; e.g., Granovetter, 1973), others have extended the structural deterministic view of network theory and underscored the content of network ties (Ahuja, 2000; Jensen and Roy, 2008; e.g., Podolny and Baron, 1997). More recently, several authors have continued to transcend the structuralist view of network research and have emphasized actors' behavioral characteristics as interacting with network structure and content- and shaping-related outcomes (Gulati *et al.*, 2011; Kilduff and Brass, 2010; Obstfeld, 2005; e.g., Pettigrew and McNulty, 1995).

Further extending this behavioral approach, we propose a new behavioral construct called *network orientation*. We define network orientation as the motives driving firms' choices regarding their network partners and conceptualize it as a behavioral characteristic of firms. Research on the relational view of the firm provides the examples of General Motors and

Toyota, which are consistent with our contention that firms display distinct behavioral orientations in their motives for network partner selection (Dyer, 1997; Dyer and Singh, 1998; Dyer and Chu, 2000). For General Motors, competitive bidding was the fundamental driver of supplier selection, whereas Toyota valued past interactions and incumbents. Consequently, the content of the relationships of General Motors was more transactional and resource-based than was true for Toyota, which focused on relational, identity-based relationships with its exchange partners (Baker, 1990; Podolny and Baron, 1997). This example demonstrates that firms have different network orientations that can be more or less transactional or relational. On the one hand, a firm with a *transactional network orientation* chooses a network partner only if it offers more favorable trade terms; the decision is based solely on an economic assessment of costs and benefits. When another potential partner with a more beneficial offer becomes available, the firm switches partners to increase its economic benefits. On the other hand, a firm with a *relational network orientation* chooses a network partner based on ongoing relationships and the reputation of the partner in question, to which the firm has a relational attachment.

The present study makes several contributions to social network theory in general and embeddedness theory in particular. First, we advance network theory, which has been predominantly confined to a structuralist view (Kilduff and Brass, 2010). Our results show that a firm's network orientation directly affects organizational outcomes and is a contingency factor for network structure. Thereby, we fill the gap in the behavioral understanding of interfirm networks by considering firms' network orientations.

Second, we use the behavioral lens to revisit network embeddedness theory. We do so by removing the confounding assumption in the embeddedness research that a firm's type of ties (arm's-length or embedded) indicates the firm's orientation in terms of partner selection (Shipilov, 2005; e.g., Uzzi, 1996; 1997; 1999). The most intriguing finding of our research is that embeddedness theory's recommendation that firms should balance arm's-length and embedded ties (Uzzi, 1996; 1997; 1999) is valid only for the firms with a transactional network orientation. In fact, a portfolio-like strategy is detrimental to firms with a relational network orientation.

Third, in addition to assuming a behavioral perspective on interfirm networks, we shed light on the tradeoffs of networks. The majority of network research have focused on the positive effects of interfirm networks (Zaheer *et al.*, 2010). However, a firm's network structure not only facilitates the flow of beneficial resources but also introduces additional constraints and risks (Kilduff and Brass, 2010). As Podolny and Page (1998: 73) emphasized, "researchers must counterbalance the focus on prevalence and functionality [of networks] with an equally strong focus on constraint and dysfunctionality". Only a few researchers have done so (Kim *et al.*, 2006). We show that although a close relationship may generate additional benefits and resources that are not readily available in the market, the same relationship may generate lock-in and create high opportunity costs where better outside options cannot be chosen.

Transactional and Relational Network Orientation

Firms encounter several potential network partners. The selection of partners from a set of available candidates is significant because it determines the resources to be accessed, the quality level signaled to the outside, and the success of the firm (Jensen and Roy, 2008; Uzzi, 1996). We distinguish between firms based on their motives for choosing particular network partners, i.e., their network orientation. On the one hand, we posit that some firms have a more *transactional network orientation*. These firms search the market for alternatives and choose a partner based solely on economic expectations. On the other hand, other firms may have a *relational network orientation*. They select a particular network partner because they have a degree of relational attachment to the firm stemming from the latter's reputation, past interactions, or referrals.

Our conceptualization of network orientation stems from the fact that each potential partner firm exhibits certain cues, such as the trade terms it offers, its reputation, or its past interactions. For example, research in international joint ventures has identified several characteristics of potential partners, such as facilities, resources, partner status, and favorable past association, that firms use to choose their partners (Geringer, 1991; Tomlinson, 1970). Firms favor certain cues and ignore others when selecting their partners. This supposition is supported by status characteristics theory, which suggests that "different characteristics have different weights" (Berger *et al.*, 1977: 116). Additionally, firms are likely to differ in terms of the weight that they assign to a particular cue, as stated in behavioral decision theory (Tversky and Kahneman, 1986). These weights, which differ among firms, constitute their network orientation. Some firms make transactional decisions, prioritizing cues related to trade terms, whereas others base their decisions on relational factors. Behavioral decision theory further argues that each decision maker has a "conception of the acts, outcomes, and contingencies associated with a particular choice [which] is controlled partly by the formulation of the problem and partly by … personal characteristics of the decision-maker" (Tversky and Kahneman, 1981: 453). Hence, we propose not only that firms differ in the weights that they assign to each partner characteristic (i.e., network orientation) but also that their network orientation is a behavioral characteristic.

Our contention that reputation, referrals, and past interactions are emphasized in the relational network orientation distinguishes our approach from that of the extant research on network partner selection, which predominantly conceptualizes firms' decisions as based on transactional motives. According to such research, firms choose only partners that possess complementary resources (e.g., Eisenhardt and Schoonhoven, 1996; Gulati and Gargiulo, 1999; Podolny, 2001), reduce uncertainty (e.g., Beckman *et al.*, 2004), facilitate performance aspirations (Baum *et al.*, 2005), or signal higher quality to others (e.g., Podolny, 2001). Yet, we know from the behavioral theory of the firm that firms are not purely profit maximizers (Gavetti, 2012; Powell *et al.*, 2011); instead, they are "intendedly rational but imperfectly so" (Lawler, 2001: 324). Emotions, sentiment, and intrinsic attraction in social exchange between network partners also affect firms' decisions (Blau, 1964; Homans, 1961; Lawler and Yoon, 1998; Lawler, 2001). Hence, we contend that the network partner selection problem is based not only on rational and economic concerns related to resource, informational and reputational benefits but also on relational motives. Indeed, recent research by Jensen and Roy (2008: 500) presented examples in which firms chose their exchange partners based on their level of business integrity, defined as "adherence to moral and ethical principles in conducting business".

Similarly, we conceptualize the relational orientation as motivated by relational attraction to partners without any immediate rational expectations or transactional cost/benefit analysis. For example, Dyer and Chu (2000) differentiated between U.S. and Japanese car makers. On the one hand, U.S. firms switch suppliers to capture short-term gains. On the other hand, the primary motive of Japanese car makers is not to achieve such gains when they offer technical assistance to, facilitate information exchange among, and favor incumbent suppliers (Dyer and Singh, 1998; Dyer and Nobeoka, 2000; Dyer and Chu, 2000). Instead they intend to create a relationship interface (Baker, 1990: 594) conferred by identity-based content (Podolny and Baron, 1997). The relational orientation is coded in the institutional logic of Toyota as a behavioral characteristic to the degree that Toyota still employed a relational approach when it entered the U.S. market (Dyer and Nobeoka, 2000; Dyer and Chu, 2000). This example illustrates that for relationally oriented firms, relational factors such as trust, familiarity and joint commitment are more important than the transactional gains from trade. Whereas a relationally oriented firm may choose to continue working with certain network partners because of relational attachments despite the more favorable economic benefits that it could accrue from another partner, firms with transactional orientation do not hesitate to switch partners to achieve such gains.

