© *Academy of Management Review*
2010, Vol. 35, No. 4, 579–603.

RECONSIDERING THE TRADE-OFF BETWEEN EXPERTISE AND FLEXIBILITY: A COGNITIVE ENTRENCHMENT PERSPECTIVE

ERIK DANE
Rice University

Research suggests that as one acquires domain expertise, one loses flexibility with regard to problem solving, adaptation, and creative idea generation. Here, I reconsider this trade-off between expertise and flexibility by examining the concept of cognitive entrenchment—a high level of stability in one's domain schemas. Proposing that cognitive entrenchment varies not only with expertise but also with one's task environment and attentional focus, I contend that the inflexibility-related limitations of expertise can be circumvented.

Through the course of human history, expertise has often been viewed as a valuable asset. For example, in his Socratic dialogues, Plato lauded the merits of expertise. Likewise, in the *Aeneid*, the Roman poet Virgil proclaimed *experto crede*—trust an expert. Today, expertise continues to be seen as a positive quality (Bunderson, 2003a; Ericsson, Prietula, & Cokely, 2007; Mumford, Scott, Gaddis, & Strange, 2002). In fact, from popular writings (Colvin, 2008; Gladwell, 2008; Shenk, 2010) to the value industry places on subject matter experts (Alberts, 2007; Gandhi & Sauser, 2008) to a growing body of academic work (e.g., Ericsson, Charness, Feltovich, & Hoffman, 2006; Ericsson & Ward, 2007; Haerem & Rau, 2007), expertise is a much discussed and highly touted concept. Perhaps not surprisingly, then, research indicates that expertise contributes to favorable outcomes in the workplace, including effective decision making and high job performance (Benner, 1984; Dreyfus & Dreyfus, 2005; Ericsson & Charness, 1994; Hogarth, 2001; Kahneman & Klein, 2009; Klein, 1998; McCloy, Campbell, & Cudeck, 1994; Prietula & Simon, 1989; Salas, Rosen, & DiazGranados, 2010; Sonnentag, 1998).

I am indebted to the individuals who offered suggestions on earlier versions of this manuscript. Thus, I formally acknowledge Markus Baer, Tina Borja, Stuart Bunderson, Ap Dijksterhuis, Roland Gau, Jennifer George, Jack Goncalo, Andrew Hargadon, Nora Madjar, Greg Oldham, Jill Perry-Smith, Michael Pratt, Scott Sonenshein, Raymond Sparrowe, Stefan Thau, and Jing Zhou for their insightful comments and invaluable assistance. I also extend my gratitude to Gerardo Okhuysen and three anonymous reviewers for their detailed feedback throughout the review process.

At the same time, however, research suggests that, in addition to its benefits, expertise carries limitations (e.g., Adelson, 1984; Frensch & Sternberg, 1989; Heath & Staudenmayer, 2000; Hecht & Proffitt, 1995; Hinds, Patterson, & Pfeffer, 2001). A number of limitations have been posited (see Holyoak, 1991, and Lewandowsky & Thomas, 2009), many concerning the premise that domain experts are inflexible in certain respects. For example, experts may have difficulty viewing domain-related problems from the perspectives of others (Camerer, Loewenstein, & Weber, 1989; Hinds, 1999) and adapting to new rules and conditions within their domain (Cañas, Quesada, Antoli, & Fajardo, 2003; Sternberg & Frensch, 1992). These findings suggest that a trade-off is associated with expertise. Specifically, as expertise is acquired, flexibility may be lost (Chi, 2006; Lewandowsky, Little, & Kalish, 2007; Sternberg, 1996).

In this article I review and reconsider research on the inflexibility-related limitations of domain expertise by introducing the concept of *cognitive entrenchment*. Defining cognitive entrenchment as a high level of stability in one's domain schemas, I maintain that this stability tends to increase as individuals attain expertise within a given domain. Furthermore, I suggest that the cognitive entrenchment construct is integral to providing a common, schema-level account of why research indicates that experts are often inflexible in thought and behavior. Specifically, I argue that because of cognitive entrenchment, experts may be restricted in their ability to identify optimal solutions to problems, to adapt to novel situations, and to generate

radically creative ideas within their domain. With regard to creative idea generation, I demonstrate how the concept of cognitive entrenchment helps resolve divergent views among scholars on whether expertise fosters or impedes the generation of creative ideas.

A question relating to the present investigation is whether domain expertise and cognitive entrenchment are inherently coupled. Toward the end of my theorizing, I examine this issue. In particular, I argue that although cognitive entrenchment tends to increase with expertise, at least two factors are likely to moderate this relationship: the degree to which individuals engage in a dynamic environment within their expertise domain and the extent to which individuals focus their attention on tasks outside their expertise domain.

In drawing together and synthesizing the full range of arguments offered here, I conclude with the observation that by taking into account the concept of cognitive entrenchment, one can understand the roots of a number of inflexibility-related limitations of expertise and, critically, recognize that these limitations are not inevitable. Indeed, individuals may be capable of attaining the benefits of expertise while circumventing the inflexibility-related limitations that have been ascribed to it. Thus, the trade-off between expertise and flexibility may be less rigid than typically conceived.

EXPERTISE AND COGNITIVE ENTRENCHMENT

To better understand what cognitive entrenchment is and how it tends to arise, we should first consider the concept of expertise. In this section I review extant research on expertise, examine how expertise is structured at the cognitive level, and describe the benefits it carries. Following this review, I explore the concept of cognitive entrenchment.

Conceptualizing Expertise

Expertise is a concept receiving attention from researchers across a range of disciplines; thus, a number of conceptualizations of expertise have been proposed (see Sternberg, 1997). For example, some sociologists view experts as those who have obtained membership within a socially recognized professional community, such as law or medicine (e.g., Rothman & Perrucci, 1970; Wilensky, 1964). Sociological work on expertise tends to be concerned with issues involving power, politics, and prestige—critical issues from the standpoint of professions and occupations whose reputations are closely tied to the perception that they are communities of experts (Evetts, Mieg, & Felt, 2006; Gerver & Bensman, 1954). As such, sociologists often recognize individuals as experts by virtue of their titles, certifications, or other socially bestowed artifacts that confer professional legitimacy (Collins & Evans, 2002).

The concept of expertise advanced here is grounded in a more psychological perspective. From this lens, expertise consists of a high level of domain-specific knowledge acquired through experience (Benner, 1984; Charness & Schultetus, 1999; Dreyfus & Dreyfus, 1986; Ericsson, 2006; Ericsson, Roring, & Nandagopal, 2007; Feltovich, Prietula, & Ericsson, 2006; Glaser & Chi, 1988; Schmidt, Hunter, & Outerbridge, 1986). Multiple experientially based routes toward expertise have been proposed, including deliberate practice (Ericsson & Charness, 1994; Ericsson & Lehmann, 1996), implicit learning (Lewicki, Hill, & Bizot, 1988; Reber, 1989), and experiential learning (Armstrong & Mahmud, 2008; Kolb, 1984). Common across each of these proposed pathways is the assumption that acquiring expertise takes time as well as appropriate feedback conditions. In fact, research indicates that those who have reached world-class levels of performance within their domain tend to have accumulated at least ten years of practice and training (Ericsson & Charness, 1994; Ericsson, Krampe, & Tesch-Romer, 1993; Ericsson, Roring, & Nandagopal, 2007) and have received accurate performance-related feedback (Hogarth, 2001; Kahneman & Klein, 2009).

Structure of Expert Knowledge

Scholars often argue that domain knowledge is organized in the form of schemas—structures containing "knowledge about a concept or type of stimulus, including its attributes and the relations among those attributes" (Fiske & Taylor, 1991: 98; see also Harris, 1994; Markus & Zajonc, 1985; Marshall, 1995; McVee, Dunsmore, & Gavelek, 2005; Rumelhart, 1984). In probing the nature of the schemas that constitute expertise, researchers have determined that two fundamental features differentiate experts' domain schemas from those of novices (see Bédard & Chi, 1992, for a review).

First, expert schemas tend to be relatively larger than novice schemas (Chase & Simon, 1973; Chi, Feltovich, & Glaser, 1981; Honeck, Firment, & Case, 1987). In other words, the overall quantity of attributes or components contained in an expert schema tends to be large (Fiske & Taylor, 1991; Rousseau, 2001).

Second, expert schemas involve a greater number of interrelationships than novice schemas (Fiske & Taylor, 1991; Kimball & Holyoak, 2000; Lurigio & Carroll, 1985). Not only are the attributes contained within expert schemas more interrelated but the linkages tying together different domain-relevant schemas are more numerous as well. Collectively, these features—the number of schema attributes and the number of relations within and between domain schemas—determine the *complexity* of an individual's domain schemas (Rousseau, 2001). Because of their size and the number of relations typically found within and between them, expert schemas are posited to be more complex than novice schemas (Dane & Pratt, 2007; Rousseau, 2001).

