A Dialectic Perspective on Innovation: Conflicting Demands, Multiple Pathways, and Ambidexterity

Ronald Bledow[1]

Michael Frese[1]

Neil Anderson[2]

Miriam Erez[3]

James Farr[4]

[1]University of Giessen, [2]University of Amsterdam, [3]Israel Institute of Technology,

[4]Pennsylvania State University

February 2009

Published in: Industrial and Organizational Psychology: Perspectives on Science and Practice, 2(3).

Link: http://www.siop.org/journal/siopjournal.aspx

Acknowledgment: This research was supported by a scholarship (D/08/45383) of the German Academic Exchange Service granted to the first author and a research grant by the Volkswagen Foundation (II/82 408). We appreciate the thoughtful comments of our colleague Kathrin Rosing. Furthermore, we would like to thank our colleagues Andreas Bausch, Nataliya Baytalskaya, Verena Mueller, Nina Rosenbusch, Alexander Schwall, and Shaker Zahra for discussions on initial ideas from which the current manuscript emerged.

Abstract

Innovation, the development and intentional introduction of new and useful ideas by individuals, teams, and organizations, lies at the heart of human adaptation. Decades of research in different disciplines and at different organizational levels have produced a wealth of knowledge about how innovation emerges and the factors that facilitate and inhibit innovation. We propose that this knowledge needs integration. In an initial step toward this goal, we apply a dialectic perspective on innovation to overcome limitations of dichotomous reasoning and to gain a more valid account of innovation. We point out that individuals, teams, and organizations need to self-regulate and manage conflicting demands of innovation and that multiple pathways can lead to idea generation and innovation. By scrutinizing the current use of the concept of organizational ambidexterity and extending it to individuals and teams, we develop a framework to help guide and facilitate future research and practice. Readers expecting specific and universal prescriptions of how to innovate will be disappointed as current research does not allow such inferences. Rather, we think innovation research should focus on developing and testing principles of innovation management in addition to developing decision aids for organizational practice. To this end, we put forward key propositions and action principles of innovation management.

A Dialectic Perspective on Innovation: Conflicting Demands, Multiple Pathways, and Ambidexterity

Throughout this paper we use the term *creativity* for the generation of new and useful ideas and that of *innovation* to include both creative ideas and their implementation. Innovation can take different forms, including technological innovation, product and service innovation, and process innovation. The importance of innovation is widely acknowledged by organizational scholars, practitioners, and the wider society in an economic environment characterized by fierce competition, rapid change, and the global challenges of climate change and economic booms and busts. Decades of research have produced a wealth of knowledge about the characteristics of individuals, teams, and organizations that are related to outcomes of innovation (e.g., Anderson, De Dreu, & Nijstad, 2004; Damanpour, 1991). Some of these findings converge around factors that have been reliably found to influence innovation, such as a shared vision, innovative organizational culture (Miron, Erez, & Naveh, 2004; Naveh & Erez, 2004), emphasis on exploration rather than exploitation, and investment in R&D (Zahra & George, 2002; Cohen & Levinthal, 1990). Findings with respect to other factors, such as team diversity (Gibson & Gibbs, 2006), task related conflict, monetary rewards (Amabile, 2000; Eisenberger & Rhoades, 2001) remain contradictory. While we think that the scientific understanding of innovation is an important endeavor in its own right, we also suggest that the impact of scientific knowledge about innovation can be improved in organizational practice. While many reasons may account for a lack of transfer of scientific knowledge to management practices, one reason may be that the scientific findings do not readily or easily produce actionable knowledge.

On the other hand, simplistically inferring practical implications or trying to be overly prescriptive can do harm, particularly if the context of an individual, team, or organization is not

taken into account. We, therefore, chose to integrate empirical findings of the extant literature with an attempt to develop a set of broad principles of innovation management that can guide decision making and action in organizations. We base this integration on a perspective on innovation which we term "dialectic"; we present and develop this perspective below. Toward this goal we offer three contributions to the literature:

- By developing and applying a dialectic perspective on innovation, we aim to gain a more valid account of innovation in organizations that can enrich research and practice.
- By reviewing core findings about innovation we illustrate how multiple pathways can lead to idea generation and innovation.
- By redefining and extending the concept of ambidexterity, we propose a cross-level framework for the successful management of inherently conflicting demands of innovation.

Tensions of Innovation: Theoretical Perspectives

A pervasive theme in research on organizational innovation is that innovation is characterized by tensions (Lewis, Welsh, Dehler, & Green, 2002), paradoxes (Miron et al., 2004), contradictions (King, Anderson, & West, 1991), dilemmas (Benner & Tushman, 2003), and the so-called "dark side" of innovation processes (Anderson & Gasteiger, 2007). Table 1 presents a number of examples of tensions related to innovation that have been noted in the published literature. We organize Table 1 by the referent level of the tension (individual, team, or organizational) and by whether the tension is primarily focused on antecedents of innovation or on innovative processes and outcomes. That tensions have been described frequently at all levels of analysis and with regard to antecedents, processes, and consequences of innovation provides

what we think is compelling evidence for their pervasiveness within organizations attempting to innovate.

Insert Table 1 about here

We propose with others that understanding and managing these tensions is central to successful innovation and use the terms *conflicting demands* and *conflicting activities* to refer to the origins of tensions, paradoxes, contradictions and dilemmas. In the following we contrast two theoretical perspectives and the strategies they imply for dealing with these tensions. One strategy deals with tensions by emphasizing the separation of conflicting activities to different sub-organizations or even different organizations altogether (O'Reilly & Tushman, 2004). The top management of the organization is responsible for the necessary integration of activities that produce the tensions. In a way, this strategy deals with tensions by reducing them as much as possible. This strategy derives from a dichotomous theory perspective (March, Sproull, & Tamuz, 1991). We contrast the dichotomous approach with a second theoretical perspective which argues that a strict separation of conflicting activities to sub-organizations leads to disadvantages. Given that a system has sufficient levels of internal complexity (Brown & Eisenhardt, 1997), the tensions should be kept within the system to be managed rather than organized "out" of the system.

Both the dichotomous ("keep separate") and dialectic ("integrate and manage") perspectives concur that the innovation process poses potentially conflicting task demands on individuals, teams, and organizations. By task demands we refer to the patterns of requisite

activity an individual, team, or organization must engage in to achieve an outcome. Innovation confronts individuals, teams, and organizations with fundamentally different demands in several important and unavoidable ways:

First, the demands of innovation differ from the demands of routine performance. Whereas routine performance is based on the exploitation of knowledge, skills, and abilities that emphasize quality and efficiency criteria, innovation requires exploratory action and creative thinking. People and teams who need to be creative and innovative must crave newness and be curious, while people and teams who are supposed to produce efficiently must be able to close their minds to new ideas that just interrupt the clear pattern of existing routines and hinder the further development of those routines into ever more efficient production.

Second, the innovation process itself encompasses different sets of activities, such as those related to idea generation and innovation implementation: These sets of activities are linked to different or conflicting antecedents. For instance, granting autonomy is linked to the generation of new ideas (Shalley, Zhou, & Oldham, 2004), while initiating structure is related to the success of implementing incremental innovation (Keller, 2006). Maximizing the conditions fostering creativity is unlikely to translate directly into innovation because innovation encompasses much more than idea generation. Indeed, the maximization of factors that facilitate the development of new ideas is likely to simultaneously cause conditions that may inhibit idea implementation, and thus innovation overall. For example, Xerox Parc developed many innovations in software design, PC hardware and PC connectivity. The creativity of this group was enormous. And these innovations were often implemented in products. However, Xerox made little economic use of these enormously creative new products that essentially were fed into innovations marketed by Apple and Microsoft (Bergin, 2006; Miller & Steinberg, 2006).

Third, in addition, there are different types of innovation: An innovation is *incremental* when it builds on and exploits existing products and processes; an innovation is *radical* or *disruptive* if it departs strongly from the status quo (Benner & Tushman, 2003). Incremental innovation leads to expected increases in mean levels of performance, while radical innovation creates variability in performance (potential for high losses or high returns). The expected level of returns is lower for radical than for incremental innovation (Taylor & Greve, 2006). We assume with others that for radical innovation the problem of conflicting task demands of innovation is more pronounced than for incremental innovation and the management of tensions is particularly challenging (Christensen, 1997). But even incremental innovation requires different performance activities and the emergent logic of incremental innovation can challenge the established logic and climate for working practices (Bouwen & Fry, 1991). After all, an innovation means by definition that something new is done, produced, or serviced – new to the context in which the organization has operated up to that point.

Dichotomous perspective on innovation: Creation-implementation and exploration-exploitation

> *Proposition 1:* Creation-implementation and exploration-exploitation are conceptual dichotomies that refer to potentially conflicting activities. However, both seemingly contradictory activities are intertwined and mutually dependent.

We label one approach to understanding the tensions of innovation a *dichotomous theory* perspective because it emphasizes the fundamental dichotomies of organizational innovation and their respective inconsistencies: creation-implementation and exploration-exploitation. The dichotomous theory perspective regards idea generation and implementation as two distinct activities that should be separated in terms of time and often even with regard to people. The

separation of people is based on the fact that some people are more creative than others, while others may be better at implementation and the maintenance of newly implemented ideas. Once an idea has been developed in the creative phase, the implementation is conceptualized to be the execution of an idea that is largely fixed. Particularly when different people are involved or if tasks are rigidly structured into phases, the differentiation of these phases is emphasized. However, as we will elaborate later, creation and implementation are intertwined and mutually dependent activities and difficulties are likely to result if a strategy of clearly separating the two sets of activities is pursued.

The second basic dichotomy is the distinction between *exploration* and *exploitation*. "Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution" (March et al., 1991; p. 71). Thus, both dichotomies are directly related as exploration encompasses creative idea generation, while implementation is a subset of exploitation. Extending the work by March et al. (1991), Benner & Tushman (2003) used the term "productivity dilemma" to refer to the difficulties organizations face as they are supposed to be both exploring and exploiting technologies and markets. An organization aiming at sustainable performance needs to exploit and adapt current products and processes *and* explore new products and processes. However, exploration and exploitation activities compete for scarce resources (March et al., 1991) and pursuing both activities has been proposed to pose inconsistent psychological demands on individuals, teams, and organizations (Smith & Tushman, 2005). Therefore, the standard suggestion is to make it possible for organizations to be both exploitative and explorative; however, because of the inherent tensions, these two functions of the organization need to be

separated – often in different locations with different personnel and even in sub-organizations that are distinct from the mother firm. This type of organization is known as the ambidextrous organization (Benner & Tushman, 2003; Gibson & Birkinshaw, 2004). One example is IBM, which developed its personal computers with a completely different set of employees than its standard mainframes (Hamel & Prahalad, 1994). Although research about exploration-exploitation has primarily focused on the organizational level of analysis, the logic underlying the dichotomous strategy can be extended to lower levels in an organization. For example, within a team the tensions between activities can be reduced by creating fixed roles around either more explorative or exploitative tasks.

While there is empirical support for the theoretical proposition that performing both activities leads to better organizational results (He & Wong, 2004), the assumptions that exploration and exploitation need to be separated has to our knowledge not been empirically tested. Not denying the trade-offs and inconsistencies that can arise, we doubt that this is a law of nature. For example, Gilson, Mathieu, Shalley, and Ruddy (2005) have demonstrated that creativity and standardization - creativity being explorative and standardization exploitative - can not only co-occur within work teams, but actually interact to bring about superior performance in terms of customer satisfaction.

While exploration and exploitation may lead to tensions and trade-offs, they can co-occur and be as much functionally interdependent as they are in conflict. For instance, the separation of exploratory from exploitative units may reduce inconsistencies, such that R&D departments can more easily explore without being constrained by a current way of doing things or by a production-focused time horizon for goal accomplishment; this approach may, however, also create new problems and loss of synergies with other departments that are responsible for the

implementation and marketing of new products (Westerman, McFarlan, & Iansiti, 2006). Companies have anecdotally reported unforeseen difficulties when they have kept research and development in their headquarters but moved production to low-cost countries. As the production base is no longer easily available, R&D departments face problems because production units frequently serve as a source of ideas and as an opportunity to test the feasibility of ideas and their implementation.

The problems of the dichotomous perspective that we note with this brief discussion, lead us to propose an alternative approach that we label a *dialectic perspective* on innovation.