Network orientation as a stable behavioral characteristic

Various scholars who have focused on interpersonal relationships and interfirm research have discussed dichotomies similar to that between the transactional and relational network orientations and have provided evidence that network orientation is a stable firm characteristic. For example, research on social exchange theory has discussed commitment behavior (Lawler and Yoon, 1998; Lawler, 2001) and the distinction between exchange and communal relationships (Clark and Mills, 1979; Clark *et al.*, 1987). An individual actor who is committed to a relationship is conceptualized as "staying with the focal relation despite good alternatives" (Lawler, 2001: 323; see also Seabright *et al.*, 1992). In a communal relationship, the individual actor is committed and exhibits high "motivation to be responsive to the communal partner's needs" (Mills *et al.*, 2004: 214), whereas the behavior in an exchange relationship is based on the expectation of future returns or the need to make good on liabilities (Clark and Mills, 1979; Clark *et al.*, 1987). Clark et al. (1987) argued that differences in relationship orientation are dispositional.

Furthermore, research in relational marketing has distinguished between transactional and affective commitment (Ganesan *et al.*, 2010). Transactionally committed firms perform cost-benefit analyses, whereas affective commitment reflects social and psychological attachment to an exchange partner based on feelings of "identification, loyalty, and affiliation" (Ganesan *et al.*, 2010: 362). Additionally, psychological contract research has identified relational and transactional forms of psychological contracts. A psychological contract is defined as the beliefs regarding the terms of an exchange (Rousseau, 1995). In contrast to relational psychological contracts, transactional psychological contracts center on monetary assessment and entail limited relational attachment (Ho *et al.*, 2006; Rousseau, 1995). In interpersonal network research, Obstfeld (2005: 102) has also proposed a similar dichotomy between tertius iungens and tertius gaudens as "a strategic, behavioral orientation toward connecting people in one's social network". The former refers to an individual's inclination to serve the group to achieve its objectives, whereas the latter highlights rational control of the network structure for the sake of personal interest. After having explained network orientation and delineated its nomological network, in the following subsection we revisit embeddedness theory using network orientation's behavioral lens.

A Behavioral Extension of Embeddedness Theory

In this section, we employ the behavioral perspective on network orientation and revisit embeddedness theory, a leading theory in network research (Kilduff and Brass, 2010). Embeddedness theory conceptualizes market transactions as a reflection of the social structure. Essentially, a transaction is considered to be both economic and social (Ahuja et al., 2011). The concept of embeddedness distinguishes strong *embedded* ties from weak *arm's-length* ties. A firm with embedded ties will concentrate its transactions among a small number of network partners with which it has strong ties, whereas in a set of arm's-length relationships, the transactions are distributed among many network partners with which the firm has weak ties (Baker, 1990; Eccles and Crane, 1988; Uzzi, 1996; 1997). Whereas embedded relationships involve personal and social ties that are based on trust and reciprocity, arm's-length relationships are weaker and more distant; they tend to be common in atomistic and competitive market settings (Shipilov, 2005; Uzzi, 1997).

It is more common for empirical studies to discuss the mechanisms that best explain the positive association between embeddedness and organizational performance (Gulati and Sytch, 2007; e.g., McEvily and Marcus, 2005). Embedded relationships facilitate informal mechanisms such as trust, joint problem-solving activities, and fine-grained information exchange (Gulati and Sytch, 2007; Uzzi, 1996; 1997). Furthermore, they equip firms with informational benefits that mitigate transaction uncertainty, ensuring favorable trade terms (Uzzi, 1996; 1997). Consequently, embedded relationships provide access to more benefits than are offered in the market by alternative partners outside of a firm's network (Uzzi, 1996). Thus, as a firm becomes more embedded, the cost of overlooking outside alternatives (i.e., the opportunity cost) decreases.

An increase in a firm's proportion of embedded ties may not always be advantageous. The costs of maintaining a network with many embedded ties may exceed the potential benefits of such a network because of reciprocal expectations regarding trust and the risk of opportunism. For example, Portes and Sensenbrenner (1993: 1339) warned that over-embeddedness may "turn promising enterprises into welfare hotels". Alternatively, over time, the resources provided by the network partners may depreciate in value and become obsolete (Afuah, 2000; Lin *et al.*, 2007). The more a firm is embedded in its respective network, the more it will complete transactions and maintain ties within its network (Kilduff & Brass, 2010). Extensive embeddedness may lock the firm into an isomorphic network structure in which access to non-redundant information is limited (Burt, 1992; Hansen, 1999; Uzzi, 1997). Consequently, the firm may become confined to its network and not receive information on outside options, or it may not be feasible for the firm to end its existing relationships and switch to more advantageous ones. Over-reliance on certain network partners causes firms to overlook better outside alternatives (Ahuja *et al.*, 2009), increasing the opportunity cost of embedded relationships. Hence, the very same relationship structure that initially provided significant competitive advantage can become a liability beyond a certain threshold of embeddedness. This phenomenon is called 'the paradox of embeddedness' by Uzzi (1996; 1997). Embeddedness theory thus proposes that there is an optimal degree of embeddedness in which a firm cultivates a mix of arm's-length and embedded ties.

Embeddedness theory treats firms as rational actors that actively optimize portfolios of ties that include embedded and arm's-length ties (Krippner and Alvarez, 2007). However, this perspective has been criticized for overlooking micro-level elements such as attributes and affect (Emirbayer and Goodwin, 1994; Krippner and Alvarez, 2007). More importantly, embeddedness research has confounded embeddedness as a network parameter (e.g., tie strength) and embeddedness as a behavioral characteristic of firms (e.g., motives for partner selection). For instance, Shipilov (2005: 282) argued that "arm's-length firms choose partners primarily based on the comparison of either prices or the quality of partners' products with those offered by other market participants". In his ethnographic investigation of firm-bank relationships, Uzzi (1999: 489) documented that "arm's-length ties put a relationship out for bidding … it's price oriented", while an embedded relationship is "an emotion-based bond" (Uzzi and Gillespie, 2002: 600). It is unclear from these descriptions whether the outcomes of embeddedness are due to tie strength or network orientation in terms of the firm's motives for partner selection. Moreover, a firm may have an embedded or arm's-length relationship, but its motive for forming this relationship may be relational or transactional.

Thus, we distinguish between embeddedness as a network property and a network orientation, determining the behavioral characteristics that firms display in choosing network partners. We argue that the strength of a network tie is different from the motives used to select a network partner. In the following subsection, we further hypothesize that firms' network orientations directly influence their opportunity costs and moderate the relationship between embeddedness and opportunity costs.

Hypotheses

"Underlying all social exchanges is the norm of reciprocity" (Ho *et al.*, 2006: 461). The network orientation that a firm employs in choosing its partners is therefore likely to be mirrored by its network partners. If a firm has a transactional network orientation, its network partners are more likely to respond with a more transactional approach than a relational approach. In contrast, firms with a relational orientation affectively commit to a relational psychological contract in their relationships (Ganesan *et al.*, 2010; Rousseau, 1995), which creates commitment and attachment to each relationship (Reagans and McEvily, 2003). Furthermore, the attachment and commitment of the firm within the relationship are likely to be reciprocated by the other party (Granovetter, 1973; Ho *et al.*, 2006; Rousseau, 1995). Such an attachment generates a close and communal relationship between the firms, one in which the partner attends to the firm's well-being and offers extra benefits that are not readily available in the transactional market (Aron *et al.*, 1991;

Clark and Mills, 1979; Clark *et al.*, 1987). Thus, the relational orientation makes both network parties invest effort and mobilize resources to help each other (Reagans and McEvily, 2003). These attachments also generate trust between the network parties and confidence in the relationship.