Owing to their complexity, expert schemas tend to be relatively detailed and accurate compared to novice schemas (Fiske & Taylor, 1991; Narvaez & Bock, 2002; Neale & Northcraft, 1990). For example, the layperson's schema of a professor may be that of an individual who spends most of his or her time teaching, thus not working during the summer. In contrast, a more expert schema of a professor, one held by professors themselves, would add research and service activities to the catalog of job-related duties and, thus, would include the recognition that the notion of "summers off" is an illusionary concept (example adapted from Rousseau, 2001). This addition of job duties to the schema brings with it an understanding of how these duties interrelate (e.g., professors who are active in research can share their findings with students to enrich their teaching). This example highlights the higher degree of complexity as well as the enhanced accuracy associated with expert schemas. In other words, the expert schema of a professor includes more attributes (e.g., research, teaching, service) and a richer set of relations between these attributes (e.g., research enhances teaching) than does the corresponding novice schema and, in this example, is more accurate as well.

In summary, domain experts possess complex schemas—schemas containing not only a relatively large number of attributes but also a relatively large number of relations between the attributes within each schema, as well as between the schemas themselves. Figures 1 and 2

FIGURE 1
Novice's Domain Schemas

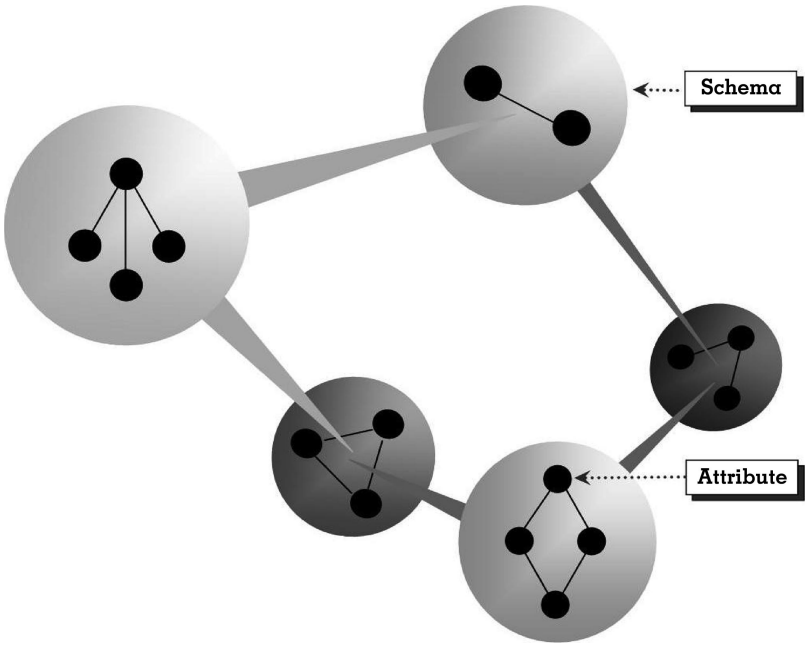
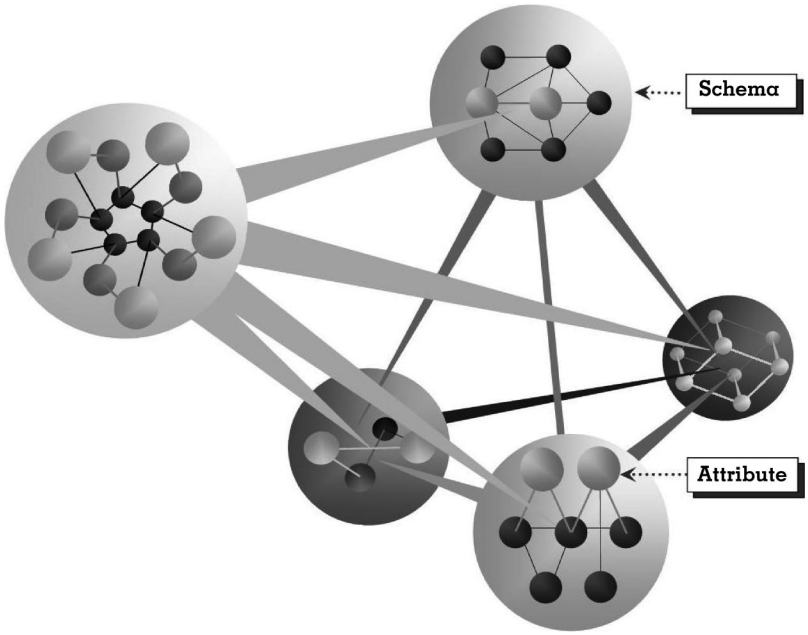


FIGURE 2
Expert's Domain Schemas



provide visual depictions of these properties. Figure 1 is an illustration of a novice's domain schemas. As depicted, there are relatively few attributes within each schema and relatively few relations within and between these schemas. Figure 2 is an illustration of an expert's domain schemas. Based on their number of attributes and interrelationships, the expert's domain schemas are more complex than the novice's schemas.

Benefits of Expertise

Research points to several benefits of expertise (see Ericsson et al., 2006, for a comprehensive review). As noted earlier, expertise may increase decision-making effectiveness and job performance in a number of contexts (e.g., Ericsson & Lehmann, 1996; Klein, 1998; Nee & Meenaghan, 2006). Expertise also enhances domain-relevant memory skills. For example, even when only briefly exposed to domain stimuli, experts display a remarkable ability to recall those stimuli (Ericsson, Patel, & Kintsch, 2000; Vicente & Wang, 1998). To illustrate, research indicates that chess masters are able to recall the exact position of each piece on the chessboard after only a brief look at the board (Chase & Simon, 1973).

In addition, experts solve problems differently and more effectively than novices. These differences have been examined in domains including physics and mathematics (e.g., Chi et al., 1981; Larkin, McDermott, Simon, & Simon, 1980; Sweller, Mawer, & Ward, 1983). In particular, research indicates that experts tend to solve problems in a forward-oriented direction, whereas novices tend to work backward. For instance, physics experts solve problems by selecting equations based on given information and calculating unknown information to identify the solution. In contrast, physics novices begin with an equation that contains the variable of interest and devise subgoals designed to ascertain the various unknowns in the equation—an approach less likely to facilitate effective problem solving (see Gick, 1986, for a review).

Each of these benefits stems from the unique "cognitive architecture" that experts possess. It is because experts have complex domain schemas that they make effective decisions, perform well, exhibit superior recall, and solve problems adroitly (for more detailed discussions see Chi, Glaser, & Farr, 1988; Ericsson et al., 2006; Hoffman, 1992). And yet, although expertise serves individuals in multiple ways, research suggests that expertise can prove limiting. As argued be-

low, the concept of cognitive entrenchment informs research on the limitations of expertise.

Cognitive Entrenchment

Despite the benefits of expertise described above, research suggests that as individuals acquire expertise, they tend to become inflexible in certain respects within their domain (Chi, 2006; Lewandowsky & Kirsner, 2000; Lewandowsky et al., 2007). For example, experts often struggle to put aside the knowledge they possess when predicting how novices will approach problems or respond to events (Birch & Bloom, 2007; Camerer et al., 1989; Hinds, 1999; Hinds & Pfeffer, 2003; Hoch, 1988; Thaler, 2000). Experts also exhibit a restricted ability to accommodate new rules and principles (Frensch & Sternberg, 1989; Marchant, Robinson, Anderson, & Schadewald, 1991).

Unfortunately, few attempts have been made to integrate extant research by providing a theoretical account of why experts are inflexible in a number of ways. With the aim of developing theory in this area, I suggest that adopting a schema-based view of domain expertise—a view aligned with the discussion of expertise provided above—may prove instrumental. As noted, researchers posit that as one attains domain expertise, one's domain schemas become increasingly complex. However, in addition to this rise in schema complexity, research suggests that, with the acquisition of expertise, one's schemas can become more *stable* as well. In other words, the attributes comprising expert schemas, as well as the relations connecting attributes to other attributes and schemas to other schemas, may become resistant to modification (Crocker, Fiske, & Taylor, 1984; Fiske & Taylor, 1991; Goldstein & Chance, 1980; Scott, 1962).

Consistent with this claim, researchers have found that the political views held by experts in the domain of politics are more constrained than the political views of others, which is due to the stability associated with their domain schemas (Larson, 1994; Stimson, 1975). Similarly, evidence indicates that even as the features of an industry evolve, the complex schemas of industry actors tend to remain stable (Hodgkinson, 1997; Reger & Palmer, 1996). More generally, scholars have identified the stability associated with the complex schemas possessed by organizational members as a fundamental obstacle to achieving successful organizational change (Bartunek & Moch, 1987; George & Jones, 2001; Labianca, Gray, & Brass, 2000; Lewin, 1951).