A dialectic perspective on innovation

"*The thread of common meaning which runs through … four conceptions of dialectic [i.e. those of Plato, Aristotle, Kant, and Hegel] is to be found in the principle of opposition. In each of them dialectic either begins or ends with some sort of intellectual conflict, or develops and then resolves such oppositions."* Adler (1952, p. 350)

To advance our understanding of innovation we propose dialectic reasoning as a useful framework. The common thread underlying the use of the term *dialectic* in Western philosophy is a focus on contradictions and the attempt to overcome contradictions in favor of higher order integrations. For other dialectic approaches, in particular eastern philosophies and "eastern ways of thinking" more generally, the emphasis is more on acceptance and tolerance of contradictions rather than active change towards a synthesis (Nisbett, Peng, Choi, & Norenzayan, 2001). In accordance with our cultural background and the phenomenon we study – the intentional introduction of new ideas that bring about innovation – we follow a dialectic approach in the tradition of Western philosophy. Dialectic thinking emphasizes that reality is in a constant state

of flux and that conflicting forces underlie the dynamic nature of both reality and human thinking (e.g. Engels, 1940). Dialectic thinking stresses the mutual dependence of concepts and phenomena and their interrelationships. For instance, from a dialectic point of view the meaning of a construct such as promotion focus is partly derived from implicitly contrasting it with its counterpart of prevention focus (Forster, Higgins, & Taylor-Bianco, 2003; Higgins, 1997).

From a dialectic perspective, we argue that the tensions between the above dichotomies, between creativity and implementation and between exploration and exploitation, should be kept within the same organizational system because they are interdependent. For example, it is precisely the ability to discuss conflicting ideas within a cross-functional team that leads to innovation (Lovelace, Shapiro, & Weingart, 2001).

Dialectic reasoning is inherently motivated as its goal is to overcome a dualism, a higher order integration of conflicting parts in the form of a new synthesis. Toward the goal of advancing our understanding of innovation, we apply dialectic reasoning to overcome the static and dichotomous way of thinking that prevails in much of the extant innovation research. We discuss how conflicting forces can be managed to achieve a synthesis in the form of successful innovation and propose that dialectic thinking can spur innovation. Indeed, Riegel (1973) argued that innovative activities, "are dominated by playful manipulations of contradictions and by conceiving issues integratively which have been torn apart by formal operational thinking" (p. 363; see also Peng & Nisbett, 1999), thus, by thinking in a dialectic manner.

At the most abstract level the well known formula of thesis, antithesis, and synthesis describes the process of ongoing negation central to dialectic reasoning. The synthesis that resolves the opposition of thesis and antithesis already contains a new dialectic process: It becomes the next thesis that results in another antithesis which can again be developed into a

higher form of synthesis. This is a powerful description of change processes in general (Weick & Quinn, 1999): From a specific situation with its routines, norms, and beliefs (the thesis) emerges some dissatisfaction with the status quo, motivating a change process (the antithesis). The synthesis is an outcome from the change process which carries the old and embraces the new at the same time. But since the new synthesis produces new problems, it also produces new antitheses (Festinger, 1983, has pointed this out as the dynamics of human cultural development).

> *Proposition 2:* Every state of an organization leads to its contradiction and negation at some point. Thus, there is a never ending cycle of continuing innovations that is based on recurring antitheses and syntheses.

We suggest that this abstract formula of thesis, antithesis, and synthesis describes the innovation process quite well, because innovation usually implies that one negates something that currently exists. At the same time, however, innovation cannot be completely "free" from the influence of what previously existed. A popular example is the fact that the first cars were essentially 'horse carriages without a horse'; various syntheses led to new innovative developments that integrated better various stages of this dialectic process of synthesizing aerodynamics, progress of engine technology, etc.

Another example is the innovation of lean production by Toyota (Womack, Jones, & Roos, 1990) which first started with the thesis of traditional Japanese production of cars by craftsmanship. An antithesis based on the use of modern production technology was developed, but this antithesis was constrained by post-war Japanese poverty; therefore, production could not mimic the American antithesis of Fordian assembly lines with its vast superiority in terms of standardization and routinization. Thus, a different antithesis had to be used which led to a

synthesis that allowed old craftsmanship to be lifted up into a new synthesis, called lean production (or, more accurately, the inclusion of certain facets of craftsmanship, such as lifelong employment, consistent development of employee skills, and frequent performance improvement suggestions by blue collar workers). Again, lean production underwent a number of innovative revisions once the basic idea was developed. This then led to the most powerful production machine in the world of automobiles (Womack et al., 1990). Once lean production was tried outside the Japanese context, this led again to a set of new theses, new antitheses, and new syntheses (Young, 1992).

In the tradition of dialectic thinking, organizational innovation can be conceptualized as a dialectic process, the resulting innovation being a specific instance of a synthesis. An initial idea of a new product or organizational process and the status quo are the contradictory forces at the beginning of the process. The successful transformation of the status quo to incorporate a new idea can be regarded as the synthesis in this dialectic process. The result of innovation is not identical with the initial idea but "resolves" the opposition of that idea and the former state[1]. The synthesis carries elements of both parts of the system – the thesis and the antithesis – but integrates and supplements them. Analytical separation of the status quo that is to be changed and the new idea, specifying the direction of innovation as contradictory categories, can obscure that both are interdependent. New ideas originate from and are embedded in the status quo and the status quo is itself the result of prior ideas. Fundamental creativity can lead to new ideas, but we argue that those ideas are also subject to incremental improvements, new ideas that emerge because details do not work well (i.e. detail orientation) and because errors may appear unexpectedly even in routinized work and lead to new thinking. Thus, there are several avenues in which an antithesis can be developed to stimulate innovation. An example in psychological

science for these different avenues are the approaches of Piaget and Tolman in their critique of behaviorism. Piaget (1947) made an all-out attack on behaviorism, while Tolman (1932) started from an empirical critique of behaviorism that was still wedded to behaviorist principles. Nevertheless, both came to similar scientific ideas that emphasized cognitive concepts. Extending the focus from innovation processes to the antecedent conditions of innovation, dialectic reasoning requires scrutinizing the relationship between antecedent conditions and outcomes.

> *Proposition 3*: Antecedent conditions have inconsistent consequences for the different requisite activities of innovation. Both sides of many conceptual dichotomies have functional value for some of the activities underlying innovation.

An example for inconsistent consequences of antecedent conditions on innovation is diversity. Diversity of individuals in teams and organizations holds the promise of spurring innovation as different perspectives are available. However, diversity can lead to information elaboration, thereby fostering innovation, but can also lead to social categorization processes that hinder innovation (we later elaborate on findings about team diversity) (Van Knippenberg, De Dreu, & Homan, 2004). The hypothesized role of individuals' regulatory focus for innovation can serve as an example for the functional value of both sides of a conceptual dichotomy. Whereas a high promotion focus aimed at moving an idea forward even in the face of uncertainty and potential failure can have high functional value for innovation success, the same is true for a prevention focus. Detailed elaboration of information and suspension of early decision-making and commitment to a first idea can be as valuable (Forster, et al., 2003).

The dialectic approach leads one to think differently about paradoxes. Originally, a paradox "*denotes contradictory, mutually exclusive elements that exist simultaneously and for*

which no synthesis or choice is possible or necessarily desirable" (Cameron & Quinn, 1988, p. 2). A dialectic approach suggests that the paradoxes discussed in the innovation literature can be resolved by taking the complexity of innovation processes and the multiple pathways to innovation into account.

Let us contrast the dialectic theory perspective with the dichotomous theory perspective described above. The dichotomous perspective regards idea generation and implementation models of innovation as two separate activities that need to be separated in terms of time and often with regard to personnel. Once the creativity phase is completed, the implementation phase is conceptualized to be the execution of the novel idea that is fixed once and for all. In contrast, a dialectic perspective emphasizes that creative processes and implementation are intertwined and mutually dependent activities. Creative activity does not only serve as input to idea implementation but is required throughout the process as unforeseen problems and opportunities arise and subtasks such as product components, production processes, and marketing strategies are addressed (Mumford, Scott, Gaddis, & Strange, 2002). The same idea will lead to different outcomes depending on the specific circumstances of an organization as ideas interact with the environment in which they are implemented and transformed. Many stakeholders are involved in any organizational innovation, which should be regarded as the result of collective action. Thus, innovation at the team or organizational level emerges through processes in which the contributions of different actors are integrated and the final result is different from what the actors initially intended (Hargrave & Van De Ven, 2006).

A Dialectic Review of Research on Innovation at Multiple Organizational Levels

The steps commonly assumed to describe the path from ideas to their implementation consist of: idea generation, idea evaluation and selection, idea mobilization, building a prototype, implementing the prototype into a final product, and marketing the product towards its successful penetration to the market (Amabile, 1988; Farr, Sin, & Tesluk, 2003; West, 2002b). Along this process, different factors can either facilitate or inhibit the innovation process. In the following sections, we review the research literature on the steps from idea generation to its implementation, moving from the individual to the organizational level, in order to discuss some propositions that follow from a dialectic approach. We are not advocating a phase model of innovation, but are using these familiar terms heuristically as convenient parcels of an outline of the innovation process. We demonstrate that the duality of competing processes exists not only between these steps but also within each step.

Step 1: The generation of new and useful ideas by individuals

> *Proposition 4:* There are multiple pathways to developing creative ideas, such as necessity, slack resources, or errors. Activities commonly considered as 'uncreative', such as attention to detail, can lead to a point at which useful new ideas can first be initiated.

One focus of psychological research has been on creative idea generation. Creativity is often defined as the generation of new ideas that are useful and appropriate (West, 2002b; Amabile, 2000). Research has found that different and even conflicting factors can stimulate idea generation and we infer there are multiple "entry points" and pathways to the generation of new and potentially useful ideas: Two competing forces – necessity and limited resources, but also

slack and "garbage cans" (see below) - stimulate creativity. New ideas can arise in the face of opportunities, such as technological developments, or can be stimulated by pressing problems, necessities, and distress with the status quo. These different entry points of idea generation are reflected in conflicting theoretical propositions and empirical findings about the importance of slack resources for creativity. Slack resources can enable individuals and organizations to develop and explore ideas even if they do not lead to tangible results in the short term (Damanpour, 1991; Voss, Sirdeshmukh, & Voss, 2008). Cohen, March, and Olsen (1972) coined the term "garbage can" which refers to a form of organized anarchies, consisting of solutions looking for issues to which they might be an answer. However, not only the saying "necessity is the mother of invention" questions if slack resources really are a prerequisite for innovation. Environmental threat (Voss et al., 2008), time pressure (Ohly, Sonnentag, & Pluntke, 2006; Baer & Oldham, 2006), and sheer necessity (Gasper, 2003) can also be drivers of idea generation. These are opposing ideas. A dialectic viewpoint would suggest that a synthesis is possible: Threat, time pressure, and necessity can influence an active approach to dealing with problems, and such an active approach may lead to higher creativity which includes developing creative ideas with a goal oriented approach. In our thinking, personal initiative is influenced by these threats and necessities (Binnewies, Ohly, & Sonnentag, 2007; Fay & Sonnentag, 2002) and personal initiative implies creativity (Frese, Teng, & Wijnen, 1999). On the other hand, the complete lack of slack resources may lead to the expectation that nothing works well in the organization and, therefore, there is little outcome control and action control – this leads to a lower degree of personal initiative which includes lower creativity (Frese, Garst, & Fay, 2007).

> *Proposition 5:* Providing an environment that allows for ideas to emerge is useful, but rewarding creativity and structuring creativity are advisable when goals can be specified.

Another area in which contradictory propositions exist is the influence of organizational practices on individuals' motivation to engage in creative activities. Leaders can chose to increase employee creativity by setting goals for creativity and rewarding creative behavior (Eisenberger, Pierce, & Cameron, 1999; Shalley, 1991). Extrinsic motivators, such as money, can enhance creativity because individuals are motivated to focus on the generation of new and original ideas (Eisenberger et al., 2001; Livne-Tarandach, Erez & Erev, 2004). A leader may specify what kind of creative ideas he or she is seeking. A project manager of a marketing campaign may ask for new ideas related to how new customers can be addressed and further constrain the options he or she considers feasible. This aligns individuals with the leaders' concept of what kind of new ideas add value. Setting goals and rewarding creativity is contradicted by the idea that intrinsic motivation is the main motivational driver of creativity (Collins & Amabile, 1999). The recommendation that follows from intrinsic motivation is to create a work environment that facilitates creativity rather than directly rewarding creativity. This perspective questions the usefulness of goal setting and rewarding creativity because it may undermine intrinsic motivation (Amabile, 2000).

A synthesis is possible between these contradictory ideas. Goal oriented creativity and extrinsic motivators increase creativity whenever the goal to be creative clearly refers to a specific task (Shalley, 1991); this is often the case when creative ideas are implemented. More likely than not, creative ideas are very important in the implementation "phase" (Mumford et al., 2002). Whenever a goal cannot yet be specified for a task, it pays to provide environments in which there is unconditional acceptance and intrinsic motivation (Collins & Amabile, 1999; West, 2002b). A dialectic viewpoint suggests that one approach, namely freedom that provides unconditional support for creativity, may produce the success of its opposite, namely goal

oriented creativity and extrinsic motivators, once the novel idea is deemed to be successful by an organization. In other words, the thesis freedom leads to its antithesis whenever creative ideas are translated into concrete products – in this later 'phase', goal oriented creativity is probably successful. While this resembles the implementation 'phase', we maintain that creativity is still needed: therefore, it is not a purely new phase even if the motivation for this creativity may be externally developed. Just so that we are not misunderstood that we want to introduce a phase model again, we hasten to add that even at that point of the innovation process, it may be useful to have undirected, non-goal-oriented sessions of creativity. Such a creativity session may be somewhat shorter than in the first creative 'phase', however, to produce better ideas for implementation.