In contrast, transactional firms are less relationally attached to their network partners. These firms search the market for the best alternatives. They are ready to end a relationship and switch to another partner that provides more profitable trade terms. This tendency is reciprocated; the network partner reacts in the same way and does not offer favorable terms. For example, Eccles and Crane (1988) noted that some firms would like to work with multiple banks (i.e., in arm's-length relationships) but also desire the advantages of an embedded relationship. This paradox among firms with a transactional orientation is difficult to resolve because the network partners respond transactionally as well due to reciprocity (Eccles and Crane, 1988), thus declining to offer favorable trade terms. Similarly, Helper (1991: 817) noted that some U.S. automakers continuously search for alternative bids and switch partners, which creates a 'legacy of mistrust'. Consequently, whereas relationally oriented firms gain additional benefits that are not readily available in the market structure because of mutual commitment, firms that display a transactional orientation do not receive favorable terms and only receive market prices.

Hypothesis 1 (H1): The more relational (transactional) a firm's network orientation, the lower (higher) the opportunity costs it experiences.

In addition to positing this main effect of network orientation, we propose that the relationship between the levels of embeddedness and opportunity cost differ for firms with different network orientations. Firms with a transactional orientation do not experience relational attachment and continuously scan the market for alternatives. They are more likely to switch network partners as soon as they identify a better alternative. Switching allows firms to avoid being locked into an embedded network, which, in turn, reduces opportunity costs. Yet, if a firm becomes too embedded, switching becomes more difficult due to increased informational redundancy, which limits firms' search capabilities. Additionally, given that they have a transactional network orientation, such firms may fail to obtain offers that are more favorable than those available in the market. Hence, we agree that, as predicted by the embeddedness paradox, there is a U-shaped relationship between embeddedness and opportunity costs for firms with a transactional orientation such that a firm has lower opportunity costs when it balances arm's-length and embedded ties.

However, we propose that this prediction from embeddedness theory is only accurate for firms with a transactional network orientation, whereas the relationship is reversed for firms with a relational network orientation. Whereas firms with a transactional orientation gain extra benefits only if they become more embedded, these benefits are already within reach of relationally oriented firms due to their network orientation (cf. Hypothesis 1). However, firms with a relational network orientation will find that increasing embeddedness makes them both relationally and structurally enmeshed in a network of few partners. The result is a lock-in situation in which the firm must forego favorable outside options due to information redundancy (Hansen, 1999; Uzzi, 1997) and simply because this type of relational and structural attachment is harder to end.

Above a particular embeddedness threshold, the opportunity costs for relationally oriented firms are likely to decrease. Because the highly embedded relationships among relationally oriented firms are close and communal relationships in which the boundaries of the self fade away, the firm includes others in the self, and network partners experience "a sense of we-ness" (Aron *et al.*, 1991: 242). Brewer (1991: 476) states that "when the definition of self changes, the meaning of self-interest and self-serving motivations also changes accordingly". The partner firm identifies with the firm and internalizes and acts to further the interests and outcomes of the firm (Clark and Mills, 1979; Clark *et al.*, 1987). The reformulation of the self in intimate relationships (Aron *et al.*, 1991; e.g., Clark and Mills, 1979; Clark *et al.*, 1987) is quite similar to Uzzi's (1999: 489) observation regarding bank representatives: "[A]fter he [the entrepreneur] becomes a friend, you want to see your friend's success and that goes along many lines … So there's a lot of things that you kind of from a moral standpoint take into effect". The bank representative's internalization of the firm's interests yields "relational rents" (Dyer and Singh, 1998) for the firm, reducing its opportunity costs because the partner is committed to investing in the relationship and perceives the firm's successes and failures as his/her own. Conversely, transactionally oriented firms demonstrate a lack of commitment, switching tendency, and transactional concerns, all of which prevent the formation of close and communal relationships with network partners. Consequently, we argue that for relationally oriented firms, there is an *inverse* U-shaped relationship between embeddedness and opportunity costs in which opportunity costs are the highest when embedded and arm's-length ties are balanced.

Hypothesis 2 (H2): Network orientation moderates the relationship between embeddedness and the opportunity costs of a firm. For firms with a transactional orientation, there is a U-shaped relationship between embeddedness and the opportunity cost of the firm in which a mix of arm's-length and embedded ties is associated with lower opportunity cost. In contrast for relationally network oriented firms, this relationship is reversed.

This hypothesis is particularly important because it challenges the popular strategy recommendation associated with embeddedness theory: that firms should balance embedded and arm's-length ties. Although we agree that a curvilinear relationship exists between embeddedness and opportunity costs, as proposed by the embeddedness theory, we argue that a mix of arm's-length and embedded ties is beneficial only to firms with a transactional orientation; rather, it is detrimental for relationally oriented firms.

Data and Methods

The hypotheses were tested using a data set obtained from the 2003 National Survey of Small Business Finances ("NSSBF" hereafter) administered by the Federal Reserve Bank. We chose this context and dataset for two reasons. First, the survey provided extensive information about firm and owner characteristics, financial service inventories and detailed information on firm-bank relationships. Second, similar NSSBF surveys were conducted earlier, in 1987, 1993 and 1998. The resulting datasets were highly similar to those of the later survey, and these earlier versions were used by other researchers who investigated the embeddedness of firm-bank interactions (e.g., Petersen and Rajan, 1994; Uzzi, 1999; Uzzi and Gillespie, 2002). Hence, using this dataset enabled us to compare our results directly with those of previous studies of embeddedness.

The target population of the NSSBF survey was all for-profit, non-financial, non-farm, non-subsidiary U.S. firms that had fewer than 500 employees and were in operation as of year-end 2003. The data included information on 4240 firms that were sampled from 6.3 million small businesses via a stratified random sampling procedure based on the number of employees, urban/rural status, and census divisions (see Federal Reserve Board, 2008). Sixty percent of the responding firms were corporations, 83 percent were family owned, and 19 percent were owned by women. In the sample, 41 percent of the firms were operating in the service industry, 19 percent in retail and 12 percent in manufacturing. Note that the NSSBF data sample is stratified random rather than simple random. Therefore, in our analyses, we use the sampling weights contained in the NSSBF data to estimate the population statistics.

The survey was completed in two stages: a screener interview used to verify each firm's eligibility and a main phone interview prior to which pre-mailed worksheets were completed. The phone interviews lasted 59 minutes on average. A firm was considered ineligible if the respondent was not the owner. A survey was considered completed if the overall item response rate was at least 75 percent. Note that 1.8 percent of the observations were imputed with 5 implicates. Our results were consistent for all of the implicates. Thus, we report only the results using the first implicate.

Dependent variable

The context is ego networks of firms with banks. A firm-bank relationship is formed if the firm accesses credit from the bank. To investigate the *opportunity cost* of such a relationship, we focused on the most recent loan received by the firm. In this context, the outside option for the firm would be the opportunity to acquire the same type of the credit from another bank. Thus, a firm accrues an opportunity cost if it could have received the same loan from another bank at a lower interest rate.

To calculate the opportunity cost of the bank-firm relationship, we subtracted the interest rate received from the current bank from the average interest rate that was available outside of the network for the same type of loan and multiplied it by the amount of credit requested. We took the log of the opportunity cost to account for right skewness. Note that the amount of the loan requested applied for was different from the amount granted for 246 of 1761 firms that received loans. The results remained qualitatively similar when the opportunity cost was calculated using the amount of credit sought instead of the amount granted (correlation = 0.99, $p < 0.001$).

Independent variables

Our main independent variables are *embeddedness* and *network orientation*. We followed Uzzi (1999) and Shipilov (2005) in operationalizing the degree of a firm's use of embedded ties and arm's-length relationships. We operationalized embeddedness using the Herfindahl index as $\sum_{j=1}^{N} P_j^2$, where j varies from 1 to N banks and P_j is the proportion of the banking business that the firm had conducted with bank j. As in Uzzi (1999), we defined P_j with reference to the savings, checking, and line-of-credit accounts that had been identified by earlier researchers as the fundamental accounts in the firm-bank relationship. This index varies between 0, which indicates arm's-length relationships (i.e., that the firm's banking business is dispersed among many banks), and 1, which indicates an embedded relationship (i.e., that the firm's entire banking business is concentrated on one bank).