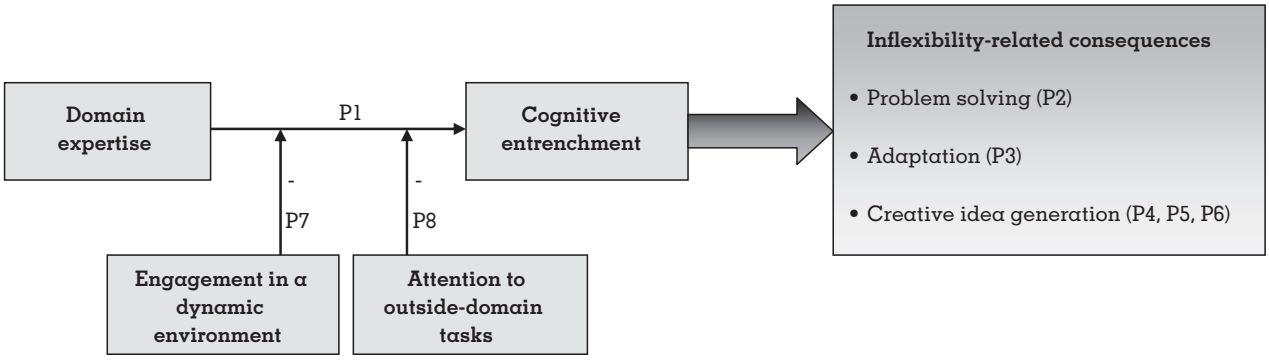
I adopt the term *cognitive entrenchment* (or, simply, *entrenchment*) to refer to a high level of stability in one's domain schemas. Although cognitive entrenchment may not arise solely among experts, the acquisition of domain expertise can lead to such entrenchment (Becker, 2005; Sternberg & Lubart, 1995; Zell, 2003). The schema stability characterizing cognitive entrenchment may emerge, at least in part, from the frequency with which experts tend to draw on their domain schemas. In particular, because expertise is accrued through continual training, practice, and performance (Dreyfus & Dreyfus, 1986; Ericsson & Charness, 1994; Feltovich et al., 2006), the content and relations comprising an expert's domain schemas are likely to be activated and applied innumerable times. This repeated activation and use may stabilize the structure of the expert's schemas such that schema revision becomes relatively unlikely (Fiske & Taylor, 1991). As such, cognitive entrenchment sets in. The following proposition captures this effect.

> *Proposition 1: Domain expertise is positively related to cognitive entrenchment.*

Figure 3 depicts this posited relationship. Intended as an organizing framework rather than a full causal model, this figure depicts a number of additional relationships and propositions discussed in the sections to come.

In further considering the nature of cognitive entrenchment, one should note that such entrenchment is not always problematic and, indeed, may carry certain benefits—a point I explore later in this article. Nevertheless, the entrenchment that often pervades expert schemas is notable in that it may account for a range of inflexibility-related limitations researchers have ascribed to expertise. In the following section I examine multiple lines of inquiry concerned with experts' inflexibility and position cognitive entrenchment as a concept integrating these bodies of work. In doing so I illustrate how cognitive entrenchment is related to, although distinct from, concepts like fixation and habits, and I demonstrate how the entrenchment construct enriches our understanding of certain areas of research and reconciles debates in others.

FIGURE 3
Antecedents and Inflexibility-Related Consequences of Cognitive Entrenchment



ACCOUNTING FOR EXPERTS' INFLEXIBILITY VIA COGNITIVE ENTRENCHMENT

Common across and driving the range of arguments offered in this section is the observation that schemas guide cognition within one's domain (Fiske & Taylor, 1991; Markus & Zajonc, 1985). Notably, individuals' domain schemas are activated when they are exposed to domain-relevant stimuli (Bilalić, McLeod, & Gobet, 2008a; Smith, 1998). In turn, these schemas influence what individuals attend to as well as how they view and think about the situations they encounter (Cooper & Shallice, 2006; Henderson & Hollingworth, 1999; Marshall, 1995; Walsh, 1995). This suggests that stable schemas predispose individuals to respond consistently and, thus, inflexibly in certain respects. As argued here, schema stability—the essence of cognitive entrenchment—carries consequences that account for a range of findings in research on problem solving, adaptation, and creative idea generation. Each of these consequences is discussed below and depicted in Figure 3.

Problem Solving

In research on the topic of visual perception, a *fixation* is said to occur when one focuses one's gaze on a single feature of a broader scene (Henderson, 2007). Somewhat analogously, research on problem solving adopts the term to refer to situations in which one is focused on a suboptimal course of action and, thus, is rendered unable to identify or develop a more effective alternative (Jansson & Smith, 1991; Smith, 1995a,b; Smith & Blankenship, 1991). In other words, problem-solving fixation occurs when a person becomes "stuck" attempting to derive a solution to a given problem (Birch & Rabinowitz, 1951; Luchins, 1942; Rudolph, Morrison, & Carroll, 2009; Vul & Pashler, 2007). For example, in a classic study Duncker (1945) found that individuals had difficulty recognizing the functional value of a box as a support because they were fixated on the idea that the box was simply a container. Hence, they exhibited *functional fixedness*—fixation with regard to thinking of alternative uses for a familiar object (Adamson, 1952).

Among the most frequently demonstrated instances of fixation in the problem-solving literature are "Einstellung" effects, which occur "when the first idea that comes to mind, triggered by previous experience with similar situations, prevents alternatives from being considered" (Bilalić et al., 2008a: 653). For example, research suggests that people trained to solve problems using a specific method are often unable to solve problems that are similar in appearance but different in terms of their requisite solution method (Luchins & Luchins, 1959; see also Bilalić, McLeod, & Gobet, 2008b; Lippman, 1994; Lovett & Anderson, 1996). In essence, problem solvers can become fixated on a particular method to their own detriment when encountering problems that call for alternative solutions.

While problem-solving fixation can arise from a variety of causes, such as experimental inducement (Smith & Blankenship, 1991) and delayed information feedback (Rudolph et al., 2009), researchers have suggested that domain expertise contributes to some instances of fixation (Jansson & Smith, 1991; Saariluoma, 1992). When an expert's domain schemas are acti-

vated, certain solutions are often immediately brought to mind (Bilalić et al., 2008a; Gobet & Simon, 1996, 2000). In some cases these solutions may be well suited to the problem at hand—a claim supported by the observation that experts tend to be effective problem solvers (e.g., Chi et al., 1981; Larkin et al., 1980). However, in other cases these solutions may be suboptimal. To the extent an expert cannot set aside a suboptimal solution and derive a more effective alternative, problem-solving fixation occurs. This situation may be particularly likely to arise when experts are cognitively entrenched. The stability of an entrenched expert's domain schemas may consistently bring to mind a suboptimal solution and thus "block" potentially superior solutions from emerging (cf. Smith & Blankenship, 1991). Consequently, for those high in cognitive entrenchment, it may prove difficult to devise solutions beyond those activated when these individuals are presented with a problem.

> *Proposition 2: Cognitive entrenchment increases the likelihood of problem-solving fixation within one's domain.*

Adaptation

Research indicates that the scope of experts' inflexibility extends beyond fixation effects. Notably, evidence suggests that *adaptation*—adjusting to novel task demands—can be a challenge for experts (Cañas et al., 2003; Lewandowsky et al., 2007; Sternberg & Frensch, 1992). Although an inability to adapt effectively is similar to problem-solving fixation in that each situation involves the repeated use of an inappropriate method, these types of inflexibility are nevertheless distinct. Specifically, fixation arises when one cannot recognize how to reach a solution; failure to adapt occurs when one has learned that a change in task conditions necessitates novel action but unwittingly fails to adopt the requisite response (Lewandowsky & Thomas, 2009). For example, in one study expert bridge players found it difficult to adapt to a modified game of bridge in which the bidding procedure was altered (Frensch & Sternberg, 1989). In another study expert accountants proved less adept than novices at using a new tax law that rendered obsolete a previous rule concerning tax deductions (Marchant et al., 1991).

Furthermore, as noted earlier, domain experts often find it difficult to take the perspective of a domain novice (e.g., Hinds, 1999; Thaler, 2000). As a result, experts may struggle to explain domain concepts to novices (Heath & Staudenmayer, 2000). Specifically, research has shown that when experts are instructing novices, they tend to use too many abstract terms and complex concepts (Hinds et al., 2001). These results suggest that experts are often limited in their ability to adapt their method of instruction to a novice's level.

In short, experts can be relatively slow to adapt when circumstances call for them to do so. This inflexibility may relate to the degree to which experts perform tasks within their expertise domain in a habitual manner. Behavior is rooted in *habits*—"learned dispositions to repeat past performances" (Wood & Neal, 2007: 843)—to the extent it is automatically triggered by domain-related cues (Aarts & Dijksterhuis, 2000; Aarts, Verplanken, & van Knippenberg, 1998). Habits develop through behavioral repetition in a given setting and represent how one customarily behaves in response to a given set of stimuli (Neal, Wood, & Quinn, 2006; Ouellette & Wood, 1998; Wood, Quinn, & Kashy, 2002).

Evidence suggests that habits are represented within and activated by one's knowledge structures (Aarts & Dijksterhuis, 2000; Aarts et al., 1998; Murray & Häubl, 2007). Notably, habits may be encoded cognitively in the form of *scripts*—schemas associated with frequently encountered situations that enable individuals to interpret events and behave appropriately within a given context (Abelson, 1981; Gioia & Poole, 1984; Harris, 1994; Lord & Kernan, 1987). Although some scripts are shared among members of a culture, such as scripts concerned with how to order, dine, and pay at a restaurant (Abelson, 1981), other scripts are more personal or idiosyncratic (Demorest, 1995; Verplanken, Myrbakk, & Rudi, 2005). As with their other domain schemas, experts' scripts tend to be relatively accurate compared to those of a novice (Ashforth & Fried, 1988) and are likely to facilitate task performance (Gioia & Poole, 1984; Nee & Meenaghan, 2006).