> *Proposition 6:* Fostering positive moods facilitates creativity. However, the functional value of negative moods, such as distress of the status quo and effortful persistence, need to be acknowledged as part of goal-directed innovation.

Evidence for our general claim that highly different circumstances and processes can lead to idea generation also comes from the literature investigating the mood-creativity link. There is consistent evidence on the creativity enhancing impact of positive emotional states (e.g., Isen, Daubman, & Nowicki, 1987; Amabile, Barsade, Mueller, & Staw, 2005). At the same time, negative mood can also foster creative thinking under certain conditions. George & Zhou (2002; 2007) have pointed out that both negative as well as positive emotions may have a useful function: Negative mood promotes creativity when support for creativity and positive emotions are present because negative mood signals a problematic state of affairs, leading individuals to systematically address the problem at hand. Fong (2006) found that experiencing the state of emotional ambivalence – the simultaneous presence of positive and negative emotions - leads to

a state of higher creativity. De Dreu, Baas, & Nijstad (2008) suggested a dual-pathway to creativity model in which creativity can be achieved through effortful persistence or a state of positive mood. Thus, the emotional underpinnings of creativity can vary and creativity can emerge from a complex interaction of seemingly contradictory emotional tendencies.

> *Proposition 7:* Innovation requires the regulation of exploration and exploitation and their antecedents (e.g., divergent and convergent thinking, learning and performance orientation). Exploitative activities and expertise provide the foundation for useful new ideas but need to be challenged by explorative activities for new ideas to emerge. New ideas that emerge, in turn, require exploitative activities to be successfully implemented.

Creative idea generation is subsumed under exploration within the conceptual dichotomy of exploration and exploitation activities in organizations. However, conceptually isolating creative idea generation from exploitative activities and empirically investigating it as an isolated phenomenon obscures that creative idea generation is embedded in and influenced by actions at work, be they exploratory or exploitative. Paying high attention to detail, developing routines, refining and exploiting skills - that is, engaging in activities that appear antithetical to creativity – can actually provide a basis for new ideas. Detailed expertise in a domain enables individuals to come up with ideas that are both new and useful (e.g., Taylor & Greve, 2006; Conti, Coon, & Amabile, 1996). Routinization and standardization can free up the cognitive resources required for creative thought (Ohly, Sonnentag, & Pluntke, 2006). Engaging and excelling in exploitative activities are essential in leading to a point at which it first becomes clear that an established way of doing things has its limits and that the incremental value of a current product or service for meeting customer needs is limited. Although essential preconditions for creative ideas, current skills and expertise are double-edged swords: Core competencies can become core rigidities

(Leonard-Barton, 1992), individuals may continue to use available problem-solving solutions and routines even when more effective ways of doing things are available (Luchins, 1942), and adherence to existing rules and guidelines can keep people from experimenting and inventing new procedures (George & Zhou, 2001). How do we resolve conflicting propositions on the role of expertise and routinization for innovation? Based on deep and broad expertise and well-developed routines, innovation can be spurred by engaging in the process of negation, that is, questioning the current way of doing things and combining available knowledge in new ways.

Given the different pathways to creativity and the fact that creativity can be based on activities that appear antithetical to creativity, simplistic recommendations based on isolated relationships between determinants and creativity seem misguided, even if those relationships are well established. If innovation is the desired outcome, making recommendations is even more challenging, since creativity is only one element of successful innovation. Implementation, the transformation of ideas to new products and processes, is arguably a greater challenge than idea generation and is paradoxically the area with less research attention (West, 2002a).

Step 2: The implementation of new and useful ideas

Organizational scholars have long argued that idea generation and idea implementation are fundamentally different activities and that independent or even conflicting determinants, such as personality or goal orientations, influence performance of the respective activities (e.g., Farr & Ford, 1990; Farr et al., 2003; Kimberly & Evanisko, 1981). As both are necessary and potentially conflicting, innovation poses fundamental problems for self-regulation of individuals aiming to bring about innovation and management of innovation in organizational settings. The creation of new ideas is an exploratory activity that is based on divergent processes and leads to

increases in variability. In contrast, implementation activities are based on convergent processes, aimed at exploiting the potential value of new ideas, and leading to a reduction of variability. When committed to a new idea, activities need to converge around the implementation of that idea. Persistence is required to overcome barriers and resistance (Frese & Fay, 2001). Individuals also need to resist engaging in divergent activities that do not serve the implementation of the chosen idea. Farr et al., (2003) have suggested that learning orientation is related to explorative idea generation, while performance orientation contributes to exploitative idea implementation. Learning orientation is reflected in a desire to explore, seek challenging situations, and engage in deep processing (Yeo & Neal, 2004). Performance orientation focuses on demonstrating one's ability, avoiding mistakes, and adhering to normative performance standards. Both orientations being required for innovating speaks for rejecting the tyranny of the "or" and embracing an emphatic "and" approach (Cameron & Quinn, 1988; Lewis, 2000) in contrast to emphasizing the one or the other. At the same time, however, individuals can be required to be either strongly performance or learning oriented at any given point in time if this is demanded by the task. The challenge for individuals is thus to be aware of the dynamic nature of the task demands and to switch between different mind and action sets.

> *Proposition 8:* Openness to experience and conscientiousness facilitate different requisite activities of innovation. Individuals disposed toward either high openness to experience or high conscientiousness need to invest regulatory effort to meet all requisite demands of innovation.

As far as personality is concerned, research largely confirms the intuitively appealing proposition that psychological characteristics that are conceptually linked to creativity are consistently related to innovative behavior. More creative individuals are open to experience

(George & Zhou, 2001), demonstrate divergent thinking styles (Kirton, 1976), and are unconventional (Frese, Teng, & Wijnen, 1999). However, these are hardly characteristics that go hand in hand with persistence, attention to detail, and the rigorous implementation of others' ideas – the latter are all necessary aspects of innovation implementation (Miron et al., 2004). Conscientiousness is another trait that should only be related to implementation and should inhibit creativity, particularly its sub-factor of dependability. Thus, placing a strong emphasis on either openness to experience or on conscientiousness in selection and placement decisions for R & D teams may be problematic (Hulsheger, Anderson, & Salgado, 2009a).

From a dialectic perspective, the crucial issue is to synergize the qualities of both openness to experience and conscientiousness for innovation. On the individual level, we expect this to be less difficult for individuals high on both dimensions compared to individuals disposed towards either high conscientiousness or high openness to experience. Individuals need to invest high regulatory effort to meet demands of innovation that are inconsistent with their disposition. Individuals highly open to experience need to invest regulatory effort to conform to agreed courses of action, "close" their mind at times, and focus on implementation whenever this is required. In contrast, individual who are highly conscientious without simultaneously being open to experience need to invest effort to challenge outdated ways of doing things, break rules hindering innovation, and take the risk of sometimes not being dependable concerning routine tasks for the sake of innovating. This would be an aspect of managing or regulating one's personality (Rauch & Frese, 2007). As most individuals are not disposed to easily perform all requisite activities of innovation, investing high degrees of regulatory effort is necessary. This points towards the importance of an active approach towards work, such as being proactive (Griffin, Neal, & Parker, 2007), demonstrating personal initiative (Frese & Fay, 2001), and being

highly engaged (Macey & Schneider, 2008). On the level of the individual, we thus propose an active approach toward work as a crucial precondition for synergizing conflicting but necessary activities.

Shifting our focus from individuals to teams, a complementary opportunity of synergizing conflicting activities becomes feasible. Teams provide the opportunity to bring together requisite psychological qualities that may infrequently co-occur within individual persons.

Idea generation and implementation in teams

> *Proposition 9:* Given frequent occurrence of convergent team processes, such as conformity and consensus-seeking, divergent activities need to be encouraged, for instance, by appreciating minority dissent and challenging the content of the vision the team is pursuing. However, outcomes from such divergent team processes also need to be reintegrated, for instance, by clearly communicating a new vision.

Corresponding to the research focus on creativity and divergent thinking at the individual level, researchers have put forward the thesis that team member diversity and divergent processes in teams, such as minority dissent and task related conflict, fuel innovation (e.g., De Dreu, 2002; Shin & Zhou, 2007). Indeed, meta-analytic evidence at the team level (Hulsheger, Anderson & Salgado, 2008) supports the value of team member diversity for innovation. Diversity of team members in terms of educational background, knowledge, and demographics can be supportive of innovation (Shin & Zhou, 2007). However, cultural diversity was found to have a negative impact on team innovation (Gibson & Gibbs, 2006). Minority dissent has been found to be a facilitator of innovation, but only if overt task reflexivity about the team's

objectives and processes was high (De Dreu, 2002). Further research by De Dreu and West (2001) showed that only if team members could participate in decision making was minority dissent supportive of innovation. For task conflict meta-analytic findings suggest neither a generally positive nor a negative effect on innovation (Hulsheger et al., 2008). There is, however, some support for a curvilinear relationship of task conflict with innovation, such that moderate levels of task conflict are optimal (De Dreu, 2006). Furthermore, as task conflict is unrelated to team innovation across studies, it does not seem to be detrimental, per se, to team innovation. This is different for team performance as an outcome where there is a clear negative relationship (De Dreu & Weingart, 2003). Thus, some teams with task conflict may actually be capable of leveraging the conflict for the enhancement of innovation, even though this is not generally the case and task conflict impedes overall team performance.

Teams aiming to innovate are required not only to develop and explore new ideas, but also to align team members toward the common goal of innovation and to achieve other performance criteria, such as quality and efficiency demands (Miron, et al., 2004). Thus, an antithetical proposition to the emphasis of diversity and divergent processes stresses the importance of convergence in teams (Pearce & Ensley, 2004). Indeed, meta-analytic evidence on shared vision and task orientation as two factors supporting convergence and integration of team members' activities toward common goals corroborates this proposition (Hulsheger et al., 2008). Shared vision and task orientation are more closely related to successful innovation than the variability-enhancing factors of diversity and task conflict and are among the strongest determinants of successful team innovation. Visions can lead to either incremental or transformational goals. Thus, visions can help with incremental and with radical innovation. Visions may lead to incremental innovation, driven by the attempt to implement the vision as fast

as possible and be the first mover in the market. On the other hand, transformational visions exist, e.g., in politics, Martin Luther King's dream about equal opportunities for African Americans, or the vision to reach the Moon, which led to dramatic technological innovations.

In line with the dialectic approach, we suggest that as effective as a shared vision is for innovation, it can have undesired consequences if it comes at the expense of not exploring new possibilities for radical innovations which lie outside of the realm of the present vision. The vision of producing more powerful and faster cars within a certain technological paradigm has stimulated innovation in automotive industries. These innovations have served their purpose and may even prove useful for radical future innovations. However, there have been ample suggestions in the popular press that the vision of producing more powerful and faster cars has been detrimental to divergent thought and subsequent innovations related to fuel efficient cars, new drive technologies, and low cost individual mobility. Thus, through the commonality of purpose and perspective that a strong vision promotes, the development of new and divergent visions may be hindered.

We think the findings on convergent and divergent processes in teams are not contradictory but can be resolved. On the basis of strong convergent and integrative processes (e.g. participation in decision making, shared vision, team reflexivity, and task orientation), divergent processes can fuel innovation, while convergent processes alone can lead teams to becoming locked into a path they are currently pursuing. Tensions between convergent and divergent processes need to be actively managed within a system towards the right balance, with the empirical evidence speaking for a predominance of convergent and integrative processes (Hulsheger et al., 2008).

The dynamics of innovation

Proposition 10: The dynamics of innovation can be both orderly and chaotic. Detailed plans on implementing ideas need to co-occur with the readiness to flexibly change and possibly alter a course of action as unforeseen events occur.

Frequently, stage models are used to outline the pathway from the generation of a new idea to its implementation and routinization (Zaltman, Duncan & Holbek, 1973). However, stage models can be misleading if they are interpreted as describing the actual succession of different activities or if they are even taken as normative guides to how individuals and teams should proceed when innovating. At each point in time of the innovation process, individuals and teams can shifts from exploring new possibilities to exploiting what they have already accomplished and back to exploratory activity. King (1992) and Cheng & Van de Ven (1996) found that linear models do not adequately represent the innovation process. Innovation, in particular radical innovation, unfolds in a cyclical and non-linear fashion rather than as a sequence of phases (Anderson et al., 2004; Farr et al., 2003). Performance episodes of explorative idea generation and exploitative implementation activities alternate with limited predictability. The relative weight of different processes shifts over time. In general, idea creation processes tend to be emphasized in the beginning, while implementation processes are more prevalent in the final stages of an innovation project (West, 2002b). However, even when a project is close to completion, additional creative activity can be necessary to deal with unforeseen disturbances (Mumford, et al., 2002), and new ideas may unintentionally emerge that stimulate further innovation. In a particularly informative study, Cheng & Van de Ven (1996) showed that within a single project the pattern of events and activities can frequently be chaotic – that is, not random but unpredictable – while at other (later) times follow a periodic, orderly pattern.