We chose this measure of embeddedness for two reasons. First, this measure was used in earlier research to describe the embeddedness paradox (e.g., Petersen and Rajan, 1994; Shipilov, 2005; Uzzi, 1996; 1997). Second, these studies exhibited construct and face validity. This operationalization of embeddedness called 'first order network coupling' (Shipilov, 2005; e.g., Uzzi, 1996) and 'network complementarity' (e.g., Uzzi, 1999). There are other measures used in network research, such as *duration* and *multiplexity,* that measure the relational aspect of embeddedness; *network size* has been used to measure the structural aspect of embeddedness (e.g., Uzzi, 1999). We controlled for those relational and structural measures of embeddedness but used first-order network coupling as our main embeddedness measure to directly address the earlier research on the embeddedness paradox (Baum *et al.*, 2005; e.g., Uzzi, 1996; 1999).

Our second main independent variable is *network orientation*. The NSSBF survey asked each firm to state up to three reasons why it chose to apply for a loan from a particular bank. On average, each firm provided 1.36 reasons. The open-ended responses were then recoded as responses within 54 categories (Federal Reserve Board, 2008). These categories included credit policies or experience, institution characteristics and offerings, account terms, relationships and referrals, miscellaneous reasons, and other.

Two PhD students in strategic management who were not otherwise involved in the present study coded each of these 54 categories as transactional, relational, or other. Transactional and relational reasons were coded as 0 and 1, respectively. The two coders were in agreement regarding the coding (Cohen's kappa = 0.90) 94 percent of the time. Mismatches were resolved by the authors. To allow the replication of our results by other researchers, we provide the final coding of the reasons in the appendix.

Thirty-three percent of the reasons mentioned were transactional, 60 percent were relational, and 7 percent were coded as 'other.' For instance, reason 57 in the NSSBF survey is 'long-term relationship/ ongoing relationship/ prior relationship', which highlights that the bank was chosen to refine an embedded relationship. In contrast, reason 43, which is 'low interest rate and/or low loan (origination) fees', is an example of a transactional motive. Reasons categorized as other were discarded. There were 149 firms whose only identified reason was in the 'other' category. These observations were coded as missing.

A firm's network orientation was measured as the average of the category scores for its reasons. Network orientation in this study varies between 0 (i.e., the firm has a transactional network orientation) and 1 (i.e., the firm is relationally oriented). Values between 0 and 1 indicate a mixed orientation.

Control variables

To better test our hypotheses and rule out alternative explanations for our findings, we controlled for relational and structural embeddedness and for several organizational, market and loan characteristics that may affect opportunity costs and access to loans. We selected control variables following previous empirical research in finance and economics and based on the embeddedness research that has utilized NSSBF data (Berger and Udell, 1995; Berger *et* *al.*, 2007; Blanchflower *et al.*, 1998; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo *et al.*, 2002; e.g., Petersen and Rajan, 1994; Uzzi, 1999; Uzzi and Gillespie, 2002; Vickery, 2008).

The economic perspective regarding firm-bank relationships holds that banks accrue private information regarding firms' financial situations as the duration and multitude of each relationship increases (Berger and Udell, 1995). In addition, according to the embeddedness theory, duration and multiplexity reinforce the strength of the relationship (Uzzi, 1999). We therefore included relational embeddedness controls, the *duration* of the firm's relationship with the bank that granted the loan (in years) (Petersen and Rajan, 1994; Uzzi, 1999) and the *multiplexity* of the relationship with the bank (i.e., the number of financial services used by the firm, including credit-related services, cash management services, pension services, brokerage services, and card processing services, checking, savings, lines of credit, capital leases, business mortgages, equipment loans, motor vehicle loans, other loans, transactions services (Seabright *et al.*, 1992; Uzzi, 1999). The size of a firm's bank network also affects its ability to seek alternatives and both signals and determine its dependence on its current partner(s) (Gulati and Sytch, 2007; Hansen, 1999). We controlled for structural embeddedness via *network size,* measured as the number of banks with which the firm had worked.

Petersen and Rajan (1994) found that organizational characteristics such as size and age influence interest rates. Hence, we controlled for organizational characteristics such as *organization age, number of employees*, *log of total sales*, *corporate status* (coded 1 if yes), *debt ratio* (total liabilities/total assets) and *acid ratio* (current assets minus inventory/current liabilities). Note that we observed some outliers in determining the debt and acid ratios. We retained those outliers because the NSSBF manual indicated that the financial data were already reviewed and because the survey weights were tuned to account for influential observations (Federal Reserve Board, 2008). Additionally, several studies documented evidence of discrimination against minority-owned businesses with regard to loan access within the NSSBF data set (e.g., Blanchflower *et al.*, 1998; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo *et al.*, 2002). We thus controlled for gender and minority status in examining firm ownership and considered whether each firm was a family firm. A firm was defined as *female-owned*, *minority-owned,* or *family-owned* if more than 50 percent of the shares were owned by females, minorities, or a single family, respectively. We also controlled for whether the owner or the firm had declared *bankruptcy* in the last seven years (coded 1 if yes).

Vickery's (2008) finding indicating that small firms manage their interest rate risk by choosing between fixed-rate and variable-rate loans highlights the influence of loan characteristics on the interest rates received. To control for loan characteristics, we measured *loan maturity*, determined whether the loan was *fixed* (1 if yes) and whether *collateral* was required (1 if yes), and identified the *loan type* (e.g., a new line of credit, a capital lease, a mortgage for business purposes, a vehicle loan for business purposes, an equipment loan, or another type of loan). The NSSBF survey recorded loans accessed at different periods. Therefore, we controlled for the *prime rate* as of the date of the loan application. Moreover, we controlled for the ratio of the amount sought to the firm's total assets (*loan/asset ratio)* and the *bond spread* (the yield of corporate bonds rated BAA minus the yield of 10-year government bonds at the time of the loan application).

How competitive the lending market is may also affect access to loans and interest rates (Cavalluzzo *et al.*, 2002; Petersen and Rajan, 1994). Similarly, interest rates may be geographically differentiated. Therefore, we controlled for market characteristics via a *bank competition index* in the firm's locale (1 = low, 2 = moderate, 3 = high competition), *industry* using two-digit SIC codes, and *region* using census divisions. Table 9 reports the correlations among the variables.