When task conditions change, however, the content of an expert's scripts may be incommensurate with the altered nature of the situation. In such cases an expert's scripts and the habits associated with them can lead to dysfunctional

behavior (Louis & Sutton, 1991; but see Hassin, Bargh, & Zimerman, 2009, for an alternative perspective). Even when experts recognize that their habitual responses are incompatible with new rules, their potential for setting aside or altering these habits may be limited. Indeed, research demonstrates that existing habits can hinder the pursuit of modified behavioral goals (Verplanken & Faes, 1999; see also Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2001).

From a cognitive entrenchment perspective, an expert's failure to adapt is likely due to a high level of stability in the scripts underlying the expert's habits. For those with stable scripts, exposure to situational cues may consistently activate the same habitual responses, even when such responses are no longer efficacious (Bagozzi & Dholakia, 2005). In other words, as a result of cognitive entrenchment, it is difficult to disengage one's habits. This claim equates with the general argument advanced here that schema stability accounts for inflexibility in thought and behavior, and it points to the following.

> *Proposition 3: Cognitive entrenchment increases the difficulty of adaptation within one's domain.*

Creative Idea Generation

Beyond enriching theory surrounding experts' inflexibility with regard to problem solving and adaptation, cognitive entrenchment may also inform research focusing on another area in which scholars have argued that experts exhibit inflexibility: creative idea generation. Work in this area of study suggests divergent, and indeed contradictory, possibilities. Specifically, while some researchers contend that domain expertise may be useful or even essential for generating creative ideas (e.g., Amabile, 1996; Ericsson, 1999; Weisberg, 1999, 2006), others maintain that domain expertise can be a hindrance in this regard (e.g., Stacey, Eckert, & Wiley, 2002; Ward, 1994; Wiley, 1998). Below, I provide a detailed overview of this topic and discuss how the cognitive entrenchment construct may reconcile competing positions.

Traditionally, researchers in the fields of management and psychology have tended to view creative ideas as those that are both novel and potentially useful from the perspective of a given organization or domain (e.g., Amabile, 1996; Amabile & Mueller, 2008; Madjar, Oldham, & Pratt, 2002; Runco, 2004; Shalley, Zhou, & Oldham, 2004; Unsworth, 2001; Ward, 2007; Woodman, Sawyer, & Griffin, 1993; see also Joas, 1996, and Latour & Woolgar, 1979, for sociological perspectives on creativity). As scholars have argued, creative idea generation is one of several activities concerned with the overall *process* of creativity (see Lubart, 2000–2001, for a review of creativity process models). Other creativity-relevant activities in this respect include finding or recognizing problems (Getzels, 1979; Reiter-Palmon, 2009), gathering relevant information (Amabile, 1996), evaluating ideas (Lonergan, Scott, & Mumford, 2004; Runco & Smith, 1992), pursuing sponsorship for ideas (Scott & Bruce, 1994), and developing prototypes (Hargadon & Sutton, 1997). These activities are not necessarily pursued sequentially but, rather, may occur concurrently (Lubart, 2000-2001; Scott & Bruce, 1994). From an organizational perspective, such activities contribute to innovation—the process by which creative ideas are developed, adopted, and ultimately implemented (Bledow, Frese, Anderson, Erez, & Farr, 2009; George, 2007; Gupta, Tesluk, & Taylor, 2007; Madjar & Shalley, 2008).

Fueled by the recognition that creative ideas are critical to organizational innovation, adaptation, and survival (Baer & Oldham, 2006; Hirst, van Knippenberg, & Zhou, 2009; Shalley & Perry-Smith, 2008), research on creative idea generation has bourgeoned in recent years. Although management researchers have devoted considerable attention to the social factors that influence the generation of creative ideas, such as work environments, reward systems, supervisory styles, coworker support, and expected evaluation (e.g., Amabile, Conti, Coon, Lazenby, & Herron, 1996; Amabile, Hennessey, & Grossman, 1986; Baer, Oldham, & Cummings, 2003; George & Zhou, 2001; Oldham & Cummings, 1996; Shalley, 1995; Shalley, Gilson, & Blum, 2000; Shalley & Perry-Smith, 2001; see also Kasof, 1995, for more on the social and situational foundations of creativity), evidence suggests that creative idea generation is shaped not only by social factors but also by individual factors, including intelligence, personality, thinking style, and expertise (e.g., Amabile, 1996; Barron & Harrington, 1981; Feist, 1998; Glynn, 1996; Woodman et al., 1993; Zhang &

Sternberg, 2009). Of these factors, research examining the impact of expertise on creative idea generation is relatively limited and, as noted, points in divergent directions.

To make sense of the lack of research convergence on this issue, it may help to consider the cognitive processes posited to underlie creative idea generation. Although a range of processes may contribute to the generation of creative ideas (see Baer, 1993; Campbell, 1960; Dietrich, 2004; Mednick, 1962; Smith, Ward, & Finke, 1995; Wallas, 1926; Zhong, Dijksterhuis, & Galinsky, 2008), some researchers suggest that a particular set of operations—"conceptual combination and reorganization"—often spurs creative idea generation (Baughman & Mumford, 1995; Mobley, Doares, & Mumford, 1992; Mumford, Baughman, Maher, Costanza, & Supinski, 1997; Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991; Reiter-Palmon & Illies, 2004; Scott, Lonergan, & Mumford, 2005). Conceptual combination and reorganization processes involve the combination of two or more schemas or the reorganization of the attributes underlying a particular schema (Mumford & Gustafson, 1988; Mumford et al., 1991). For example, linguistic history is replete with cases in which two terms that appear unrelated, such as *home page* and *conference call*, have been combined to create novel concepts that ultimately integrate into certain lexicons (Ward, Smith, & Vaid, 1997).

A conceptual combination and reorganization view of creative idea generation suggests a pivotal role for the complex schemas underlying domain expertise. The large number of attributes contained in complex schemas provides experts with considerable "raw material" for generating creative ideas. Indeed, as one's expertise develops, the number of combination and reorganization possibilities rises owing to the increasing complexity of one's domain schemas (Mumford, Blair, Dailey, Leritz, & Osburn, 2006). However, to the extent that expert schemas are beset with a high level of stability, conceptual combination and reorganization may be hampered. For such combination and reorganization to occur, schemas and the attributes that comprise them must be sufficiently amenable to reintegration (Mumford & Gustafson, 1988). Hence, with regard to generating creative ideas, cognitive entrenchment may limit the advantage of possessing complex schemas by preventing conceptual combination and reorganization from occurring.

Taken together, these observations suggest a tension between expertise and creative idea generation. Experts have access to a stockpile of concepts to combine and reorganize in creative ways, yet the stability often found in expert schemas may handcuff cognitive processes associated with generating creative ideas. Given the distinct effects of schema complexity and schema stability, it is perhaps not surprising that scholars have posited a range of possibilities concerning how expertise and creative idea generation relate.

In developing theory on this topic, it bears noting that there are qualitatively different types of creative ideas, each of which is likely to be affected by cognitive entrenchment to different degrees. Specifically, some creative ideas, despite being novel and potentially useful, tend to be relatively "incremental"—that is, they represent refinements or extensions of existing ideas or technologies (Benner & Tushman, 2003; Dewar & Dutton, 1986; Tzabbar, 2009). In contrast, other creative ideas are more groundbreaking or unconventional (Dewar & Dutton, 1986; Kirton, 1976). These creative ideas, typically referred to as *radical*, tend to challenge the status quo (Audia & Goncalo, 2007), thus representing a "clear, risky departure from existing practice" (Ettlie, Bridges, & O'Keefe, 1984: 683) and a transformation of the "accepted conceptual space" (Boden, 1998: 348) within the focal domain. Because these two types of creativity vary in how much unconventional—and hence nonentrenched—thinking they require, there may be distinct relationships between expertise and both incremental and radical creativity, respectively.

Incremental idea generation, which arises through "continuity with existing solutions" (Audia & Goncalo, 2007: 2), is likely to be feasible for experts. Indeed, experts may be quite adept at generating incremental solutions to domain-related problems. As noted, experts possess a large quantity of knowledge, which, in turn, provides them with a large number of concepts to combine or reorganize. The conceptual operations producing incrementally creative ideas are thought to occur through extensions or connections of well-established concepts within a given domain and are therefore unlikely to require radical recombination and reorganization (Mumford & Gustafson, 1988). In other words,

incremental creativity involves relatively minor rearrangements of the attributes and schemas underlying an expert's domain knowledge. This indicates that entrenchment is unlikely to hinder the generation of incrementally creative ideas. Thus, one's potential for generating incrementally creative ideas is likely to vary directly with the amount of domain knowledge one possesses. More knowledge implies a larger "network of possible wanderings" (Newell & Simon, 1972: 82) through which incrementally creative ideas may be developed.

Proposition 4: The relationship between domain expertise and incremental idea generation is positive.