We expect individuals and teams can follow multiple pathways to innovation, some emphasizing clearly planned approaches, while for others "order emerges more from chaos" (Cheng & Van de Ven, 1996). However, neither a rigid approach that tries to follow a static stage by stage model while ignoring the uncertainty attached to innovation, nor an approach where order doesn't emerge out of chaos is likely to succeed. Thus, as important as the development of detailed implementation plans for innovation is (Frese et al., 2007), equally important is the flexibility to be responsive to unforeseen events, give up previous plans, and to make fundamental changes to the course of action.

Organizational level antecedents of innovation

> Proposition 11: As innovation has emerged from contradictory organizational structures and cultures, "one-best-way" recommendations for organizational innovation that do not take into account the particularities of a given organization are misguided and may even do more harm than add value.

If we extend our focus from individuals and teams to organizations by asking what kind of organizations have been able to successfully innovate, we come to the conclusion that the principle of multiple pathways also applies for organizational innovation: innovation has many different entry points and can be achieved via multiple pathways, meaning that the structures and cultures from which innovation arises can be different or even oppositional.

At the organizational level-of-analysis, we know from meta-analytic evidence (Camisón-Zornoza, Lapiedra-Alcamí, Segarra-Ciprés, & Montserrat Boronat-Navarro, 2001; Damanpour, 1991) that larger, specialized, and functionally diversified organizations that posses high degrees of technical knowledge resources produce more innovations. In contrast, centralization of

organizations is negatively related to innovation. Although these findings are somewhat dated, we think they are still informative about the general factors facilitating innovation. It may seem paradoxical but the mechanisms operating at the level of a specific company may be quite opposite to the relationships that emerge across companies and studies. Large companies may fail to innovate, and small companies which are new to a market and lack a well-developed technical knowledge base may have a competitive advantage for producing new products and services in comparison to large companies.

For example, Christensen's (1997) work on disruptive innovation demonstrates that small companies in the hard-disk industry have repeatedly entered the market with radical innovations leading to the failure of large, established companies, which have not been able to innovate successfully because they focused too strongly on their main customers. In light of the above cited meta-analytical findings, this does not seem to be a very frequent phenomenon. Our main point is, again, that caution is necessary in directly deriving implications for any particular firm from our knowledge about general determinants of innovation, because the entry points and pathways to successful innovation are manifold.

The idea of different entry points and pathways to innovation can be illustrated by describing a group of German companies that do not fit well our innovative stereotype but which has been extremely successful in the recent decades at innovating and extending its markets (Venohr & Meyer, 2007). These companies are located in rural areas in the mostly conservative southwestern part of Germany far away from any government-funded technology center and are among the market leaders in their closely defined technological niche. The companies are family-owned and run by professional management. Size and industry vary highly, including trading companies with ten thousand employees and mechanical systems engineering companies

with a few hundred employees. The most successful of these companies have been termed 'hidden champions" (Simon, 1996). Their workforce is to a large part rooted in the region. The dominant cultural focus is on quality, efficiency, and process effectiveness. Labor relations are described as consensus oriented, fluctuation and turnover among employees is low, and the basic organizational values are described as authoritarian. These companies have been reported to focus all their resources on solving a burning problem for a well defined customer group, using their customers as a main source of innovation, while developing and extending their core competencies rather than diversifying widely. They use a highly integrated business model and have stayed successful at innovating and growing with this strategy for several decades. Quite interesting is the observation that they seem to do most things differently than suggested by popular management books (Simon, 1996).

This group of companies highlights that a strategy quite opposite to many recommendations can be highly successful at continuous innovation. Thus, in the absence of rigorous empirical evidence and validated contingency models, prescriptive recommendations on how organizations should innovate seem misguided (Hamel & Prahalad, 1994).

Although we have emphasized throughout this article the pervasive existence of conflicting demands of innovation for individuals, teams, and organizations, there is little empirical research that has directly examined how conflicting demands might be effectively managed and self-regulated. In the absence of strong empirical research on management and self-regulation of conflicting demands, we draw on recent theoretical developments. Current organizational theory offers at least one concept that seems to be useful for understanding how conflicting demands might be managed in the context of innovation in organizations. This concept is ambidexterity. By redefining ambidexterity within our dialectic perspective and

applying it across levels of analysis, we aim at taking the first steps towards a framework that may prove useful for future research and the practice of innovation.

Ambidexterity - Managing Conflicting Demands at Multiple Organizational Levels

From the proposition that innovation poses a variety of different demands, it follows that individuals and social systems need to be capable of performing fundamentally different activities and need to be able to integrate these activities in order to successfully innovate (Smith & Tushman, 2005). Literally referring to the rare characteristic of some people to be equally adept in using their left and right hands, the term ambidexterity has been used in organizational science to describe the ability of organizations to engage in both explorative and exploitative activities (e.g., O'Reilly & Tushman, 2004; Raisch & Birkinshaw, 2008). Whereas previous research has primarily used the term to describe organizations, we provide a generalized functional definition of ambidexterity and extend the concept to individuals, teams, and leaders.

We define *ambidexterity* as the ability of a complex and adaptive system to manage and meet conflicting demands by engaging in fundamentally different activities. On the most general level ambidexterity implies successfully managing the dichotomy of explorative variability creation and exploitative variability reduction. Systems can develop a variety of different internal structures and processes to perform fundamentally different activities. Thus, ambidexterity can take different shapes. How ambidexterity is achieved can be differentiated along the lines of integration and separation of activities. Activities can be structurally or temporally separated to different subsystems or across time (Gupta, Smith, & Shalley, 2006). For instance, in a team responsible for the development of a new product, some members may concentrate on coming up with radically new ideas, while others focus on scrutinizing the feasibility and usefulness of

ideas. The same activities can be performed by an individual alone switching back and forth between engaging in unconstrained creativity and evaluating and selecting ideas. Management activities and self-regulatory processes are necessary to integrate different activities performed by subsystems or at different points in time.

Regulating the conflicting demands of innovation is not only a challenge for the upper echelon of an organization but a phenomenon that spans all levels of an organization. Individual employees, collectives of employees such as work teams, and the organization as a whole have to find strategies to deal with conflicting demands in order to successfully innovate and adapt to changing markets. Within an organization, department, or team, activities can be more or less separated and distributed to different individuals. How conflicting demands are regulated at one level affects the regulation at other levels of an organization (Mahmoud-Jouini, Charue-Duboc, & Fourcade, 2007). For instance, if individual employees are capable of self-regulating conflicting activities, the requirement of leaders to be directive about what activities need to be performed is reduced.

Integration of different activities can occur at a hierarchically higher level, such as the leader, or by individuals themselves, for instance, by proactively attending to different and conflicting task demands and being flexible enough to switch between requisite activities or roles in a team. We expect that strong separation of activities to different subsystems will create dysfunctional consequences, since synergies that reside in pursuing both interdependent activities are lost. As we have previously noted, exploitative activities can be the foundation from which useful new ideas emerge. In addition, the separation of activities creates new tensions and conflicts that must be managed. This may occur, for instance, when a new product developed in an isolated explorative business unit enters the production routines of exploitative

business units (Westerman et al., 2006). We assert that dealing with conflicting demands by high degrees of separation of activities to subsystems is a second best strategy that may become necessary if a system does not have the requisite complexity to manage internally the conflicting demands.

While in all organizations there are those individuals, teams and business units that focus more on exploring new possibilities, while others focus more on adapting and exploiting, research has not yet provided *decision aids* (Highhouse, 2008) to indicate the appropriate level and degree of separation for a given system. Exploration and exploitation activities and tensions between these activities co-occur at all levels of an organization. Even in an organization with high exploitative orientation, explorative task demands exist and vice versa. For example, when implementing process innovations such as Just-in-Time-Production to streamline a business, employees' initiative (which includes creativity) was important because it allowed them to explore how to adopt the process innovation in their particular jobs (Baer & Frese, 2003). That is, even if the productivity dilemma between exploration and exploitation is solved by some type of structural separation, at all levels of the organization there remain exploration *and* exploitation demands that need to be managed because human thought and action are never solely explorative or exploitative.

Several authors have emphasized the need to balance rather than separate exploration and exploitation. While we agree with the notion that both activities are necessary and organizations should not focus on one to the expense of the other, the idea of a 'balance" can be misleading if it implies that a moderate and equal amount of exploration and exploitation is always superior. Over time and depending on external circumstance such as the dynamics of the market, the relative importance of different activities can shift (Jansen, Van Den Bosch, & Volberda, 2006;

Burgelman, 2002). Optimal antecedent conditions of organizational structures, management practices, and individual dispositions may be quite different depending on the relative importance of exploratory and exploitative activities, although they should always enable both kinds of activities.

Table 2 presents examples of ambidextrous strategies and tactics that could be implemented at three different levels of analysis – the individual, team, and organizational - in order to deal with the conflict posed by the need to both explore and exploit. Examples are presented that follow a separation strategy (in the Separation column) or an integration strategy (in the Active Management and Self-regulation columns) for dealing with conflicting demands and activities. None of these examples is empirically based; rather we have derived them primarily from conceptual developments by organizational theorists and our own dialectic perspective. We organize our discussion of these examples by level of analysis.

Insert Table 2 about here

Ambidexterity at the individual level

> *Proposition 12:* At the level of the individual we use the term ambidextrous to describe the capability of individuals to perform contradictory activities and switch between different mindsets and action sets (e.g., switching from unconstrained creativity to scrutinizing the usefulness of ideas). For innovation to succeed these general capabilities need to be based on domain-relevant expertise.

In keeping with the terminology derived from the organizational level, we propose that ambidexterity at the individual level refers to an individual's ability to perform explorative and exploitative activities and integrate both kinds of activities towards successful innovation through self-regulation. Ambidexterity is not another psychological trait. Rather, it refers to the regulated coexistence of characteristics that may seem incompatible from a dichotomous perspective, but which hold a functional value for innovation. Examples of such dichotomies include attention to detail and innovativeness (Miron et al., 2004), prevention and promotion focus (Forster et al., 2003; Higgins et al., 1997), and conscientiousness and openness to experience (George & Zhou, 2001), as well as systematic versus intuitive problem solving style (Scott & Bruce, 1994). Rather than overemphasizing any one of these characteristics, we propose that the contradictory qualities need to be regulated in order to successfully innovate.

Since seemingly contradictory qualities such as attention to detail and innovativeness are distinct empirical dimensions rather than opposite poles of one continuum, there are individuals who are high on both dimensions. Miron et al. (2004) found 7.4% of the engineers and technicians out of a large sample of R&D employees to meet the criteria of high attention to detail and high creativity breakthrough. Thus, individual ambidexterity in this area appears to be a rare phenomenon. However, just looking at individual differences in stable characteristics obscures that the cognitive and behavioral complexity described by ambidexterity can also appear over time. Individuals can switch between different mind and action sets in accordance with situational demands. For instance, individuals can carefully elaborate and weigh advantages and disadvantage of different courses of action and, once a decision is made, switch to a mode of information processing that is focused on acting to achieve a specific goal (Gollwitzer, Heckhausen, & Steller, 1990).

Research has demonstrated that managers of product development teams were able to switch their management style from an emergent style in uncertain periods that required exploration to a planned style in more certain periods that required implementation, and that teams led by managers with fluctuating styles were more innovative than others (Lewis, et al., 2002). Furthermore, individuals who were asked to generate original words and also keep the error rate low managed to do so by dividing their work into two sequential periods, first, generating original words and then checking for errors (Livne-Tarandach, Erez and Erev, under review).

Action theory (Frese & Zapf, 1994) provides concepts helpful to understanding how conflicting demands are self-regulated and how individuals switch between different modes of acting. In particular, the idea of opportunistic action regulation captures the integration of different modes of action (Hacker, 2003; Visser, 1994). From an action theory point of view, regulating actions that bring about innovation differ from regulating repetitive actions. The latter follows a hierarchical-sequential, top-down pattern. Consciously accessible goals represent future states that the acting person attempts to achieve. Goals are decomposed into sub-goals which are achieved sequentially. In contrast, the goal of innovative acting is not clearly defined in all its details before action. The goal coevolves and changes as action proceeds. Hacker (2003) suggested calling this *opportunistic action regulation*, which is characterized by systematic episodes interspersed by more chaotic episodes triggered by unforeseen opportunities that change the course of action. To meet the demands of innovation, both modes of action regulation are necessary and the challenge is to switch between and integrate both modes. We argue here that this captures quite well the idea of two fundamentally different capabilities that need to be integrated.