Table 9: Descriptive statistics and correlations between regression model variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 Opportunity Cost (log)	1																				
2 Network orientation	-.05	1																			
3 Embeddedness	-.06	.03	1																		
4 Duration	.06	.16	-.01	1																	
5 Multiplexity	.21	.03	-.06	.4	1																
6 Network size	.25	-.08	-.15	.18	.41	1															
7 Loan maturity	-.05	-.09	-.06	-.03	-.06	0	1														
8 Fixed-rate loan	.39	.06	-.03	.03	.14	.1	-.14	1													
9 Collateral on loan	-.21	.05	-.01	.02	-.09	-.12	-.17	-.04	1												
10 Debt ratio	-.04	.02	0	-.03	-.02	-.04	-.01	0	.04	1											
11 Acid Ratio	-.03	-.04	.01	.03	0	0	0	-.03	.03	.02	1										
12 Loan prime rate	-.08	.01	0	.06	-.04	-.05	.06	-.09	.01	-.01	-.01	1									
13 Corporation	.25	-.02	.07	.18	.22	.29	-.14	.14	-.04	-.05	.01	-.04	1								
14 Age of firm	.14	.02	-.06	.27	.12	.09	-.01	.04	-.05	0	-.02	0	.11	1							
15 Family-owned firm	-.21	-.06	-.04	-.09	-.13	-.11	.09	-.11	.05	.01	.01	.05	-.17	.01	1						
16 Female-owned firm	-.09	.01	-.05	-.1	-.1	-.11	.04	-.07	.04	-.01	-.01	.01	-.14	-.1	.11	1					
17 Minority-owned firm	.07	.03	-.01	-.08	-.06	-.03	.04	-.03	.01	-.01	-.01	-.01	-.03	-.09	.03	.05	1				
18 Number of employees	.5	-.02	-.07	.23	.38	.37	-.08	.2	-.15	-.03	-.01	-.05	.3	.21	-.23	-.11	-.03	1			
19 Total sales (log)	.57	-.01	.07	.3	.36	.45	-.2	.27	-.14	-.03	-.01	-.11	.48	.24	-.26	-.22	-.06	.55	1		
20 Bankrupt	-.05	.03	.02	.01	.01	.13	-.01	-.05	-.03	-.03	-.01	.01	.05	-.05	-.01	.02	.03	.02	.05	1	
21 Bank competition index	.03	.02	-.01	0	.01	.04	-.04	.04	.04	-.02	.01	-.02	.03	-.01	.01	-.01	.04	.04	.02	-.01	1
Mean	12.1	0.69	0.86	4.28	1.64	2.81	3.78	1.55	1.45	12.37	28.59	4.4	0.6	16.5	0.83	0.19	0.08	31.5	13	0.18	0.58
Standard deviation	2.23	0.42	0.25	8.47	3.4	1.89	4.97	0.5	0.5	131.9	1383.5	0.76	0.49	12.3	0.37	0.39	0.28	57.9	2.83	0.38	0.61
N	1761	1612	4240	4240	4240	4240	1665	1761	1761	3420	2944	1761	4240	4240	4240	4181	4181	4240	4240	4190	4240

Results

In the NSSBF dataset, only 41 percent of the firms acquired loans or provided information on recently approved loans. Receiving credit requires an endogenous process; a firm's access to credits is not random (Petersen and Rajan, 1994; Uzzi, 1999). This fact causes sample selection bias. Therefore, we performed the Heckman correction using a two-step approach to account for sample selection bias. In the first step, we ran a probit model to estimate whether credit was accessed (coded 1). The Inverse Mills ratio obtained in the first step was then entered in the second step, which required the use of ordinary least-squares estimation for the model of interest (Greene, 2003).

Table 10 presents the estimation results for loan application success, i.e., the selection model, and the opportunity cost of each relationship. As previously discussed, the dependent variable of opportunity cost was observable only if the firm in question received a loan. The selection model used in the first step of the Heckman two-stage procedure estimated the determinants of access to credit. The results showed that family firms and larger firms (in terms of both the number of employees and total sales) were more likely to obtain loans. In addition, if the owner or the firm had declared bankruptcy in the past seven years, the firm was less likely to receive a loan. The control variables in the model used to estimate the opportunity costs indicated that loan characteristics such as maturity, a fixed rate loan, collateral requirement and loan types influenced the opportunity costs. The bound spread at the time of the loan application was positively associated with opportunity costs. We did not find any significant effects of the duration of the bank-firm relationship or of network size. However, we found a marginal effect of network multiplexity: as the multiplexity of the firm-bank relationship increased, the opportunity cost of the relationship became higher.

Hypothesis 1 argues that firms with a more relational network orientation have lower opportunity costs. The results showed that as the network orientation of a firm became more relational, the opportunity cost of the loan decreased. This result supported Hypothesis 1. Relationally oriented firms can leverage the reciprocity of their orientation and obtain interest rates that are lower than they would otherwise obtain. As a result, although a transactional network orientation allows a firm to search for better alternatives in the market, a relational orientation will allow that firm to beat market prices, which in turn will lower the opportunity cost of the loan.

Table 10: Results of Heckman's two-step procedure regression analyses

Independent Variable	Loan Accessed (Selection Model) Coefficient	S.E.	Opportunity Cost Coefficient	S.E.
Constant	-5.351**	(1.871)	16.046**	(1.328)
Network orientation			-4.384*	(1.872)
Embeddedness	4.705**	(1.234)	-7.620*	(3.444)
$(\text{Embeddedness})^2$	-3.129**	(.819)	4.708*	(2.338)
Network orientation*Embeddedness			12.550*	(5.314)
Network orientation*$(\text{Embeddedness})^2$			-8.303*	(3.528)
Control variables				
Duration of the firm-bank relationship			-.005	(.007)
Multiplexity of the firm-bank relationship			.034†	(.020)
Network size	.188**	(.019)	-.062	(.046)
Loan maturity			.081**	(.016)
Fixed-rate loan			-.355**	(.119)
Collateral on loan			.303**	(.109)
Loan type: New line of credit			-.647**	(.164)
Loan type: Capital lease			-1.833**	(.487)
Loan type: Mortgage			-.396	(.253)
Loan type: Vehicle			-1.015**	(.193)
Loan type: Equipment			-1.372**	(.194)
Loan type: Line of credit renewal			-.626**	(.208)
Bond spread			.265*	(.122)
Loan prime rate			.014	(.067)
Loan/Asset ratio			.020	(.017)
Debt ratio			-.001	.000
Acid ratio			.000	.000
Corporation	-.149**	(.056)	.034	(.142)
Age of firm	.000	(.002)	.002	(.006)
Family-owned firm	.162*	(.068)		
Female-owned firm	.095	(.059)		
Minority-owned firm	.102	(.080)		
Number of employees	.006**	(.001)		
Total sales (log)	.186**	(.018)		
Bankruptcy	-.129*	(.054)		

Bank competition index	.016	(.037)		
Industry: Mining	.248	(1.813)		
Industry: Construction	1.725	(1.857)		
Industry: Manufacturing	.230	(1.812)		
Industry: Transportation/Public utilities	.288	(1.812)		
Industry: Retail trade	.077	(1.814)		
Industry: Finance, Insurance and Real Estate	.030	(1.812)		
Industry: Services	.016	(1.813)		
Industry: Public administration	.038	(1.811)		
Region: New England			-.391	(.276)
Region: Middle Atlantic			-.332	(.233)
Region: East North Central			-.425*	(.199)
Region: West North Central			-.363†	(.220)
Region: South Atlantic			-.209	(.197)
Region: East South Central			-.524†	(.268)
Region: West South Central			-.628**	(.225)
Region: Mountain			-.679**	(.239)
Sigma			2.082**	
Log likelihood			-3086	
Rho			-.825**	

† $p < .1$, * $p < .05$, ** $p < .01$ (two-tailed)

$N = 3793$, Missing values: 447

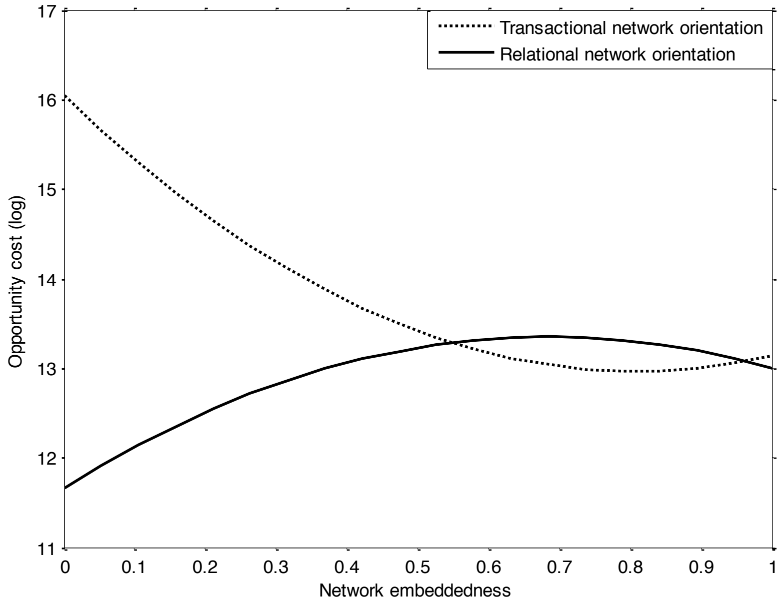


Figure 8: Visualization of the interaction between network embeddedness and network orientation