In contrast, to the extent that experts are cognitively entrenched, radical idea generation may prove difficult to achieve at a high level of expertise. Radical ideas arise through combining disparate schemas or substantially reorganizing the attributes underlying a particular schema (Baughman & Mumford, 1995; Mobley et al., 1992; Mumford & Gustafson, 1988). Insofar as experts are entrenched, the stability of their schemas may limit their ability to flexibly combine and reorganize concepts in a manner that departs from established paradigms or patterns of thought within their domain (Mumford et al., 2006; Mumford & Gustafson, 1988).

Proposition 5: Cognitive entrenchment limits radical idea generation within one's domain.

In sum, while expertise provides individuals with a large number of domain concepts to combine and reorganize so as to generate creative ideas, it also tends to lead to cognitive entrenchment, which, in turn, limits radical idea generation. As a result, one's ability to generate radically creative ideas may be higher at a moderate, as opposed to a high, level of domain expertise—a claim that equates with a limited body of empirical research pertinent to this topic (e.g., Audia & Goncalo, 2007; Lehmann, 1958, 1960).

Proposition 6: The relationship between domain expertise and radical idea generation takes the form of an inverted U.

Intriguingly, this proposition echoes Kuhn's classic observation that those who are relative newcomers to a given domain are more likely than the most experienced domain experts to conceive radically new scientific paradigms because they are "little committed by prior practice to the traditional rules of normal science" (1962: 90; for a counterpoint see Wray, 2003). It should be noted, however, that while Kuhn stakes his claim on issues surrounding social forces, such as vested interests, the arguments offered above suggest an alternative but perhaps complementary cognitive-level phenomenon accounting for why generating radically creative ideas can be difficult for experts (i.e., cognitive entrenchment).

Bringing together the full range of claims advanced thus far in this article, research suggests that expert knowledge is stored in complex cognitive schemas. Experts' complex schemas tend to be highly stable—a condition referred to here as cognitive entrenchment. Cognitive entrenchment provides a schema-level explanation for why experts tend to be inflexible in a number of respects. In addition, the entrenchment construct informs our understanding of how expertise relates to incremental and radical idea generation.

The consequences of cognitive entrenchment discussed above raise a key question. Specifically, are all experts equally subject to entrenchment, or does entrenchment vary across experts such that some may attain the benefits of expertise without being subjected to its inflexibility-related limitations? In the next section I address this question by arguing that the emergence of cognitive entrenchment is not a foregone conclusion for all experts.

FACTORS MODERATING THE RELATIONSHIP BETWEEN DOMAIN EXPERTISE AND COGNITIVE ENTRENCHMENT

Scholars argue that the schema stability characterizing cognitive entrenchment tends to be resilient to inconsistency and difficult to modify (Fiske & Taylor, 1991; Reger & Palmer, 1996). This observation complements work indicating that people's beliefs tend to persist, even in the face of disconfirming evidence (e.g., Anderson, Lepper, & Ross, 1980; Anderson & Lindsay, 1998; Nickerson, 1998). However, while cognitive entrenchment, once established, can prove recalcitrant, not all domain experts necessarily become highly entrenched. On the contrary, the

relationship between domain expertise and cognitive entrenchment proposed earlier may vary with at least two factors: (1) the degree to which one engages in a dynamic environment within one's expertise domain and (2) the degree to which one focuses attention on tasks outside one's expertise domain (see Figure 3). While these factors may not represent an exhaustive set of factors worth considering—a point I revisit toward the end of this article—they are noteworthy in that extant research hints at their importance and they share a common mechanism. Specifically, both factors discussed below help individuals maintain sufficient "doubt" (Locke, Golden-Biddle, & Feldman, 2008) concerning the extent of their own domain knowledge such that their schemas remain malleable.

Engaging in a Dynamic Environment

To begin, the relationship between domain expertise and cognitive entrenchment may be contingent on whether and to what extent one engages in a dynamic environment within one's domain. Dynamic environments require individuals to respond to changing conditions by making a series of interdependent decisions in real time (Edwards, 1962; Gonzalez, 2005). These environments are found in a number of domains, including those involving emergency response operations, such as firefighting (Klein, 1998), and those calling for behavior that is either highly collaborative, such as improvisational theater (Vera & Crossan, 2004), or inherently adversarial, such as trial law (Dane, 2008). In addition, evidence suggests that dynamic environments can be found in high-velocity industries—industries that involve intense competition and rapid change (Bourgeois & Eisenhardt, 1988; Nadkarni & Barr, 2008).

To perform tasks effectively in a dynamic environment, individuals must remain open to a wide range of possibilities, options, and information, as opposed to relying on a limited set of inputs (Atkins, Wood, & Rutgers, 2002; Eisenhardt, 1989; Weick, 1993). This is due to the unpredictability of such environments (Brehmer, 1992; Edwards, 1962). Because events in a dynamic environment rarely proceed exactly as anticipated, one must be prepared to adapt (Gonzalez, Lerch, & Lebiere, 2003). The unpredictability and surprises associated with dynamic environments may lead individuals to question the relationships among features of their domain (Farjoun, 2010). In particular, when a given action is followed by an unexpected outcome, one's certitude about what "is" may be supplanted with *doubt* concerning cause-and-effect relationships (Locke et al., 2008; Peirce, 1931–1958; Starbuck, 1996; Weick, 1993).

Although excessive doubt can be problematic in that it may reduce conviction (Srikantia & Pasmore, 1996), some level of doubt can be useful in certain respects. Researchers argue that doubt helps generate new perspectives by reducing habitual behavior, fostering creativity, and motivating a search for discovery (Locke et al., 2008; Maitlis & Sonenshein, 2010). Indeed, some have pointed to doubt as a critical feature of "wisdom" (Meacham, 1983; Sutton & Hargadon, 1996; Weick, 1993). As suggested here, doubt arises when one's beliefs about cause-and-effect relationships within a domain are brought into question (Farjoun, 2010; Locke et al., 2008; Starbuck, 1996), which provokes a need for updating or restructuring these beliefs (Christianson, Farkas, Sutcliffe, & Weick, 2009; Maitlis & Sonenshein, 2010; Weick, Sutcliffe, & Obstfeld, 2005). To the extent this updating occurs at the schematic level, it represents a reduction in entrenchment.

> *Proposition 7: Engaging in a dynamic environment within one's domain attenuates the relationship between domain expertise and cognitive entrenchment.*

Focusing Attention on Outside-Domain Tasks

The relationship between domain expertise and cognitive entrenchment may also depend on how one focuses one's attention, or takes "possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought" (James, 1890: 403–404). While researchers have demonstrated that attending to tasks *within* one's domain is critical for developing expertise (see Engeström, Engeström, & Kärkkäinen, 1995), one may be able to avoid cognitive entrenchment by focusing attention on tasks in other domains (outside-domain tasks). Although few scholars have explored this possibility at length, some have suggested it. For example, Hargadon notes, "Having one foot outside your world

means you can be less beholden to the ties that would otherwise bind and blind you in that world" (2006: 209). Likewise, Berns asserts, "It typically takes a novel stimulus—either a new piece of information or getting out of the environment in which an individual has become comfortable—to jolt attentional systems awake and reconfigure both perception and imagination" (2008: 57–58).

In focusing attention on outside-domain tasks, individuals are likely to encounter exceptions or counterexamples to what they believe to be true (cf. Langer, 1989a,b). Encountering exceptions may, in turn, lead individuals to view stimuli within their expertise domain in more conditional terms—that is, that a given object *could be* something rather than *is* something (Langer & Piper, 1987). For example, a repair technician is likely to view duct tape as an adhesive. However, through outside-domain involvement, this technician may recognize that there is a range of additional applications of duct tape, including its debated but intriguing medical role as a wart remover (see Focht, Spicer, & Fairchok, 2002).

Encountering exceptions through attending to other domains may foster doubt concerning how much one really knows about features in one's expertise domain (Srikantia & Pasmore, 1996). This doubt may produce a loosening of the relationships underlying one's domain schemas. In support of this claim, research on the modification of belief-based schemas suggests that when individuals encounter exceptions or inconsistencies, some degree of schema revision can occur (Crocker et al., 1984; George & Jones, 2001; Weber & Crocker, 1983). For example, upon meeting a casually dressed lawyer, one may modify the "dress-related" attribute contained within one's schema of a lawyer to reflect the fact that while many lawyers tend to dress formally, some do not (cf. Weber & Crocker, 1983). Taken together, these observations suggest the following.

> *Proposition 8: Attending to outside-domain tasks attenuates the relationship between domain expertise and cognitive entrenchment.*

DISCUSSION AND IMPLICATIONS

For centuries people have extolled the benefits of expertise. In recent years, however, researchers have identified cases in which expertise appears to be more of a burden than a boon (e.g., Birch & Bloom, 2007; Heath & Staudenmayer, 2000; Hinds et al., 2001). Work in this area suggests the existence of a trade-off between expertise and flexibility such that flexibility is sacrificed as expertise is acquired—an assumption reflected in claims that, benefits aside, expertise is a "curse" (Hinds, 1999), carries a "price" (Hecht & Proffitt, 1995), and has a "dark side" (Castel, McCabe, Roediger, & Heitman, 2007).