A factor that is supportive of both successfully performing exploratory and exploitative activities is domain relevant expertise, both in terms of breadth and depth of expertise. In a study on innovation and performance in the comic book industry, Taylor and Greve (2006) found "the role of expertise in jointly spurring creativity and raising average performance is so strong that it overwhelms the theorized tradeoff between exploration and exploitation" (p.734). A similar positive effect on both successfully exploring and exploiting was also found for past innovation success. Thus, gaining profound and diverse domain expertise enables individuals to become ambidextrous is meeting both exploratory and exploitative task demands.

Ambidexterity at the team level

> *Proposition 13:* Ambidextrous teams are composed of team members with the requisite variety of characteristics (e.g., cognitive style, expertise) for a given task and are able to integrate performance episodes in which individual team members work alone with performance episodes in which team members work together.

Innovation often emerges from individuals working in team settings. The central feature of ambidextrous teams is that they are able to maintain and capitalize on the variability of what individuals bring to a team in terms of ideas, expertise, and individual differences, while at the same time integrating this variability toward common goals. Our conception of ambidexterity at the team level can be related to team composition, the dichotomy of individual and team work, contextual ambidexterity, and ambidextrous leadership.

Not only do team members bring variability to a team in terms of different ideas and expertise, there is also variability among team members in terms of personality and cognitive styles. Ambidexterity can be achieved by composing team members that bring to the team the

different qualities rarely combined within one person. For instance, Miron-Spector, Erez, and Naveh (2006) found that the most innovative teams were composed of a majority of highly creative people, a moderate number of conformists (who knew how to fit the product to the context), and a small number of members who were highly attentive to detail; teams with this composition were more innovative than homogenous teams composed of only creative people. Such a mix ensures that different task demands of idea generation and implementation are met. West and Anderson (1994) have demonstrated that the proportion of highly innovative team members has an impact on the radicalness of innovation generated by the team. Furthermore, newcomers increase heterogeneity of teams and affect innovativeness (Perretti & Negro, 2007). We expect team diversity to be particularly effective if team members value this diversity (Homan, van Knippenberg, Van Kleef, & De Dreu, 2007) and understand the functional and dysfunctional consequences that different cognitive styles can have. For instance, Kearney, Gebert, and Voelpel (2009) found that teams composed of team members high in need for cognition were better able to integrate diversity with respect to age and educational specialization to achieve superior performance.

Team members tend to share their common rather than their unique knowledge, and can overlook their diverse, unique capabilities (Stasser, Vaughan, & Stewart, 2000). To overcome this tendency, Arbel and Erez (2008) developed a methodology that assesses the team members' diverse cognitive style, provides individual feedback to the team members, and asks them to share their strengths with each other and utilize them as needed while they design an innovative product. Teams that used this methodology designed more innovative products than teams that did not share their unique task related characteristics with each other. Thus, by carefully composing teams in accordance with the desired innovativeness of the outcome and actively

managing team diversity in terms of expertise and cognitive style, the likelihood of team success can be improved.

Many arguments can be made for team work, for example, the magnitude of a task may make it impossible for a single individual to perform it successfully. Further, teams can counterbalance characteristics that rarely occur within one person. However, it is clear that team work is not always more effective than individual task performance. Not only do we know about process loss in teams (Steiner, 1972) and production blocking in brainstorming groups (Diehl & Stroebe, 1991), there is evidence that individual creators can outperform teams at integrating the depths and breadth of their expertise toward new syntheses (Taylor & Greve, 2006). Based on this evidence, it can be advisable to assign parts of a project to individuals. For team work, we hypothesize a temporal separation strategy to be more effective than constant collaborative work in teams. That is, interspersing performance episodes in which team members work closely together with individual performance episodes in which individuals can develop and pursue ideas independently, unconstrained from the activities and influence of other team members.

Individual self-regulation in terms of switching between different activities over time and team self-regulation in terms of changing leadership roles based on team members' strengths and weaknesses require an environment that supports and allows for self-regulation. An important environmental characteristic that allows for good self-regulation at work is freedom or autonomy which has been shown to be related to innovation behavior (Amabile, Conti, Coon, Lazenby, & Herron, 1996). Gibson & Birkinshaw (2004) use the term contextual ambidexterity to describe an environment that allows individuals to decide for themselves when to closely align their activities with the standards and routines of an organization and when to depart and create value through innovative behavior. We concur with the idea of contextual ambidexterity, as the

dynamics and unpredictability of the innovation process make it difficult for leaders to constantly specify instructions about when to focus on what kind of activity (Raisch & Birkinshaw, 2008). The necessity to shape an environment supportive of exploration *and* exploitation points to the importance of leadership for innovation (Mumford et al., 2002).

> *Proposition 14:* Ambidextrous leaders are characterized by cognitive as well as behavioral complexity and are able to dynamically adapt their tactics (such as being directive or providing autonomy) to contextual demands. We propose transformational leadership is supportive of both exploratory and exploitative activity of followers and their integration and is thus a central component of ambidextrous leadership.

We extend the concept of ambidexterity to leadership and define ambidextrous leadership as the ability of leaders to manage tensions between variety creation and variety reduction toward successful innovation. On a general level, we characterize ambidextrous leadership as the ability of leaders to perform a broad range of seemingly conflicting behaviors (Denison, Hooijberg, & Quinn, 1995) that are supportive of both explorative idea generation and exploitative idea implementation among their employees. Furthermore, leaders need to adapt these different behaviors according to contextual demands, the progress of the project, and the needs of individual employees. Effective ambidextrous leadership thus demands cognitive, emotional, and behavioral complexity and flexibility (Buijs, 2007; Denison, et al., 1995; Mumford, et al., 2002).

In a meta-analysis on leadership and innovation Hulsheger, Anderson, and Salgado (2009b) found that all investigated leadership styles - supportive leadership, initiating structure, leader-member exchange, participative leadership, and transformational leadership – displayed substantial, positive mean corrected correlations with innovation. The fact that very different

leadership behaviors are related to innovation supports the assertion that different or even contradictory leader behaviors hold functional value for innovation. The familiar argument that there are different pathways to innovation again emerges. Whereas the relative contribution of different leadership styles depends on contingency conditions, such as the research or development focus of a department (Keller, 2006), we stress that one needs to take different, seemingly contradictory leadership behaviors into account simultaneously, rather than focusing on the impact of single leadership constructs.

A particularly important tension exists around the degree of structuring and controlling activities by the leaders versus the degree of autonomy provided for employees (increasing their chances to explore). A controlling leadership tactic, e.g., close monitoring, may help to avoid inefficiencies to ensure the alignment of followers' activities. However, several studies have reported detrimental effects of controlling leadership on creativity (Stahl & Koser, 1978; Zhou, 2003). In contrast, the leadership tactic of providing autonomy and situational control may also "run into trouble". Gebert, Boerner, & Lanwehr (2003) found support for a curvilinear relationship between autonomy and innovation with moderate levels of autonomy being optimal for innovativeness of organizations. Alternatively, we derive from our dialectic perspective that the simultaneous presence of integrative mechanisms, such as a shared vision, can help to align the activities of different employees and buffer negative effects of high autonomy. How different leadership tactics and combinations of leadership tactics relate to success needs to be researched in more detail.

If innovation is marked by periods of stability and clarity and by bursts of creativity and ambiguity, then a key issue is how managers respond to such fluctuations. They increase their structuring activities if required and focus on providing autonomy and intellectual stimulation if

creation and exploration are central to the project. However, there is only limited empirical research about the necessary dynamics of leadership for innovation. Lewis et al., (2002) investigated different project management styles which she categorized as either emergent or planned and found evidence that different aggregates of action are required at different times. However, all project management activities decreased over time and her results do not support the idea that more managerial control is supportive in later implementation stages of a project, as may be inferred from a stage model of innovation.

We propose transformational leadership to serve an important role in managing conflicting demands between variability creation and integration of variability as it is supportive of different activities required for innovation. Providing intellectual stimulation and individual consideration stimulate followers' creativity and explorative activity. At the same time, transformational leaders provide direction by formulating a vision and inspirationally motivating their followers, resulting in greater alignment of their followers' activities (Kearney & Gebert, 2009). Recent empirical studies confirm that transformational leadership is not only correlated with innovation success, but also interacts with diversity to support the hypothesis that transformational leaders can capitalize on the potential of diversity for innovation (Kearney & Gebert, 2009; Shin & Zhou, 2007; Jansen, George, Van den Bosch, & Volberda, 2008). However, as with our concern regarding unambiguously positive consequences of a shared vision, followers of transformational leaders may be influenced by the leader to such an extent that it becomes dysfunctional for innovation, because they do not develop ideas outside of the realm of the charismatically communicated vision.

Ambidextrous organizations

Proposition 15: Ambidextrous organizations cannot only be achieved through separating explorative from exploitative activities and integrating activities at the level of the top management team but also by creating organizational values and practices that enable the management of conflicting demands within one system.

Ambidextrous organizations, as defined by O'Reilly and Tushman (2004), solve the conflict and trade-offs between improving and exploiting existing products and developing new, potentially disruptive products by structurally separating explorative from exploitative business units. If organizations pursue a strategy that separates explorative activities from exploitative activities, they need to implement different practices, such as reward systems and criteria for personnel selection, and foster different cultures that are consistent with the respective unit's goal. In this organizational design model it is the responsibility of the top management team to integrate and balance conflicting activities (O'Reilly & Tushman, 2004).

Although the empirical evidence is still scarce, it supports the central assertion of ambidexterity that organizations perform at a superior level if they both explore and exploit (e.g., Katila & Ahuja, 2002). He & Wong (2004) found a positive interaction of exploration and exploitation, such that companies that balanced and engaged in both activities simultaneously performed best in terms of sales performance. On closer examination, however, the findings by He & Wong (2004) pose fundamental problems for a dichotomous theory perspective and its one-sided focus on the conflict between exploration and exploitation. He & Wong (2004) found that an exploitative strategy not only predicted sales performance via the mediator of process innovation intensity. An exploitative strategy positively and incrementally predicted product innovation intensity together with the presence of an explorative strategy (both strategies are

independent dimensions). This supports the argument based on our dialectic perspective that exploitative activities can lead to product innovation.

In contrast to evidence that both exploration and exploitation are required for sustainable performance, the ambidextrous organizational design proposition of high degrees of structural separation of explorative from exploitative activities is supported to our knowledge by case studies only. For instance, O'Reilly & Tushman (2004) describe how creating structurally separated business units has enabled Ciba Vison (now Novartis) to successfully develop fundamentally new products and manufacturing processes in the area of contact lenses and related products. In contrast, Westerman et al. (2004) report how Walgreens successfully used a more integrated approach in developing and implementing its online business, capitalizing on synergies with the exploitative activities of its stores. Westerman et al. (2004) noted that structural separation of explorative business units can have advantages at the beginning of an innovation life cycle, while it creates difficulties at later stages of an innovation life cycle. Given its prominence in the current literature, we think it is remarkable that the recommendation to strongly separate explorative from exploitative business units has not been clearly supported by empirical evidence. Contingency models specifying the conditions under which structural separation is advisable and recommended degrees of separation are not available.

In contrast to the hypothesis on structural separation, the need for integration of different activities in the top management team has been empirically supported by different groups of researchers. Top management teams need to see “the unity and conflict of opposites” (Engels, 1940) and transformational leadership can support this process (Jansen et al., 2008; Lubatkin, Simsek, Yan, & Veiga, 2006).

In one sense, O'Reilly and Tushman's (2004) proposition of an ambidextrous organization also is to a certain extent dialectic, as they emphasize the need for simultaneous presence of explorative and exploitative activities in an organization, although they emphasize separation (at lower levels of an organization) and integration (in the top management) of these activities. An approach that is even more dichotomous suggests that organizations can only focus on either exploration or exploitation at any given point in time (e. g. Abernathy & Utterback, 1978). Even from our dialectic approach, an argument can be made to create new business units, potentially with newly hired employees, that are unconstrained by more exploitative activities of the organization: As we stated, innovation cannot be completely "free" from what existed previously, and new business units with newly hired employees will be more likely to develop innovations that are not related to what the organization has been producing. The question is to what extend this is desirable, given the problems we have outlined with structural separation, such as producing these innovations in the established exploitative business units, loss of synergies, and limited resources. Setting up new business units is likely to come at the expense of explorative activities within the system of an organization. Given the lack of empirical evidence and our theoretical propositions, we assert that the traditional notion of the ambidextrous organizations is not the only or even the one best strategy to meet conflicting demands.

The less an organization has structurally separated its differing activities, the more conflicting demands are imposed on subunits of the organization and the more important it is that these subunits themselves become ambidextrous. However, given that exploration and exploitation is an abstract dichotomy, we expect exploration and exploitation to always be necessary at every level and in every unit of the organization. While the relative importance of

each activity can vary, values and practices that support and integrate both activities are necessary throughout the organization.