In Hypothesis 2, we propose that the effect of embeddedness on the opportunity cost of a loan is moderated by network orientation. The results presented in Table 10 show the significant interaction effect of network orientation with both the linear and squared embeddedness terms, which supports Hypothesis 2. Figure 8 depicts the interaction between embeddedness and network orientation. For firms with a transactional orientation, a mix of arm's-length and embedded relationships was optimal. These firms had higher opportunity costs when they concentrated their banking business in only one bank via embedded ties or distributed it among many banks with arm's-length ties; having a mix of arm's-length and embedded ties was not favorable. In contrast, for firms with a relational network orientation, the curvilinear relationship was reversed; a mixed portfolio strategy generated the highest opportunity costs. One interesting finding was that in cases of low embeddedness, relationally oriented firms had lower opportunity costs for loans than did the firms with a transactional orientation. These results imply that firms achieve lower opportunity costs when they diversify their banking business among many banks with arm's-length relationships if they have a relational network orientation. In contrast, transactionally oriented firms over-value short-term trade gains. However, the relational orientation should be treated with caution because opportunity costs for these firms increase with the level of embeddedness.

Embeddedness and the squared term of embeddedness have significant effects according to this study. We found a curvilinear relationship between a firm's embeddedness and its opportunity costs: the opportunity cost of embeddedness was the lowest when the firm had a mix of arm's-length and embedded ties. This result validated the findings of the earlier studies on the embeddedness paradox, which in turn reinforced the reliability of the findings of the present study.

Discussion

We assumed a behavioral perspective on social network theory and reformulated embeddedness theory accordingly. We argued that firms differ in terms of their motives for choosing their network partners. Some firms select network partners based on a purely economic rationale, whereas for others partnering decisions have a more relational basis.

The results supported our conceptualization of network orientation as a behavioral firm characteristic that is independent of embeddedness. We found that the opportunity cost of a relationship was lower when firms were more relationally oriented. These firms obtained benefits from their network partners that were not available under market conditions, which lowered the cost of foregoing outside alternative partners. Our results also demonstrated that a balance of arm's-length and embedded ties is in fact not optimal for relationally oriented firms. Indeed, we found that such a strategy was detrimental to these firms.

These results have important implications for social network and embeddedness theory. First, the present study highlights the importance of extending the structuralist view of social network theory to consider firms' behavioral characteristics. Second, the strategy recommendations regarding the balance of arm's-length and embeddedness ties should vary based on the firm's network orientation. Third, when a firm forms a network relationship with another firm, both firms access to benefits and opportunity costs accrue – the latter due to the relationships the firm has resultantly forgone. In the following subsections, we further elaborate on these contributions of our study.

Behavioral understanding of social network theory

The social network and embeddedness theories characterize economic activities as related to social relationships rather than as purely focused on utility maximization among atomistic, autonomous market players (Zaheer *et al.*, 2010). Despite the accomplishments of these theories in altering the pure economic paradigm of firms, they have been criticized for their overemphasis on the structural properties of networks: for overlooking behavioral considerations (Gulati *et al.*, 2011; Kilduff and Brass, 2010; e.g., Pettigrew and McNulty, 1995). For instance, one would expect two firms with the same network size, position in the network and tie strength to exhibit similar organizational outcomes (Kilduff and Brass, 2010; Nahapiet and Ghoshal, 1998). However, these firms may differ in their way of approaching and using their network relationships, which may result in differences between their organizational outcomes (Gulati *et al.*, 2011). Only recently have studies begun to challenge the dominant structuralist view of network theory by considering firm characteristics (e.g., absorptive capacity, bargaining power, the ability to check non-cooperativeness) as a component of the network structure-performance relationship (e.g., Lavie and Rosenkopf, 2006; Shipilov, 2006; 2009). To focus solely on network structures or tie strength rather than also considering behavioral attributes will yield a less fine-grained understanding of networks (Gulati *et al.*, 2011).

The present paper has demonstrated that firms' network orientations, as behavioral characteristics, also play a significant role. We considered why firms chose their network partners in firm-bank relationships and showed that firms that selected their network partners based on relational motives obtained more favorable trade terms than they would have from outside options. As Kanter (1994: 100) notes, "[interfirm relationships] seem to work best when they are more familylike and less rational". In addition to the direct effect of network orientation, we found that network orientation moderated the relationship between the level of embeddedness and opportunity costs.

Balancing arm's length and embedded ties

Working from our conclusion regarding the behavioral approach to network theory, the present study extended embeddedness theory and emphasized behavior in network partner selection. We observed that embeddedness theory confounded tie strength, which is a network property, with the behaviors attributed to tie strength (Shipilov, 2005; e.g., Uzzi, 1996; 1997; 1999). The present paper separated these two qualities. We have thereby introduced firms' network orientation as a behavioral characteristic.

We investigated a popular strategy recommendation of embeddedness theory: that firms balance arm's-length and embedded ties. Our results revealed that a mixed portfolio strategy in this regard is beneficial only if firms select their network partners based on transactional motives. More importantly, this strategy was less beneficial for relationally oriented firms. Thus, our results indicated that the correctness of this strategy recommendation is contingent on firms' behavioral characteristics, i.e., whether the firms in question are transactionally or relationally oriented. This finding is in line with the results of Shipilov (2005), who attributed his findings to the horizontal nature of the network context he was studying rather than to the behavioral characteristics of the firms that he examined.

It is significant that the present study employed a newer version of the data set used by the earlier studies that investigated the embeddedness paradox (e.g., Uzzi, 1999; Uzzi and Gillespie, 2002). We confirmed the findings of these studies that show that there is a curvilinear relationship between opportunity costs and embeddedness, but we also found support for the moderating role of network orientation. Our ability to validate the earlier research by using a similar data set further strengthens the reliability of our findings.

Opportunity costs of network relationships

In addition to examining network orientation, the present study focused on the tradeoffs of networks. The extant research on social network theory is dominated by a focus on the positive outcomes of network characteristics (Kim *et al.*, 2006; Zaheer *et al.*, 2010). For instance, the ties that a firm forms with other firms provide access to critical resources, such as tacit and explicit knowledge (Ahuja, 2000; Burt, 2004; Rowley *et al.*, 2000). Such ties also provide information about new capabilities (McEvily and Marcus, 2005), establish trust (Ingram and Roberts, 2000), increase the firm's bargaining power (Burt, 1992); and signal quality (Jensen, 2008; Podolny, 2001). However, embeddedness research has also suggested that over-embedded ties can generate redundant information sources (Burt, 1992; Hansen, 1999; Uzzi, 1997), encourage the formation of rigid routines and resources that hamper growth and change (Lavie *et al.*, 2011), and create vulnerability when network partners' resources become obsolete (Afuah, 2000; Shipilov, 2005).

We extended this research on the negative aspects of networks in two ways. First, consistent with the earlier research, we focused on the opportunity costs associated with embedded networks. We showed that when firms with a relational network orientation became more embedded, they were locked into a set of relationships that were fortified by the level of embeddedness and relational attachment. An increase in the level of embeddedness resulted in higher opportunity costs for these firms by making it necessary for them to forego better outside options. Second, we demonstrated that the trade-off between embeddedness and opportunity costs was contingent on the behavioral characteristics of the firms we examined.