In this article I reconsidered the assumption that expertise and inflexibility are inextricably linked and offered a schema-level explanation for why some experts are likely to be inflexible while others are not. Taken together, my arguments suggest that the inflexibility-related limitations often ascribed to expertise are more accurately classified as consequences of cognitive entrenchment—a high level of stability in one's domain schemas. If, in fact, entrenchment were an unavoidable outcome of expertise, or even simply a defining characteristic of it, this distinction could be considered either trivial or redundant. However, this article points to neither of these conclusions. Rather, it implies that individuals can reap the benefits of expertise while foregoing its inflexibility-related limitations. As argued, individuals may avoid becoming highly entrenched by engaging in a dynamic environment within their expertise domain or performing tasks in other domains. When considered in conjunction with research on expertise, these arguments—particularly those concerned with outside-domain tasks—carry novel implications.

To begin, research has shown expertise to be domain specific. In other words, attaining expertise in one domain does not typically enhance one's expertise in other domains (Chi, 2006; Feltovich et al., 2006; Lewandowsky et al., 2007; but see Barnett & Koslowski, 2002, for a counterpoint). Additionally, to acquire expertise in a given domain, one must engage in a significant amount of domain-related practice and training (Ericsson, 1996, 2006; Ericsson & Charness, 1994; Ericsson et al., 1993; Ericsson & Lehmann, 1996). From an attentional focus standpoint, this suggests that individuals pursuing expertise within a particular domain should focus their attention predominantly on tasks *within* that domain. However, as noted earlier, expertise acquisition can lead to cognitive entrenchment. To avoid

such entrenchment, I suggested that experts should focus their attention more widely—toward tasks and activities not only within but also *outside* their domain. Therefore, while expertise may not be readily transferable across domains, there is merit to outside-domain participation precisely because of the domain specificity of expertise. By performing tasks in other domains, individuals are likely to encounter doubt-inducing exceptions to what they believe to be true about their domain of expertise, thus preserving their potential for flexible thinking within their expertise domain. This implies that individuals will benefit from a gradual broadening of their attentional focus toward outside-domain tasks as they pursue and achieve domain expertise.

Through achieving a wider breadth of attention by participating in outside domains, experts may not only avoid cognitive entrenchment but may also sidestep the inflexibility-related consequences of entrenchment discussed in this article. For example, in performing outside-domain tasks, experts may retain their potential for generating radically creative ideas. This suggests a caveat to the inverted-U-shaped relationship between domain expertise and radical idea generation posited in Proposition 6. Namely, the slope of the drop-off in radical idea generation associated with a high level of expertise depends on the degree to which experts focus their attention outside their domain. This prospect equates with Simonton's claim that the domain experts who are most likely to develop radically creative ideas are not "narrow-minded persons who concentrate all their waking hours on a highly specialized endeavor" but, rather, those who have wide interests across different domains (2009: 449). Moreover, and as depicted in Figure 3, focusing attention on outside-domain tasks may permit individuals to at least partially avoid the other inflexibility-related consequences of entrenchment discussed in this article: problem-solving fixation and adaptation difficulty.

Building on this line of reasoning, focusing attention on outside-domain tasks may be especially critical for those who do not typically engage in a dynamic environment within their expertise domain—the other factor posited to attenuate the relationship between domain expertise and cognitive entrenchment. Indeed, performing tasks in outside domains may be viewed as a surrogate approach for attaining the benefits associated with engaging in a dynamic environment that some individuals are denied. In other words, for those operating in a nondynamic or *static* environment, outside-domain involvement represents an alternative route to circumventing entrenchment and maintaining flexibility.

Of course, it bears noting that an expert's breadth of attention may conceivably become too wide. After all, if experts spend very little time participating in their expertise domain and instead direct most of their attention to other domains, their domain expertise may gradually diminish or become obsolete. In support of this point, research indicates that in order to maintain their expertise, individuals must continue to devote attention to tasks associated with their domain (Krampe & Ericsson, 1996; Sonnentag & Kleine, 2000). Perhaps for this reason, some professional groups require members to participate routinely in education programs that promote knowledge acquisition and retention (e.g., continuing legal education for attorneys). In short, while experts can avoid entrenchment by focusing attention on outside-domain tasks, those adopting this approach should strive to allocate enough attention to their expertise domain to maintain their expert knowledge.

Costs versus Benefits of Cognitive Entrenchment

In this article I explored the inflexibility-related consequences of cognitive entrenchment. As suggested here, inflexibility can be problematic for experts in a variety of ways. At the same time, it is important to note that the consequences of entrenchment may not be negative in all circumstances. Indeed, in some situations inflexibility may prove benign or even useful. It is therefore worth considering the conditions under which the consequences of entrenchment are most costly and the conditions under which these consequences are potentially beneficial.

The arguments I presented in this article suggest that entrenchment is particularly costly when circumstances change such that greater flexibility is needed. This point was made directly with regard to adaptation but may hold in other respects as well. For instance, although inflexibility in the area of problem solving may,

in some cases, serve experts well by consistently bringing effective solutions to mind, changes within a domain may engender fixation effects as experts attempt to solve emergent problems using outdated solutions. In fact, this situation is analogous to the classic research design used to evoke problem-solving fixation in which the nature of the problem is altered such that previously efficacious solutions are no longer optimal (see Luchins, 1942). In addition, as domains change because of internal or external pressures, the importance of radical creativity may rise (Benner & Tushman, 2003; Hill & Rothaermel, 2003). As such, the negative impact of cognitive entrenchment on radical creativity may be especially costly during periods of change and uncertainty (Nystrom & Starbuck, 1984). In contrast, entrenchment may be relatively unproblematic, or even beneficial, in domains characterized by a relatively high degree of stability (Feltovich, Spiro, & Coulson, 1997). In such domains entrenchment may produce functional and reliable responses to commonly encountered problems.

The costs versus benefits of cognitive entrenchment may also relate to the values and norms associated with one's domain. For example, in an innovative culture, radical idea generation tends to be embraced (Sutton, 2001; West & Richter, 2008). In such a culture cognitive entrenchment is likely to be considered a significant hindrance insofar as it constrains the cognitive processes that lead to radical idea generation. In contrast, cognitive entrenchment may be less costly and more beneficial in organizations seeking to protect culturally normative patterns of thinking. In these organizations cognitive entrenchment may be valued to the extent it benefits the organization by aligning behavior with what constitutes "appropriate" thought and action (cf. March, 1994). A variety of contexts may fit this mold, including network marketing organizations (Pratt, 2000) and military units (Karsten, 1998).

Taken together, these observations suggest that the degree to which cognitive entrenchment is costly varies with certain features of the focal domain (e.g., rate of change, cultural values), and they raise the possibility that, in some settings, cognitive entrenchment is beneficial. Further developing this idea, it may be the case that some degree of entrenchment is beneficial in professionalized occupations such as law and medicine. By their nature, professions possess a large and somewhat esoteric body of knowledge that makes their professional services valuable and, in some cases, inimitable (Elliot, 1972; Levay & Waks, 2009; Pratt, Rockmann, & Kaufmann, 2006; von Nordenflycht, 2010). While the knowledge associated with many professions is continually evolving (e.g., new drugs are frequently introduced in the field of medicine; see Norman, Eva, Brooks, & Hamstra, 2006), the evolution of knowledge within a profession may be gradual (Robertson, Scarbrough, & Swan, 2003)—an assumption integral to the lengthy duration of education and training associated with several professions. For example, in spending many years training to become physicians, individuals assume that the body of knowledge they accrue will remain relevant in the future. Therefore, because of the relative stability of the knowledge base underlying many professions, there may be certain advantages to cognitive entrenchment in professional communities.

Additionally, except when pressures for change are immediate and substantial, ideas that challenge traditional practices valued within a profession often receive little traction (Greenwood, Suddaby, & Hinings, 2002). For example, only as a result of an extreme shortage of lawyers did law firms consider and ultimately adopt new employment arrangements that departed from the traditional "up-or-out" system inherent to the legal profession (Sherer & Lee, 2002). Thus, among professional groups, radically creative ideas tend to be critiqued on normative grounds to the extent they undermine practices that are integral to the profession's identity (Ferlie, Fitzgerald, Wood, & Hawkins, 2005). These claims suggest another reason that cognitive entrenchment may be perceived as functional within professions—namely, that as an inhibitor of radical idea generation, entrenchment may prevent the emergence of radical ideas that could threaten venerated traditions. Moreover, because entrenchment is unlikely to hinder the generation of incrementally creative ideas, professions may continue to evolve through incremental advances that keep valued practices intact.

In all, these observations point to potential benefits of cognitive entrenchment in professional groups. However, it should be acknowledged that the net benefit of entrenchment may

differ across professions to the extent that they vary in the stability of their knowledge bases. More broadly, it can be concluded that cognitive entrenchment is likely to carry benefits that should be leveraged and costs that should be considered as a function of the occupation or profession in which one is employed.