Where organizational values and practices that support either exploration or exploitation are in conflict, a strategy of balancing competing values and practices is necessary. However, we believe that, more often than not, different cultural values and practices are not incompatible. Miron et al. (2004) and Naveh & Erez (2004) found cultural values for innovation, quality, and efficiency to be distinct but not necessarily incompatible. Organizations that find ways to integrate cultural values and practices that we generally conceive of as being important but incompatible will be most successful. The study by Gilson et al. (2005) we have already mentioned shows that creativity and standardization are not necessarily incompatible but can be complementary. Adler, Goldoftas, & Levine (1999) provide a case study concerning a Toyota subsidiary that succeeded in overcoming trade-offs between flexibility and efficiency by developing new organizational mechanisms, such as meta-routines (routines for changing other routines) and the temporal separation of routine and non-routine tasks. Concerning organizational practices of knowledge flows across hierarchical levels, Mom, Van Den Bosch, and Volberda (2007) have shown that the direction of knowledge flow is differentially related to explorative and exploitative activities by managers. A predominance of top-down knowledge flow is related to a focus on exploitative activities, whereas hierarchically bottom-up and horizontal knowledge flows facilitate managers' exploratory activities. We infer that knowledge flows need to be in a balance that is contingent on the strategic focus of a business unit.

Error management culture is an example of a cultural approach for dealing with the dialectics of errors as having positive and negative consequences for innovation (Frese et al., 2009; van Dyck, Frese, Baer, & Sonnentag, 2005). While aiming at avoiding negative

consequences of errors and the reoccurrence of errors, error management culture aims at simultaneously capitalizing on positive consequences of errors. A cultural characteristic of organizations that can serve both exploratory and exploitative goals is climate for initiative, describing an active approach toward work throughout the organization. Individual initiatives can create variability and be the origin of innovation that unfolds upward across organizational levels. At the same time climate for initiative has been found to facilitate the implementation of process innovation because an active work culture ensures that employees self start to deal with unforeseen problems during the implementation of innovation (Baer & Frese, 2003).

A Dialectic Perspective on the Science and Practice of Innovation Management

Our conceptual approach that contrasts dichotomous and dialectic thinking also applies to the science-practice relation in innovation management. Research on innovation and practical efforts to promote and manage innovation in organizations are separate activities geared toward different goals. While science explores the unknowns of innovation, practice aims at exploiting knowledge for innovation endeavors to succeed. Both activities face different demands, for instance, in the dichotomy of rigor being a primary demand for science and relevance being a primary demand for practice. There are good reasons why both activities – the science of innovation and the practice of innovation management - need to be separated. A “natural distance” between pure science and day-to-day practices is a positive and healthy feature of any science-based professional discipline. For instance, the science of innovation needs extensive timeframes to produce generalizable findings, while innovation management addresses unique challenges of specific organizations that need to be met in real (and usually short) time. However, the separation of science and practice has lead to scientific findings with little impact

on organizational practices of innovation and to organizational practices that lack empirical evidence and we suspect that often may appear effective rather than actually being effective. Therefore, as important as some degree of separation between science and practice of innovation may be, also important are integration and exchange.

Despite the growing attention to science – practice relations in I-O psychology in general, there is little discussion specifically related to creativity and innovation. Rather, research into innovation, and especially studies into individual creativity, seems to have continued unabated and in splendid isolation from any imperative to demonstrate applicability to the real-world concerns of personnel practitioners and line managers concerned with stimulating and harnessing innovation at different levels of analysis (West, 2002b). Rather ironically, innovation research has demonstrated all the ontologically deleterious hallmarks of "excessive conformity": "Continu[ing] to routinely investigate old chestnut phenomena using conventional methods and designs, at times … actively dissuaded from pursuing an innovative agenda or from trialing untested methods and approaches" (Anderson, 1998, p. 323).

The field of I-O Psychology has paid scarce attention to developing practical tools, transferring tools from basic psychology to organizational practice, and evaluating tools used in practice. There has been little transfer from science to practice in the sense of what Highhouse (2008) terms "decision aids" based upon robust scientific findings into pragmatic products and processes to assist practitioners in their tasks. This is remarkable and distressing as I-O psychology is arguably the psychological discipline that should provide such applications. Even more so with regard to our focal topics, as the consultancy marketplace for tools supporting creativity and innovation interventions in the workplace appears to be notably pre-formative, in that such tools are apparently not based upon solid research findings but exhibit elements of

being invidiously popularist in appealing to the whims and wish-lists of practitioners desiring quick-fix solutions toward the ill-informed maximization of innovation in organizations (see also, King, 1992; West, 2001). Even in the area of testing for creativity and innovation potential in selection situations, several popular tests have been challenged over their questionable psychometric properties (e.g. Patterson, 2002; Anderson & Sleep, 2004).

At the individual level, methods should be developed to allow individuals to switch between divergent and convergent thinking modes. At the team level, methods should be developed for optimizing team composition, such that it is most supportive of innovation. In addition, methods for improving team processes, such as assuring team psychological safety, and enabling team reflexivity, should be further developed and implemented. At the organizational level, implementing organizational practices that are in support of both exploration and exploitation is necessary, enabling the co-existence of innovation, quality and efficiency.

As important as the development of scientifically-based products of innovation management is, an overreliance and unreasoned application of any specific practice or method, even if it is evidence-based, stands in contrast to our dialectic approach: The pathways and processes leading to innovation are manifold and different contexts call for different solutions. A practice that is right at one point in time can become maladaptive as an innovation project unfolds or environmental contingency conditions change. Providing employees with time to pursue projects that grow out of their personal interest can stimulate variability generation and innovation as Google has demonstrated (Mayer, 2006). However, if cost-competition and streamlining of a business become more important, companies need to change their once highly successful practices toward greater convergence of employees' activities. Thus, an understanding of the dialectic processes underlying innovation and the ability to read contextual demands is at

the heart of successful innovation management and provides the basis for an appropriate application of specific methods.

The challenge for a science of organizational innovation is to develop dynamic contingency models of innovation management that inform practice on when different practices are recommendable. We concur with Locke (2003) that science should produce action principles to guide practice. For instance, brainstorming in teams is a widely adopted practice, but creativity researchers question its effectiveness (Diehl & Stroebe, 1991). Due to production blocking, individuals in teams actually produce fewer ideas than they would if each team member generated ideas individually. Does that imply that brainstorming is in general not advisable? We do not think so. If a limited set of convergent ideas is sufficient or if there needs to be high agreement among the team members to act, traditional brainstorming can be a pragmatic solution (Sutton & Hargadon, 1996). However, if the goal of a team is to develop as many divergent ideas as possible, nominal brainstorming in which individuals first generate ideas individually is advisable, a process that can be extended by going through iterative cycles between individual idea generation and idea integration in teams. Our point is that personnel practitioners and line managers do not only need a fixed set of scientifically-based products for managing innovation. Understanding the fundamental psychological and social principles involved in innovation and the ability to adapt methods to contextual demands is at least as important.

Action principles of innovation management

Principles of action have been suggested to follow from theory to make the theory practice-oriented (Locke, 2003). While we are aware that our dialectic perspective is in no way a

formalized theory to produce tightly argued principles, we would like to suggest a few principles that follow from our thinking about innovation. We propose that these principles apply at the individual, team, and organizational level and we use the term "system" to refer to a unit at all three levels:

- **Principle of conflicting demands**: Bringing about innovation poses conflicting demands on systems. To meet the demands of innovation, systems need to value and perform a variety of different and partially conflicting activities (e.g., creative idea generation and focused innovation implementation; exploration and exploitation).
- **Principle of antithesis**: Whenever a system moves to the extremes of one activity of a dichotomy, such as exploration-exploitation, over a longer period of time, an antithesis will occur requiring the system to change its course of action, incorporating the activity it has neglected (e.g., a strong focus on developing new products and reinventing processes will result in an antithetical call for stability).
- **Principle of integrating variability:** The more variability there is on a lower level of a system, the more important integrative mechanisms at a higher level become (e.g., variability: amount of new ideas, diversity of people, business units with different cultures and purposes; integration: shared vision in a team, a transformational leader).
- **Principle of overcoming dichotomous thinking:** Activities regarded as contradictory, paradoxical, or in conflict can often be reconciled within a dialectic approach toward innovation. Systems may benefit by moving from "either/or" thinking and acting to a "both/and" approach (e.g., encouraging explorative activity in predominantly exploitative organizations and organizational units).

- **Principle of separation:** Although we have been critical of the strong emphasis on separating explorative and exploitative activities in the current ambidexterity literature, this is a possible pathway to innovation as several case studies have demonstrated (e.g., launching explorative business units unconstrained by the current way of doing things). We suggest if this pathway is taken, good mechanisms need to be in place to bring the separated activities together again, not only on the level of top management but also for the involved subsystems.
- **Principle of actively managing dialectic tensions**: If a system has the internal complexity to manage conflicting activities, it can capitalize on the interdependencies of conflicting activities other systems need to separate (e.g. a company vision that encompasses both creative experimentation and standardization of core processes).
- **Principle of proactivity**: A proactive orientation of a system facilitates the learning processes required to meet the conflicting demands of innovation (e.g., a system that is proactive in realizing changing demands and then self-starts in switching between different activities).
- **Principle of dialogue between research and practice:** A dialogue between researchers in academia and practitioners may lead to the discovery of new practical implementations to existing solutions. Furthermore, it may stimulate new theoretical developments and new solutions to practical problems.

Limitations to our approach and directions for relevant future research

We have emphasized that the propositions and action principles we have put forward cannot be considered to be examples of evidenced-based management (Rousseau, 2006); rather we have derived these primarily from conceptual developments by organizational theorists, our

own dialectic perspective, and from available empirical evidence to the best of our current knowledge. All of the propositions, action principles, and the strategies of dealing with conflicting demands (Table 2) require specification and additional research at all level from the individual through the team level and up to the organizational level.

From our proposition that multiple pathways can lead to idea generation and implementation, it should not be inferred that “everything and anything goes”. Quite to the contrary, innovation is a high risk endeavor that often fails. Thus, future research needs to point out, how systems can meet conflicting demands of innovation to remain adaptive in the long term. The most important research questions that follow from our reasoning are: What are the cognitive, behavioral, cultural, and structural antecedents of ambidexterity? What are optimal levels of separation of conflicting activities at different organizational levels that sufficiently reduce tensions, while not compromising their interdependence? What are the boundary conditions for the effectiveness of different strategies in dealing with conflicting demands of innovation? Finally, allowing for a two-way communication between academia and industry will facilitate the validation of existing theories of innovation, leading to new theoretical developments and practical implementation. We emphasize this endeavor should be based on Lewin’s (1951) proposition that "there is nothing as practical as a good theory." (p. 169).

References

Abernathy, W. J. (1978). *The productivity dilemma*. Baltimore: Johns Hopkins University Press.

Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. *Technology Review, 80*, 40-47.

Adler, M. J. (1952). *The great ideas: A syntopicon of great books of the western world* (Vol. I). London: Encyclopedia Britannica.

Adler, P. S., Goldoftas, B., & Levine, D. I. (1999). Flexibility versus efficiency? A case study of model changeovers in the Toyota production system. *Organization Science, 10*, 43-68.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in Organizational Behavior, 10*, 123-176.

Amabile, T. M. (2000). Stimulate Creativity by Fueling Passion. In E. A. Locke (Ed.), *Blackwell Handbook of Principles of Organizational Behavior* (pp. 331-341). Oxford, England: Blackwell.

Amabile, T. M., Barsade, S. G., Mueller, J. S., & Staw, B. M. (2005). Affect and creativity at work. *Administrative Science Quarterly, 50*, 367-403.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, 39, 1154- 1184.

Anderson, N., De Dreu, C. K., & Nijstad, B. A. (2004). The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of Organizational Behavior, 25*, 147-173.

Anderson, N., & Gasteiger, R. M. (2007). Helping creativity and innovation thrive in organizations: Functional and dysfunctional perspectives. In J. Langan-Fox, C. L. Cooper & R. J. Klimoski (Eds.), *Research companion to the dysfunctional workplace: Management challenges and symptoms* (pp. 422-440).

Anderson, N., & Sleap, S. (2004). An evaluation of gender differences on the Belbin team role self-perception inventory. *Journal of Occupational and Organizational Psychology, 77*, 429-437.

Anderson, N. R., & West, M. A. (1998). Measuring climate for work group innovation: development and validation of the team climate inventory. *Journal of Organizational Behavior, 19*, 235-258.

Arbel, I., and Erez, M. (2008). “Team sharing and reflexivity as a lever to innovation in product development teams". EU-US Early Career Researcher Conference on Research and Innovation Studies. Organized by the PRIME Network of Excellence, *University of Twente, Enschede*, The Netherlands, July 2008.

Baer, M., & Frese, M. (2003). Innovation is not enough: Climates for initiative and psychological safety, process innovations, and firm performance. *Journal of Organizational Behavior, 24*, 45-68.

Baer, M., & Oldham, G. R. (2006). The curvilinear relation between experienced creative time pressure and creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology, 91*, 963-970.