Limitations

The nature of the data in the present paper only allowed a cross-sectional investigation of the hypothesized relationships. Although we justified the directionality of the relationships between our variables on theoretical grounds, longitudinal research should be conducted to validate our theories. Future research should also employ longitudinal data to further examine network dynamics. As Ahuja et al. (2011) rightly stated, "most of our theorizing often suggests a curiously static and passive approach on the part of these actors with respect to the network itself." Porac et al. (1989) found that the strategic choices of Scottish knitwear firms influenced their network structure. This structure filtered the information to which the firms had access and shaped their cognition, which in turn affected their strategic choices. In analyzing the dynamics of networks, future research can also uncover these types of endogenous loops among networks, behaviors, and cognition. Another limitation of the present study is that it only considers vertical network structures of firms and banks. For example, in his study of the horizontal networks of Canadian syndicates, Shipilov (2005) also noted findings that were contrary to mainstream embeddedness research. Hence, future research needs to account for the difference between horizontal and vertical networks.

Conclusion

The present study employed firms' network orientation as a behavioral characteristic that influenced their choice of network partners. We demonstrated evidence that the motives for partner selection are important; as firms become more relationally oriented, they experience lower opportunity costs. Furthermore, we revisited a suggestion from network embeddedness theory – that firms cultivate a mix of arm's length and embedded ties – and investigated the potential detrimental effects of embeddedness. Our results showed that this type of strategy was harmful for firms that chose their network partners based on relational motives. The present study contributes to social network theory by introducing network orientation as a behavioral characteristic of firms and furthers embeddedness theory by demonstrating that a balance of embedded and arm's-length ties may be either beneficial or detrimental based on a firm's network orientation.

Appendix

Table A3. Reasons to apply for a loan from a particular bank

ID Reason	ID Reason
Relational network orientation	*Calculative network orientation*
11 Previous loan, loan when starting business	10 Credit availability
17 Credit availability contingent on use of other services	13 Turned down by other institutions
25 Reputation, soundness, aggressiveness, progressivity	14 No or less collateral, no personal guarantees
32 Local Bank	15 SBA loan availability or assistance
50 Captive finance(e.g. used financial institution owned by seller)	16 Lending policies or terms
51 Seller referral (e.g. car dealer suggested loan company)	18 Large loan capability
52 Obtained from supplier of equipment &/or automobile company	20 Service availability
53 Other referral	21 Quality of service or of services
54 Owner has personal/other business with institution	22 Location, proximity
55 Owner knows (an) officer(s) or employee(s), relative, or bank owner(s)	23 Convenience/ease of use
56 Friendly, knowledgeable employees or management	24 Hours
57 Long-term relationship/ ongoing relationship	26 Small size of institution
58 Reciprocity, institution does business with firm	27 Large size of institution
59 Primary Bank	28 Size of institution (small/large not ascertainable)
71 Institution or salesman solicited firm	29 One-stop shopping, able to obtain multiple services at same institution
72 Original institution taken over by current one	30 Internet, electronic services
73 Loan assumption, old institution sold loan	31 Knowledge of industry
75 Minority ownership in institution	33 Willing to work in/specialize in Small business services
76 Other requirements of institution	34 Availability
Other reasons	40 Good prices/terms
12 Only institution to grant credit	41 Low fees or prices
70 Only institution in town, limited choice	42 High interest rate (savings or checking)
90 No Reason	43 Low interest rate and/or low loan (origination) fees
91 Gave unfavorable response	44 Interest rate (high or low not ascertainable)
92 Denied loan Institution; do not use institution	45 Good credit-card processing terms
93 No longer use institution and/or reacted negatively to institution	74 Diversification, convenient to have multiple institutions
94 Other encoded	77 Dissatisfaction with previous institution
95 Credit needed, no other response given	
99 Non-ascertainable mentioned.	

Chapter 6

THE ROAD AHEAD

Organizations' directions are determined by the members who constitute them. For example, Hambrick and Mason (1984) and Finkelstein et al. (2008:4) ascertain the executives' "characteristics, what they do, how they do it, and particularly, how they affect organizational outcomes". Behavioral strategy emphasizes right on this human factor in strategic management with an ambitious aim to "enrich strategy theory … [through] realistic assumptions about human … and social behavior" (Powell et al., 2011: 1371). The present dissertation contributes to the growing body of research in behavioral strategy.

The collection of the studies presented in the previous chapters provided further insights into measurement of cognition, consensus formation process, optimal power differences, and social network theory with assumptions grounded on social cognition, behavioral decision theory, psychology and organizational behavior. These studies offered a new method to measure, visualize and aggregate individual cognition to group and between group level with a strong emphasis on multiple dimensions of cognition, shed light on micro-processes on consensus formation in relation to within-group power differences and psychological safety, a novel model of strategic decision making, and a new behavioral construct that refined existing theories from a behavioral perspective. Consequently, each study on its own laid down responses to core research questions of behavioral strategy identified by Powell and his colleagues (2011).

While the present dissertation addressed and contributed to existing core research problems of behavioral strategy, several important challenges are still waiting to be resolved. First, behavioral strategy needs to produce a set of integrative theories. Second, it should continue building links between so far disconnected disciplines and literatures to advance strategic management. Third, behavioral strategy should come up with prescriptive tools to help practitioners to cope with their cognitive and behavioral biases. In the following sections, we elaborate more on the road ahead for behavioral strategy.

Integrate

"There is nothing so practical as a good theory" as put beautifully by Kurt Lewin (quoted in van Knippenberg, 2011:3). A good theory explains *why* (Sutton and Staw, 1995). It provides a story that sets up causal connections between acts, events, structure and thoughts by going deeper into the processes (Sutton and Staw, 1995). As a result of offering a wider perspective that embraces and advances earlier theoretical perspectives, an integrative theory creates an ecosystem of new discussions, lights up new ideas, and leads to new research questions.

Salancik (1995) raised the critique against network theory that answers provided by network theory usually come from other theories. A similar critique can be posed for behavioral strategy that it repackages explanations provided by social and cognitive psychological theories and applies them into strategic management. Due to the lack of integrative and overarching theories of its own, behavioral strategy has so far remained as "a patchwork of theories and findings" (Powell *et al.*, 2011:1370). However, there is hope. Much of behavioral strategy's promise has yet to be realized.

Exploiting the analogy between management and medicine, Weick (1995a) argues that the best management scholars interpret, speculate, propose and hypothesize observed phenomena before they explain, model and theorize as the best doctors first treat the symptoms before relying on a diagnosis. That is, theories come out at a later stage to summarize observations, form causal relationships between variables, integrate accumulated research to explain why the observed phenomenon occur. Research in behavioral strategy has been quite successful in challenging strategic management's dominant views of efficient markets and rational agents by highlighting cognitive biases and behavioral failures (Gavetti, 2012). To move strategic management forward, it is about the time to produce overarching and integrative theories.

The evolution of studies in the present dissertation is a good reflection of the expected development of behavioral strategy. While studies in Chapter 3 and Chapter 4 heavily used theories of strategic decision making and cognitive and social psychology to answer questions related to consensus formation and distribution of power, the last and most recent study achieved constructing a behavioral theory of network embeddedness where it explained *why* firms choose certain network partners. It addressed the theoretical problem of network partner selection, provided a novel explanation using the lenses of behavioral strategy, and consequently reformulated the strategy recommendations of embeddedness theory. That study exemplifies the prospects of behavioral strategy and underscores the importance of creating integrative theories of behavioral strategy that can enrich accumulated knowledge in strategic management.