Practical Implications

Turning to practical implications, perhaps the most direct extension of the arguments offered here is that individuals seeking to avoid entrenchment—particularly those who do not tend to engage in a dynamic environment—should participate in activities beyond their domain of expertise. This prescription dovetails with a limited body of research pointing to the importance of multidomain engagement. For example, research indicates that many successful scientists tend to be polymaths—that is, in addition to their scientific expertise, they have artistic, literary, or musical avocations (Root-Bernstein et al., 2008; Root-Bernstein, Bernstein, & Garnier, 1995). In addition, evidence suggests that participating in non-work-related hobbies increases creative problem-solving effectiveness at work (Jaussi, Randel, & Dionne, 2007).

Although some individuals participate in multiple domains on their own initiative, managers can play a role in helping to ensure that organizational members, particularly experts, focus their attention in diverse ways. One approach would be to offer paid time off to organizational members who wish to engage in volunteer service work. This may provide individuals with the financial freedom and time necessary to participate in tasks in a different domain. Managers could also adopt practices akin to Google's 20 percent rule, which permits and encourages employees to work on projects outside their job description, and potentially outside their domain of expertise, for one day each week. While Google may have implemented the 20 percent rule as a motivational tool, the company may garner additional benefits from it to the extent this practice helps employees avoid cognitive entrenchment as they acquire job expertise.

An additional approach relevant to multinational corporations would be to leverage expatriate assignments. Such assignments often differ significantly from standard job duties because of sociocultural factors (Mendenhall & Oddou, 1985). Thus, expatriates must focus their attention not only on business issues within their domain of expertise but also on cultural matters. Doing so is likely to provide access to a wealth of outside-domain inputs that may destabilize one's cognitive schemas (see Leung, Maddux, Galinsky, & Chiu, 2008, and Maddux & Galinsky, 2009).

Finally, among individuals for whom cognitive entrenchment is an asset, engaging in a dynamic environment and focusing attention on outside-domain tasks may compromise the schema stability that typically serves them well. These individuals may benefit from seeking out a static environment or limiting the extent to which they direct their attention to domains beyond their area of expertise. More generally, all individuals should consider whether and how cognitive entrenchment either aids or inhibits them within their domain and, insofar as possible, should strive to "manage" their level of entrenchment accordingly, given the avenues discussed in this article.

Future Research Directions

The arguments presented in this article suggest directions for future research. First, although cognitive entrenchment tends to increase with domain expertise, I maintained that these concepts are not inherently coupled. Indeed, not only might some experts be low in their level of entrenchment, but it is also possible that a moderately high degree of entrenchment could be found among individuals with relatively little domain expertise. While the concept of an "entrenched novice" may seem counterintuitive, research suggests that novices can be inflexible in certain respects. For example, one need not be a domain expert to develop habits (Ouellette & Wood, 1998; Wood et al., 2002), which I argued here are outgrowths of stable schemas. In addition, under high-stress conditions, experts and novices alike often exhibit rigid responses (Chajut & Algom, 2003; Easterbook, 1959; Staw, Sandelands, & Dutton, 1981). These observations suggest a need to examine if and how entrenchment can arise among domain novices.

Next, I suggested in this article that attending to tasks in outside domains limits cognitive entrenchment. However, I said little concerning the degree to which one domain must differ from

another to prompt this effect. Although more research is needed to determine the most relevant dimensions on which to compare domains (cf. Barnett & Ceci, 2002; Kaufman, 2007), domains can be differentiated based on the knowledge, skills, and abilities (KSAs; Motowidlo, Borman, & Schmit, 1997; Motowidlo & Van Scotter, 1994) they require. For example, a physics expert working on a mechanical engineering task is focusing attention on a different domain, but the KSAs associated with these two domains are likely to be more closely related than the KSAs associated with performing a physics task versus a visual arts task. Researchers could examine whether the moderating role of outside-domain participation on the relationship between expertise and entrenchment is more pronounced when an expert attends to another domain that is highly distinct from his or her expertise domain versus highly similar to it in terms of the KSAs each domain requires.

In line with the former possibility, as the substantive difference between domains increases, individuals may be more likely to encounter exceptions that engender doubt. For example, to the extent that domains in the hard sciences differ markedly from those in the arts (see Simonton, 2009), an expert scientist may perhaps circumvent entrenchment by encountering a number of concepts and phenomena being used in different ways through participation in an artistic domain. This possibility accords with the research on polymaths noted earlier.

Alternatively, it is possible that a large substantive difference between domains renders it *less* likely that individuals will encounter doubt-inducing exceptions. Simply put, if two domains are completely distinct, the core concepts, resources, or technologies associated with each domain may be nonoverlapping. For example, there may be very little conceptual overlap between the domains of nuclear physics and retail sales. As such, it is not immediately clear how working as a retail salesperson would lead an expert nuclear physicist to question or doubt features of his or her base of knowledge concerning nuclear physics. Given these divergent possibilities, research is needed to determine just how different or how similar domains must be to fully activate the moderation effect associated with outside-domain participation posited in this article and depicted in Figure 3.

Finally, it bears considering what avenues beyond engaging in a dynamic environment and participating in outside domains could attenuate the relationship between domain expertise and cognitive entrenchment. In addressing this issue, scholars could explore whether personality traits like openness to experience (McCrae, 1987) and cognitive styles like open-minded thinking (Stanovich & West, 1997) might play such a role. In addition, certain social context factors are worth examining. For example, individuals working in teams that are high in functional background diversity (Bunderson, 2003b; Hambrick, Cho, & Chen, 1996) may be exposed to a wide range of knowledge held by other members of the team (Kurtzberg & Amabile, 2000–2001; Taylor & Greve, 2006). In interpreting this diverse body of knowledge, team members may be likely to encounter schema-destabilizing concepts—particularly to the extent their team engages in questioning and other practices that promote knowledge integration (see Okhuysen & Eisenhardt, 2002, for a discussion of such practices).

Similarly, individuals who have a large number of weak ties in their social networks—ties that "involve relatively infrequent interactions, comparatively low emotional closeness, and one-way exchanges" (Perry-Smith & Shalley, 2003: 92–93)—may have access to a wide range of concepts and perspectives (Perry-Smith, 2006; Perry-Smith & Shalley, 2003). This exposure to a variety of viewpoints may help limit cognitive entrenchment insofar as it raises doubt in the manner described earlier. In short, research is needed to further investigate both individual and social factors as possible moderators of the relationship between domain expertise and cognitive entrenchment.

Conclusion

While research suggests a trade-off between expertise and flexibility, the arguments advanced in this article call this trade-off into question. Specifically, I posited that inflexibility arises most directly not from expertise but, instead, from the high degree of cognitive entrenchment that often pervades experts' domain schemas. Arguing that entrenchment is not an inevitable by-product of expertise, I contended that experts can eclipse entrenchment through engaging in a dynamic environment and attend-

ing to outside-domain tasks. The implications of the arguments presented here underscore the importance of continuing to investigate the origins, nature, and impact of cognitive entrenchment across a variety of domains.

REFERENCES

Aarts, H., & Dijksterhuis, A. 2000. Habits as knowledge structures: Automaticity in goal-directed behavior. ***Journal of Personality and Social Psychology,*** 78: 53–63.

Aarts, H., Verplanken, B., & van Knippenberg, A. 1998. Predicting behavior from actions in the past: Repeated decision making or a matter of habit? ***Journal of Applied Social Psychology,*** 28: 1355–1374.

Abelson, R. P. 1981. Psychological status of the script concept. ***American Psychologist,*** 36: 715–729.

Adamson, R. E. 1952. Functional fixedness as related to problem solving: A repetition of three experiments. ***Journal of Experimental Psychology,*** 44: 288–291.

Adelson, B. 1984. When novices surpass experts: The difficulty of a task may increase with expertise. ***Journal of Experimental Psychology: Learning, Memory, & Cognition,*** 10: 483–495.

Alberts, D. J. 2007. Stakeholders or subject matter experts, who should be consulted? ***Energy Policy,*** 35: 2336–2346.

Amabile, T. M. 1996. ***Creativity in context.*** Boulder, CO: Westview Press.

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.

Amabile, T. M., Hennessey, B. A., & Grossman, B. S. 1986. Social influences on creativity: The effects of contracted-for reward. ***Journal of Personality and Social Psychology,*** 50: 14–23.

Amabile, T. M., & Mueller, J. S. 2008. Studying creativity, its processes, and its antecedents: An exploration of the componential theory of creativity. In J. Zhou & C. E. Shalley (Eds.), ***Handbook of organizational creativity:*** 33–64. New York: Lawrence Erlbaum Associates.

Anderson, C. A., Lepper. M. R., & Ross, L. 1980. Perseverance of social theories: The role of explanation in the persistence of discredited information. ***Journal of Personality and Social Psychology,*** 39: 1037–1049.

Anderson, C. A., & Lindsay, J. J. 1998. The development, perseverance, and change of naive theories. ***Social Cognition,*** 16: 8–30.

Armstrong, S. J., & Mahmud, A. 2008. Experiential learning and the acquisition of managerial tacit knowledge. ***Academy of Management Learning & Education,*** 7: 189–208.

Ashforth, B. E., & Fried, Y. 1988. The mindlessness of organizational behaviors. ***Human Relations,*** 41: 305–329.

Atkins, P. W. B., Wood, R. E., & Rutgers, P. J. 2002. The effects of feedback format on dynamic decision making. ***Organizational Behavior and Human Decision Processes,*** 88: 587–604.