Benner, M. J., & Tushman, M. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review, 27*, 238-256.

Bergin, T. J. (2006). The proliferation and consolidation of word processing software: 1985-1995. *IEEE Annals of the History of Computing, 28*, 48-63.

Binnewies, C., Ohly, S., & Sonnentag, S. (2007). Taking personal initiative and communicating about ideas: What is important for the creative process and for idea creativity? *European Journal of Work and Organizational Psychology, 16*, 432-455.

Bouwen, R., & Fry, R. (1991). Organizational innovation and learning: Four patterns of dialogue between the dominant logic and the new logic. *International Studies of Management and Organization, 21*, 37-51.

Brown, S. L., & Eisenhardt, K. M. (1997). The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly, 42*, 1-34.

Buijs, J. (2003). Modelling product innovation processes, from linear logic to circular chaos. *Creativity and Innovation Management, 12*, 76-93.

Burgelman, R. A. (2002). Strategy as vector and the inertia of coevolutionary lock-in. *Administrative Science Quarterly, 47*, 325–357.

Cameron, K. S., & Quinn, R. E. (1988). Organizational paradox and transformation. In R. E. Quinn & K. S. Cameron (Eds.), *Paradox and transformation: Toward a theory of change in organization and management* (pp. 1-18). Cambridge: Ballinger.

Camisón-Zornoza, C., Lapiedra-Alcamí, R., Segarra-Ciprés, M., & Montserrat Boronat-Navarro, M. (2001). A meta-analysis of innovation and organizational size, *Organization Studies, 25*, 331-361.

Chandy, R. K., Chandy, R. K., & Tellis, G. J. (1998). Organizing for radical product innovation: The overlooked role of willingness to cannibalize. *Journal of Marketing Research*, 35, 474-487.

Cheng, Y.-T., & van de Ven, A. H. (1996). Learning the innovation journey: Order out of chaos? *Organization Science, 7*, 593-614.

Christensen, C. M. (1997). *Innovator's dilemma: When new technologies cause great firms to fail*. Cambridge, Mass.: Harvard Business School Press Books.

Cohen, M. D., March, J. G., & Olsen, J. P. (1972). A garbage can model of organizational choice. *Administrative Science Quarterly, 17*, 1-25.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*, 128-152.

Collins, M. A., & Amabile, T. M. (1999). Motivation and creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 297-312). New York, NY: Cambridge University Press.

Conti, R., Coon, H., & Amabile, T. M. (1996). Evidence to support the componential model of creativity: Secondary analyses of three studies. *Creativity Research Journal, 9*, 385-389.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal, 34*, 555-590.

De Dreu, C. K. W. (2002). Team innovation and team effectiveness: The importance of minority dissent and reflexivity. *European Journal of Work and Organizational Psychology, 11*, 285-298.

De Dreu, C. K. W. (2006). When too little or too much hurts: Evidence for a curvilinear relationship between task conflict and innovation in teams. *Journal of Management, 32*, 83-107.

De Dreu, C. K. W., Baas, M., & Nijstad, B. A. (2008). Hedonic tone and activation level in the mood-creativity link: Toward a dual pathway to creativity model. *Journal of Personality and Social Psychology, 94*, 739-756.

De Dreu, C. K. W., & Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology, 88*, 741-749.

De Dreu, C. K. W., & West, M. A. (2001). Minority dissent and team innovation: The importance of participation in decision making. *Journal of Applied Psychology, 86*, 1191-1201.

Denison, D. R., Hooijberg, R., & Quinn, R. E. (1995). Paradox and performance: Toward a theory of behavioral complexity in managerial leadership. *Organization Science, 6*, 524-540.

Diehl, M., & Stroebe, W. (1991). Productivity loss in idea generating groups: tracking down the blocking effect. *Journal of Personality and Social Psychology, 61*, 392-403.

Eisenberger, R., Pierce, W. D., & Cameron, J. (1999). Effects of reward on intrinsic motivation - negative, neutral, and positive: Comment on Deci, Koestner, and Ryan (1999). *Psychological Bulletin, 125*, 669-677.

Eisenberger, R., & Rhoades, L. (2001). Incremental effects of reward on creativity. *Journal of Personality and Social Psychology, 81*(4), 728-741.

Engels, F. (1940). *Dialectics of nature*. New York: International Publishers.

Farr, J. L., & Ford, C. M. (1990). Individual innovation. In M. A. West & J. L. Farr (Eds.), *Innovation and creativity at work* (pp. 63-80). Chichester: Wiley.

Farr, J. L., Sin, H.-P., & Tesluk, P. E. (2003). Knowledge management processes and work group innovation. In L. V. Shavinina (Ed.), *The international handbook on innovation* (pp. 574-586). New York, NY: Elsevier Science.

Fay, D., & Sonnentag, S. (2002). Rethinking the effects of stressors: A longitudinal study on personal initiative. *Journal of Occupational Health Psychology, 7*, 221-234.

Festinger, L. (1983). *The human legacy*. New York: Columbia University Press.

Fong, C. T. (2006). The effects of emotional ambivalence on creativity. *Academy of Management Journal,* 49(5), 1016-1030.

Forster, J. Higgins, E.T. and Taylor-Bianco, A. (2003). Speed/accuracy decisions in task performance: Built-in trade-off or separate strategic concerns? *Organizational Behavior anad Human Decision Processes*, 90, 148-164.

Frese, M., & Fay, D. (2001). Personal initiative (PI): An active performance concept for work in the 21st century. In B. M. Staw & R. M. Sutton (Eds.), *Research in Organizational Behavior* (Vol. 23, pp. 133-187). Amsterdam: Elsevier Science.

Frese, M., Garst, H., & Fay, D. (2007). Making things happen: Reciprocal relationships between work characteristics and personal initiative in a four-wave longitudinal structural equation model. *Journal of Applied Psychology, 92*, 1084-1102.

Frese, M., Krauss, S. I., Keith, N., Escher, S., Grabarkiewicz, R., Luneng, S. T., et al. (2007). Business owners' action planning and its relationship to business success in three African countries. *Journal of Applied Psychology, 92*, 1481-1498.

Frese, M., Mertins, J. C., Hardt, J. V., Fischer, S., Flock, T., Schauder, J., et al. (2009). Innovativeness of firms and organizational culture: The role of error management culture and pro-initiative climate. *University of Giessen: submitted for publication.*

Frese, M., Teng, E., & Wijnen, C. J. D. (1999). Helping to improve suggestion systems: Predictors of making suggestions in companies. *Journal of Organizational Behavior, 20*, 1139-1155.

Frese, M., & Zapf, D. (1994). Action as the core of work psychology: A German approach. In H. C. Triandis, M. D. Dunnette & L. Hough (Eds.), *Handbook of Industrial and Organizational Psychology* (Vol. 4, pp. 271-340). Palo Alto, California: Consulting Psychologists Press.

Gasper, K. (2003). When necessity is the mother of invention: Mood and problem solving. *Journal of Experimental Social Psychology, 39*, 248-262.

George, J. M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology, 86*, 513-524.

George, J. M., & Zhou, J. (2002). Understanding when bad moods foster creativity and good ones don't: The role of context and clarity of feelings. *Journal of Applied Psychology, 87*, 687-697.

Gebert, D., Boerner, S., & Lanwehr, R. (2003). The risks of autonomy: Empirical evidence for the necessity of a balance management in promoting organizational innovativeness. *Creativity and Innovation Management*, 12(1), 41-49.

George, J. M., & Zhou, J. (2007). Dual tuning in a supportive context: Joint contributions of positive mood, negative mood, and supervisory behaviors to employee creativity. *Academy of Management Journal, 50*, 605-622.

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal, 47*, 209-226.

Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly, 51*, 451-495.

Gilson, L. L., Mathieu, J. E., Shalley, C. E., & Ruddy, T. M. (2005). Creativity and standardization: Complementary or conflicting drivers of team effectiveness? *Academy of Management Journal, 48*, 521-531.

Gollwitzer, P. M., Heckhausen, H., & Steller, B. (1990). Deliberative and implemental mind-sets: Cognitive tuning towards congruous thoughts and information. *Journal of Personality and Social Psychology, 59*, 1119-1127.

Griffin, M. A., Neal, A., & Parker, S. K. (2007). A new model of work role performance: Positive behavior in uncertain and interdependent contexts. *Academy of Management Journal, 50*, 327-347.

Guilford, J. P. (1967). *The nature of human intelligence*. New York, NY: McGraw-Hill Publisher Information McGraw-Hill Print.

Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The interplay between exploration and exploitation. *Academy of Management Journal, 49*, 693-706.

Hacker, W. (2003). Action Regulation Theory: A practical tool for the design of modern work processes? *European Journal of Work and Organizational Psychology, 12*(2), 105-130.

Hamel, G., & Prahalad, C. K. (1994). *Competing for the future*. Boston, Mass.: Harvard Business School Press.

Hargrave, T. J., & Van De Ven, A. H. (2006). A collective action model of institutional innovation. *Academy of Management Review, 31*, 864-888.

He, Z.-L., & Wong, P.-K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science, 15*, 481-494.

Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist, 52*, 1280-1300.

Highhouse, S. (2008). Stubborn reliance on intuition and subjectivity in employee selection. *Industrial and Organizational Psychology: Perspectives on Science and Practice, 1*, 333-342.

Holland, J. L., & Gottfredson, G. D. (1992). Studies of the hexagonal model: An evaluation: or The perils of stalking the perfect hexagon. *Journal of Vocational Behavior*, 40, 158-170.

Homan, A. C., van Knippenberg, D., Van Kleef, G. A., & De Dreu, C. K. W. (2007). Bridging faultlines by valuing diversity: Diversity beliefs, information elaboration, and performance in diverse work groups. *Journal of Applied Psychology*, 92, 1189-1199.

Hulsheger, U. R., Anderson, N., & Salgado, J. F. (2008). Team-level Predictors of Innovation at Work: A Comprehensive Meta-Analysis Spanning Three Decades of Research, *Journal of Applied psychology*, revise and resubmit.

Hulsheger, U. R., Anderson, N., & Salgado, J. F. (2009a). *Selecting for innovation: What is good for job performance is not necessarily good for innovative performance*. Paper to be presented at the EAWOP conference, Santiago de Compostela, May 2009.

Hulsheger, U. R., Anderson, N., & Salgado, J. F. (2009b). *Leadership and Innovation: A meta-analysis of main relationships and an investigation into cultural differences*. Paper to be presented at the SIOP conference, Santiago de Compostella, April 2009.

Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology*, 52, 1122-1131.

Jansen, J. J. P., George, G., Van den Bosch, F. A. J., & Volberda, H. W. (2008). Senior team attributes and organizational ambidexterity: The moderating role of transformational leadership. *Journal of Management Studies, 45*, 982-1007.

Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science, 52*, 1661-1674.

Jansen, K. J. (2004). From persistence to pursuit: A longitudinal examination of momentum during the early stages of strategic change. *Organization Science*, 15, 276-294.

Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal, 45*, 1183–1194.

Kearney, E., & Gebert, D. (2009). Managing Diversity and Enhancing Team Outcomes: The Promise of Transformational Leadership. *Journal of Applied Psychology, 94*, 77-89.

Kearney, E., & Gebert, D. (in press). When and how diversity benefits teams - the importance of team members' need for cognition. *Academy of Management Journal*.

Keller, R. T. (2006). Transformational Leadership, Initiating Structure, and Substitutes for Leadership: A Longitudinal Study of Research and Development Project Team Performance. *Journal of Applied Psychology, 91*, 202-210.

Kimberly, J. R., & Evanisko, M. J. (1981). Organizational innovation: The influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. *Academy of Management Journal, 24*, 689-713.

King, N. (1992). Modelling the innovation process: An empirical comparison of approaches. *Journal of Occupational and Organizational Psychology, 65*, 89-100.

King, N., Anderson, N., & West, M. A. (1991). Organizational innovation in the UK: A case study of perceptions and processes. *Work & Stress, 5*, 331-339.

Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology, 61*, 622-629.

Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic Management Journal, 13*, 111-125.

Lewin, K. (1951). *Field theory in social science*. New York: Harper & Row.

Lewis, M. W. (2000). Exploring paradox: Toward a more comprehensive guide. *Academy of Management Review, 25*, 760-776.

Lewis, M. W., Welsh, M. A., Dehler, G. E., & Green, S. G. (2002). Product development tensions: Exploring contrasting styles of product management. *Academy of Management Journal, 45*, 546-564.

Livne-Tarandach, R., Erez, M. and Erev, I. (2004). *Turning enemies into Allies: The effect of performance contingent rewards and goal type on creativity*. A paper presented at the Annual Conference of SIOP, Chicago, April 2004.

Locke, E. A. (Ed.). (2004). *Handbook of principles of organizational behavior*. Oxford, England: Blackwell.

Lovelace, K., Shapiro, D. L., & Weingart, L. R. (2001). Maximizing cross-functional new product teams' innovativeness and constraint adherence: A conflict communications perspective. *Academy of Management Journal, 44*(4), 779-793.