Build Bridges and Expand

By its definition, behavioral strategy positions itself as a bridge between strategic management and cognitive and social psychology. This positioning has equipped behavioral strategy with realistic assumptions and unique insights about cognition, emotions and behavior within strategic management context. To preserve its distinguishing characteristic as an multidisciplinary research field, behavioral strategy needs to continue bridging across hitherto unconnected fields and expand to new research areas in order to stay at the forefront of strategic management.

One avenue for bridging has been already happening in terms of research methods used. For example, NK models simulation model was borrowed from evolutionary biology and often employed in relating cognition with strategy (see Ganco and Hoetker, 2009 for a review; e.g., Gavetti and Levinthal, 2000; Gavetti *et al.*, 2005). In a similar vein, in Chapter 4, I provided a computer simulation that I adapted from engineering. In addition to computer simulations, behavioral strategy can also utilize highly useful research tools such as neuroimaging, genetics and hormones, ethnographic field studies, discourse analysis, mathematical modeling, textual analysis, and experiments.

However, it is important to recognize the advantages and limitations of each research tool which requires using multiple methods to create convergent knowledge (Burton and Obel, 2011). More importantly, use of multiple methods can facilitate creating integrative theories. Van Knippenberg (2011) argues that single method studies are limited to a small set of relationships in a single empirical setting, hampering comprehensive understanding of the issue at hand. Complementary use of methods might avoid it. For example, surveys and archival data can reveal the description and explanation, i.e. “what-is”, of the observed phenomenon, employing computer simulations can then support theory building by going beyond the existing empirical setting and exploring wider context of alternatives, possibilities and boundaries, i.e. “what-might-be” (Burton and Obel, 2011).

Another direction for behavioral strategy is to expand its scope to various research areas closed to strategic management in order to discover the boundaries of behavioral strategy’s applicability. For example, innovation management stands out as a particular area open for expansion. Innovation process is highly complex and surrounded by uncertainties where employees mostly rely on their cognitive skills to make sense of the business environment (Kaplan and Tripsas, 2008). Additionally, once a new idea is discovered, social interactions among peers and higher levels takes place to make others buy into the idea and implement it. It is therefore essential to enlarge behavioral strategy's scope to fields like innovation management and apply the findings of behavioral strategy. Such an endeavor will also demarcate the boundaries of behavioral strategy enabling it to take stock of its value propositions and focus on the fields to which it can contribute the most.

Help the Strategists

Extending Weick's (1995b) analogy between medical doctors and management scholars, if medical doctors' goal is to remedy the health of theirs patients, the purpose of management scholars is then to help businesses prosper. Contrary to the conceptualizations of organizations and their constituencies as rational agents, burgeoning research stream of behavioral strategy recognizes emotions, cognitive limitations, behavioral failures and irrationalities (Gavetti, 2012; Huy, 2012; Powell *et al.*, 2011). Therefore, the onus is on behavioral strategy to develop methods and recommendations supported by integrative theories that can support practitioners in realizing and managing their cognitive and behavioral boundaries.

The present dissertation has proposed a novel method namely strategic consensus mapping (SCM) for a comprehensive understanding of strategic consensus. SCM allows practitioners to extract what individuals and groups think about the strategy and to detect where and on which strategic goals there is alignment. Using these insights practitioners can decide on whether to carry out a strategic intervention to influence consensus and alignment in the organization. Later, SCM can also be utilized to test effectiveness of this intervention. Furthermore, Chapter 3 highlighted that practitioners should not overlook the power differences and psychological safety within a group when they organize interventions to increase consensus. Chapter 4 provided insights regarding the conditions such that steep or even power differences are preferred. More specifically, Chapter 4 warned firms to consider their abilities to detect most competent employees before implementing a merit based distribution of power. Chapter 5 represented important managerial implications as well. It revisited the popular strategy recommendation of network embeddedness theory to balance embedded and arms' length ties.

I demonstrated that such policy is beneficial only for the firms that select their network partners based on transactional motives. However, at firms with relational motives such a policy is detrimental. While this study underscored network orientation as a behavioral characteristic of firms, it also proposed practitioners to take their network orientation into account before applying popular strategy recommendations, e.g. of network embeddedness theory.

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EXECUTIVE SUMMARIES

Summary in English

Organizations are embedded in a network of relationships and make sense of their business environment through the cognitive frames of their employees and executives who constantly experience battles for power. This dissertation integrates strategic management research with organizational behavior to illuminate managerial cognition, intra-organizational power and interfirm networks.

The collection of the studies presented in the present dissertation provides further insights into measurement of cognition, consensus formation process, optimal power differences, and social network theory with assumptions grounded on social cognition, behavioral decision theory, psychology and organizational behavior. These studies offered a new method to measure, visualize and aggregate individual cognition to group and between group level with a strong emphasis on multiple dimensions of cognition, shed light on micro-processes on consensus formation in relation to within-group power differences and psychological safety, a novel model of strategic decision making, and a new behavioral construct that refined existing theories from a behavioral perspective. Each study on its own laid down responses to core research questions of behavioral strategy. Consequently, this dissertation extends strategic management along behavioral lines and equips scholars and practitioners with novel methods and theoretical insights with respect to cognition, power and networks.

Summary in Dutch

Organisaties zijn onderdeel van een netwerk van verbindingen. Organisaties zien hun zakelijke omgeving door de cognitieve kaders van hun werknemers, die constant strijden om macht. In dit proefschrift wordt onderzoek gedaan naar strategisch management en het gedrag van organisaties. De verzameling van studies gepresenteerd in dit proefschrift geeft inzicht in het meten van cognition, het proces tot het komen van consensus, optimale machtsverschillen en de theorie van het sociale netwerk. Dit proefschrift geeft onderzoekers en managers nieuwe methodes en theoretische inzichten in cognition, macht en netwerken.

Summary in Turkish

Organizasyonlar bir ilişkiler ağına yerleşmiştir, ve güç çekişmeleri içinde bulunduğu çevreye kendi bakış açısından anlam vermeye çalışan yönetici ve çalışanlardan oluşur. Bu doktora tezinde yer alan makaleler yöneticilerin biliş ve anlayışlarının ölçen bir teknik sunmaya ek olarak şirket içinde fikir birliğinin oluşma sürecini, gücün nasıl dağıtılması gerektiğini ve sosyal ağlarda şirketlerin nasıl davrandığını açıklar. Bu tez çalışması stratejik yönetim ve organizasyonel davranış literatürlerini birleştirerek araştırmacılara ve yöneticilere katkıda bulunmayı amaçlar.

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Murat Tarakci obtained his Bachelor's degree with high Honors from Sabanci University, Istanbul/Turkey in Economics and Mathematics. He received his Master's degree in Mathematical Economics and Econometrics from University of Toulouse 1, France. Prior to his PhD at Erasmus School of Economics, he gained work experience at the Finance department of Unilever Turkey.

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BEHAVIORAL STRATEGY
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Organizations are embedded in a network of relationships and make sense of their business environment through the cognitive frames of their employees and executives who constantly experience battles for power. This dissertation integrates strategic management research with organizational behavior to illuminate managerial cognition, intra-organizational power and interfirm networks.

The collection of the studies presented in the present dissertation provides further insights into measurement of cognition, consensus formation process, optimal power differences, and social network theory with assumptions grounded on social cognition, behavioral decision theory, psychology and organizational behavior. These studies offered a new method to measure, visualize and aggregate individual cognition to group and between group level with a strong emphasis on multiple dimensions of cognition, shed light on micro-processes on consensus formation in relation to within-group power differences and psychological safety, a novel model of strategic decision making, and a new behavioral construct that refined existing theories from a behavioral perspective. Each study on its own laid down responses to core research questions of behavioral strategy. Consequently, this dissertation extends strategic management along behavioral lines and equips scholars and practitioners with novel methods and theoretical insights with respect to cognition, power and networks.

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