Lubatkin, M. H., Simsek, Z., Yan, L., & Veiga, J. F. (2006). Ambidexterity and performance in small- to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management, 32*, 646-672.

Luchins, A. S. (1942). Mechanization in problem-solving: The effect of Einstellung. *Psychological Monographs, 54,* No. 248.

Macey, W. H., & Schneider, B. (2008). The meaning of employee engagement. *Industrial and Organizational Psychology: Perspectives on Science and Practice, 1*, 3-30.

Mahmoud-Jouini, S. B., Charue-Duboc, F., & Fourcade, F. (2007). Multilevel integration of exploration units: Beyond the ambidextrous organization. *Academy of Management Proceedings*, 1-6.

March, J. G., Sproull, L. S., & Tamuz, M. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*, 71-87.

Mayer, M. (2006). "Ideas and innovation at Google". Stanford University, *MS&E 472 Course: Entrepreneurial Thought Leaders Seminar Series,* available at: http://stanford-online.stanford.edu/courses/msande472/060517-msande472-300.asx.

Miller, S., & Steinberg, B. (2006, 12/23/2006). Former Xerox CEO Funded Fabled PARC but Failed to Harvest Innovations. *Wall Street Journal - Eastern Edition, 248,* pA6.

Miron, E., Erez, M., & Naveh, E. (2004). Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other? *Journal of Organizational Behavior, 25*, 175-199.

Miron-Spektor, E., Erez, M., & Naveh, E. (2006). The personal attributes that enhance individual versus team innovation. *Academy of Management,* Atlanta, August 2006.

Mom, T. J. M., Van Den Bosch, F. A. J., & Volberda, H. W. (2007). Investigating managers' exploration and exploitation activities: The influence of top-down, bottom-up, and horizontal knowledge inflows. *Journal of Management Studies, 44*, 910-931.

Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *Leadership Quarterly, 13*, 705-750.

Naveh, E., & Erez, M. (2004). Innovation and attention to detail in the quality improvement paradigm. *Management Science, 50*, 1576-1586.

Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review, 108*, 291-310.

O'Reilly Iii, C. A., & Tushman, M. L. (2004). The ambidextrous organization. *Harvard Business Review, 82*, 74-81.

Ohly, S., Sonnentag, S., & Pluntke, F. (2006). Routinization, work characteristics and their relationships with creative and proactive behaviors. *Journal of Organizational Behavior, 27*, 257-279.

Patterson, F. (2002). Great minds don't think alike? Person-level predictors of innovations at work. In C. L. Cooper & I. T. Robertson (Eds.), *International Review of Industrial and Organizational Psychology* (Vol. 17, pp. 115-144). Chichester: Wiley.

Pearce, C. L., & Ensley, M. D. (2004). A reciprocal and longitudinal investigation of the innovation process: The central role of shared vision in product and process innovation teams (PPITs). *Journal of Organizational Behavior, 25*, 259-278.

Peng, K., & Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *American Psychologist, 54*, 741-754.

Perretti, F., & Negro, G. (2006). Filling empty seats: How status and organizational hierarchies affect exploration versus exploitation in team design. *Academy of Management Journal, 49*(4), 759-777.

Piaget, J. (1947). *Psychologie der Intelligenz (Psychology of intelligence)*. Zürich, Switzerland: Rascher.

Pirola-Merlo, A., & Mann, L. (2004). The relationship between individual creativity and team creativity: Aggregating across people and time. *Journal of Organizational Behavior*, 25, 235-257.

Raisch, S., & Birkinshaw, J. (2008). Organizational Ambidexterity: Antecedents, Outcomes, and Moderators. *Journal of Management, 34*, 375-409.

Riegel, K. F. (1973). Dialectic operations: The final period of cognitive development. *Human Development, 16*, 346-370.

Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal, 37*, 580-607.

Shalley, C. E. (1991). Effects of productivity goals, creativity goals, and personal discretion on individual creativity. *Journal of Applied Psychology, 76*, 179-185.

Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management, 30*, 933-958.

Shin, S. J., & Zhou, J. (2007). When is educational specialization heterogeneity related to creativity in research and development teams? Transformational leadership as a moderator. *Journal of Applied Psychology, 92*, 1709-1721.

Simon, H. (1996). *The hidden champions: lessons from 500 of the world's best unknown companies*. Cambridge, MA: Harvard Business School Press.

Smith, W. K., & Tushman, M. L. (2005). Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science, 16*, 522-536.

Rousseau, D. M. (2006). Is there such a thing as "evidence-based management"? *Academy of Management Review, 31*(2), 256-269.

Stahl, M. J., & Koser, M. C. (1978). Weighted productivity in R&D: Some associated individual and organizational variables. *IEEE Transactions on Engineering Management, 25*, 20-24.

Stasser, G., Vaughan, S. I., & Stewart, D. D. (2000). Pooling unshared information: The benefits of knowing how access to information is distributed among group members. *Organizational Behavior and Human Decision Processes, 82*, 102-116.

Steiner, I. D. (1972). *Group processes and productivity*. New York: Academic.

Sutton, R. I., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly, 41*, 685-718.

Taylor, A., & Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of Management Journal, 49*, 723-740.

Tolman, E. C. (1932). *Purposive behavior in animals and men (reprint 1960 ed.)*. New York: Appleton Century Crofts.

Van Dyck, C., Frese, M., Baer, M., & Sonnentag, S. (2005). Organizational error management culture and its impact on performance: A two-study replication. *Journal of Applied Psychology, 90*, 1228-1240.

Van Knippenberg, D., De Dreu, C. K. W., & Homan, A. C. (2004). Work group diversity and group performance: An integrative model and research agenda. *Journal of Applied Psychology, 89*, 1008-1022.

Venohr, Bernd and Meyer, Klaus E., (2007). *The German Miracle Keeps Running: How Germany's Hidden Champions Stay Ahead in the Global Economy*. Available at SSRN: http://ssrn.com/abstract=991964

Visser, W. (1994). Organization of design activities: Opportunistic, with hierarchical episodes. *Interaction with computers, 6*(3), 239-274.

Voss, G. B., Sirdeshmukh, D., & Voss, Z. G. (2008). The effects of slack resources and environmental threat on product exploration and exploitation. *Academy of Management Journal, 51*, 147-164.

Weick, K. E., & Quinn, R. E. (1999). Organizational change and development. *Annual Review of Psychology, 50*, 361-386.

West, M. A. (2001). The human team: basic motivations and innovations. In N. Anderson, D. S. Ones, H. K. Singangil & C. Viswesvaran (Eds.), *Handbook of industrial, work and organizational psychology* (Vol. 2, pp. 270-288). London / New York: Sage.

West, M. A. (2002a). Ideas are ten a penny: It's team implementation not idea generation that counts. *Applied Psychology: An International Review, 51*, 411-424.

West, M. A. (2002b). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology: An International Review, 51*, 355-387.

West, M. A., & Anderson, N. R. (1996). Innovation in top management teams. *Journal of Applied Psychology, 81*, 680-693.

Westerman, G., McFarlan, F. W., & Iansiti, M. (2006). Organization design and effectiveness over the innovation life cycle. *Organization Science, 17*, 230-238.

Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world*. New York: Rawson.

Yeo, G. B., & Neal, A. (2004). A multilevel analysis of effort, practice, and performance: Effects; of ability, conscientiousness, and goal orientation. *Journal of Applied Psychology, 89*, 231-247.

Young, S. M. (1992). A framework for successful adoption and performance of Japanese manufacturing practices in the United States. *Academy of Management Review, 17*, 677-700.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review, 27*, 185-203.

Zaltman, G., Duncan, R., & Holbek, J. (1973). *Innovations and Organizations*. New York: Wiley.

Zhou, J. (2003). When the presence of creative coworkers is related to creativity: Role of supervisor close monitoring, developmental feedback, and creative personality. *Journal of Applied Psychology, 88*(3), 413-422.

Footnotes

[1]The German term for resolve "Aufheben" is useful here, because it denotes a double meaning: First, the synthesis does away (aufheben) with the contradiction of the thesis and the antithesis, but at the same time it lifts up (aufheben) the level of knowledge (in the synthesis).

Table 1

Tensions of innovation: Examples at individual, team, and organizational levels

	Antecedents of Innovation	Innovation processes and outcomes
Organization	Cultural values and practices for innovation, efficiency and quality (Miron et al., 2004) Autonomy and control (Gebert et al., 2003) Organizational routines and dynamic capabilities (Zahra, 2002) Core competencies and core rigidities (Leonard-Barton, 1992) Prospectors and reactors (Miles & Snow, 1978) Inertia and change based momentum (Jansen, 2004)	Exploration and exploitation (March et al., 1991) The productivity dilemma (Abernathy, 1978) Incremental and radical innovation (Chandy, Chandy, & Tellis, 1998) Discontinuous innovation (Christensen, 1997) Inventing the future vs. fitting strategy to competence (Hamel & Prahalad, 1994) Dysfunctional consequences of innovation: e.g. lowered short-term profits (Anderson & Gasteiger, 2007)
Team	Transformational leadership and initiating structure (Keller, 2006) Creativity and standardization (Gilson et al., 2005) Team diversity (e.g. Hulsheger et al., 2008) Divergent team processes: e.g. minority dissent (De Dreu, 2002) Convergent team processes: e.g. shared vision (Hulsheger et al., 2008)	Exploration and exploitation in teams (Taylor & Greve, 2006) Alignment and adaptability (Gibson & Birkinshaw, 2004) Team creativity (Pirola-Merlo & Mann, 2004) and idea evaluation, selection, and implementation in teams (Farr et al., 2003) Radicalness of work group innovation (West & Anderson, 1996) Dysfunctional consequences of innovation: e.g. interpersonal conflict in teams (Anderson & Gasteiger, 2007)
Individual	Openness to experience and conscientiousness (George & Zhou, 2001) Artistic/investigative and conventional interests (Holland & Gottfredson, 1992) Divergent and convergent thinking (Guilford, 1967) Adaptors and innovators (Kirton, 1976) Positive and negative mood (George & Zhou, 2007) Promotion and prevention focus (Forster et al., 2003) Learning and performance goal orientations (Yeo & Neal, 2004) External rewards and intrinsic motivation (Collins & Amabile, 1999)	Explorative and exploitative activities of individuals (Mom et al. 2007) Ideation-implementation dilemma (Kimberly & Evanisko, 1981) Opportunistic action regulation (Hacker, 2003) Dysfunctional consequences of innovation: e.g. increased stress levels (Anderson & Gasteiger, 2007)

Table 2

Ambidexterity: The regulation of explorative and exploitative action at multiple organizational levels

	Separation	Integration by active management	Integration by self-regulation
Organization	Specialization of an organization either on exploration or exploitation Separating explorative units form exploitative units (e.g. research and development) with distinct cultures, incentive systems and leadership styles Time-based separation into phases of exploration and exploitation according to the punctuated equilibrium model	Providing leadership that embraces competing values and practices Supporting creativity and initiative in all sections and on all hierarchical levels of an organization. Transformational leadership at the top echelon of the organization Providing resources for innovation to all rather than just to specialized departments	Intra-organizational market of ideas and emergence of innovation champions Integration of conflicting activities in the top management team through dialectic processes of power and negotiation
Team	Segmentation of the innovation process into stages of idea generation, evaluation, selection and implementation Reducing task and sequential interdependence in a team Selecting people into a team with diverse KSAO's to increase diversity Creating fixed and specialized roles in a team	Engaging in complementary leadership behaviors such as structuring activity, control and empowering employees to explore autonomously A transformational leader who provides a common vision for a team that integrates diversity Adapting to situational task demands and switching between leadership activities Providing external help to switch between mindsets and activities Encouraging internal and external communication and facilitating skunk teams.	Breadth of cognitive and behavioral complexity of team members and development of transactive memory systems and team reflexitivity Emergence of shared leadership and team roles according to capabilities and task demands Political processes of selling new ideas and negotiating for resources Minority dissent as a regulating process in teams Development of skunk teams in addition to formal teams.
Individual	Distributing tasks according to individual KSAO's relevant for idea generation, idea implementation, attention-to detail. Setting goals and providing rewards for creativity. Assigning individual rather than team accountability Separating individual from highly interactive performance episodes to enable divergent processes	Acknowledging the nature of the creative process (e.g. incubation, unpredictability) in setting deadlines and providing feedback. Empowering all employees to perform exploratory activities to some extent Restraining from providing controlling rewards that impede creativity Adapting leadership to strength and weaknesses of individual employees Allowing time for individual projects that are not regulated by management Questioning false beliefs about allegedly mutually exclusive activities	Breadth of behavioral repertoire and the flexibility to act according to situational demands Individual reflexivity and meta cognition about different mindsets and activities Development of idiosyncratic strategies to deal with conflicting demands Effort and emotion regulation to deal with different task demands Self-starting, proactive actions to improve external circumstances.