Audia, P. G., & Goncalo, J. A. 2007. Past success and creativity over time: A study of inventors in the hard disk drive industry. ***Management Science,*** 53: 1–15.

Baer, J. 1993. ***Creativity and divergent thinking: A task-specific approach.*** Hillsdale, NJ: Lawrence Erlbaum Associates.

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.

Baer, M., Oldham, G. R., & Cummings, A. 2003. Rewarding creativity: When does it really matter? ***Leadership Quarterly:*** 14: 569–586.

Bagozzi, R. P., & Dholakia, U. M. 2005. Three roles of past experience in goal setting and goal striving. In T. Betsch & S. Haberstroh (Eds.), ***The routines of decision making:*** 21–38. Mahwah, NJ: Lawrence Erlbaum Associates.

Barnett, S. M., & Ceci, S. J. 2002. When and where do we apply what we learn? A taxonomy for far transfer. ***Psychological Bulletin,*** 128: 612–637.

Barnett, S. M., & Koslowski, B. 2002. Adaptive expertise: Effects of type of experience and the level of theoretical understanding it generates. ***Thinking and Reasoning,*** 8: 237–267.

Barron, F. B., & Harrington, D. M. 1981. Creativity, intelligence, and personality. ***Annual Review of Psychology,*** 32: 439–476.

Bartunek, J. M., & Moch, M. K. 1987. First-order, second-order, and third-order change and organizational development interventions: A cognitive approach. ***Journal of Applied Behavioral Science,*** 23: 483–500.

Baughman, W. A., & Mumford, M. D. 1995. Process-analytic models of creative capacities: Operations influencing the combination-and-reorganization process. ***Creativity Research Journal,*** 8: 37–62.

Becker, K. 2005. Individual and organizational unlearning: Directions for future research. ***International Journal of Organisational Behaviour,*** 9: 659–670.

Bédard, J., & Chi, M. T. H. 1992. Expertise. ***Current Directions in Psychological Science:*** 1(4): 135–139.

Benner, M. J., & Tushman, M. L. 2003. Exploitation, exploration, and process management: The productivity dilemma revisited. ***Academy of Management Review,*** 28: 238–256.

Benner, P. 1984. ***From novice to expert: Excellence and power in clinical practice.*** New York: Addison-Wesley.

Berns, G. 2008. ***Iconoclast: A neuroscientist reveals how to think differently.*** Boston: Harvard Business School Press.

Betsch, T., Haberstroh, S., Glöckner, A., Haar, T., & Fiedler, K. 2001. The effects of routine strength on adaptation and information search in recurrent decision making. ***Organizational Behavior and Human Decision Processes,*** 84: 25–53.

Bilalić, M., McLeod, P., & Gobet, F. 2008a. Why good thoughts block better ones: The mechanism of the pernicious Einstellung (set) effect. ***Cognition,*** 108: 652–661.

Bilalić, M., McLeod, P., & Gobet, F. 2008b. Inflexibility of experts—Reality or myth? Quantifying the Einstellung effect in chess masters. ***Cognitive Psychology,*** 56: 73–102.

Birch, H. G., & Rabinowitz, H. S. 1951. The negative effect of previous experience on productive thinking. ***Journal of Experimental Psychology,*** 41: 121–125.

Birch, S. A. J., & Bloom, P. 2007. The curse of knowledge in reasoning about false beliefs. ***Psychological Science,*** 18: 382–386.

Bledow, R., Frese, M., Anderson, N., Erez, M., & Farr, J. 2009. A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity. ***Industrial and Organizational Psychology,*** 2: 305–337.

Boden, M. A. 1998. Creativity and artificial intelligence. ***Artificial Intelligence,*** 103: 347–356.

Bourgeois, L. J., & Eisenhardt, K. M. 1988. Strategic decision processes in high velocity environments: Four cases in the microcomputer industry. ***Management Science,*** 34: 816–835.

Brehmer, B. 1992. Dynamic decision making: Human control of complex systems. ***Acta Psychologica,*** 81: 211–241.

Bunderson, J. S. 2003a. Recognizing and utilizing expertise in work groups: A status characteristics perspective. ***Administrative Science Quarterly,*** 48: 557–591.

Bunderson, J. S. 2003b. Team member functional background and involvement in management teams: Direct effects and the moderating role of power centralization. ***Academy of Management Journal,*** 46: 458–474.

Camerer, C., Loewenstein, G., & Weber, M. 1989. The curse of knowledge in economic settings: An experimental analysis. ***Journal of Political Economy,*** 97: 1232–1254.

Campbell, D. T. 1960. Blind variation and selective retention in creative thought as in other knowledge processes. ***Psychological Review,*** 67: 380–400.

Cañas, J. J., Quesada, J. F., Antoli, A., & Fajardo, I. 2003. Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks. ***Ergonomics,*** 46: 482–501.

Castel, A. D., McCabe, D. P., Roediger, H. L., & Heitman, J. L. 2007. The dark side of expertise. ***Psychological Science,*** 18: 3–5.

Chajut, E., & Algom, D. 2003. Selective attention improves under stress: Implications for theories of social cognition. ***Journal of Personality and Social Psychology,*** 85: 231–248.

Charness, N., & Schultetus, R. S. 1999. Knowledge and expertise. In F. T. Durso (Ed.), ***Handbook of applied cognition:*** 57–81. Chichester, UK: Wiley.

Chase, W. G., & Simon, H. A. 1973. Perception in chess. ***Cognitive Psychology,*** 4: 55–81.

Chi, M. T. H. 2006. Two approaches to the study of experts' characteristics. In K. A. Ericsson, N. Charness, P. Feltovich, & R. R. Hoffman (Eds.), ***The Cambridge handbook of expertise and expert performance:*** 21–30. Cambridge: Cambridge University Press.

Chi, M. T. H., Feltovich, P. J., & Glaser, R. 1981. Categorization and representation of physics problems by experts and novices. ***Cognitive Science,*** 5: 121–152.

Chi, M. T. H., Glaser, R., & Farr, M. 1988. ***The nature of expertise.*** Hillsdale, NJ: Lawrence Erlbaum Associates.

Christianson, M. K., Farkas, M. T., Sutcliffe, K. M., & Weick, K. E. 2009. Learning through rare events: Significant interruptions at the Baltimore & Ohio Railroad Museum. ***Organization Science,*** 20: 846–860.

Collins, H. M., & Evans. R. 2002. The Third Wave of Science Studies: Studies of expertise and experience. ***Social Studies of Science,*** 32: 235–296.

Colvin, G. 2008. ***Talent is overrated: What really separates world-class performers from everybody else.*** New York: Portfolio.

Cooper, R. P., & Shallice, T. 2006. Hierarchical schemas and goals in the control of sequential behavior. ***Psychological Review,*** 113: 887–916.

Crocker, J., Fiske, S. T., & Taylor, S. E. 1984. Schematic bases of belief change. In J. R. Eiser (Ed.), ***Attitudinal judgment:*** 197–226. New York: Springer-Verlag.

Dane, E. 2008. ***Examining experience and its role in dynamic versus static decision-making effectiveness.*** Paper presented at the annual meeting of the Academy of Management, Anaheim, CA.

Dane, E., & Pratt, M. G. 2007. Exploring intuition and its role in managerial decision making. ***Academy of Management Review,*** 32: 33–54.

Demorest, A. P. 1995. The personal script as a unit of analysis for the study of personality. ***Journal of Personality,*** 63: 569–592.

Dewar, R. D., & Dutton, J. E. 1986. The adoption of radical and incremental innovations: An empirical analysis. ***Management Science,*** 32: 1422–1433.

Dietrich, A. 2004. The cognitive neuroscience of creativity. ***Psychonomic Bulletin and Review,*** 11: 1011–1026.

Dreyfus, H. L., & Dreyfus, S. E. 1986. ***Mind over machine: The power of human intuition and expertise in the era of the computer.*** New York: Free Press.

Dreyfus, H. L., & Dreyfus, S. E. 2005. Expertise in real world contexts. ***Organization Studies,*** 26: 779–792.

Duncker, K. 1945. On problem solving. ***Psychological Monographs,*** 58: 270.

Easterbrook, J. A. 1959. The effect of emotion on cue utilization and the organization of behavior. ***Psychological Review,*** 66: 183–201.

Edwards, W. 1962. Dynamic decision theory and probabilistic information processing. ***Human Factors,*** 4: 59–73.

Eisenhardt, K. M. 1989. Making fast strategic decisions in high-velocity environments. ***Academy of Management Journal,*** 32: 543–576.

Elliot, P. 1972. ***The sociology of the professions.*** New York: Herder and Herder.

Engeström, Y., Engeström, R., & Kärkkäinen, M. 1995. Polycontextuality and boundary crossing in expert cognition: Learning and problem solving in complex work activities. ***Learning and Instruction,*** 5: 319–336.

Ericsson, K. A. 1996. The acquisition of expert performance: An introduction to some of the issues. In K. A. Ericsson (Ed.), ***The road to excellence:*** 1–50. Mahwah, NJ: Lawrence Erlbaum Associates.

Ericsson, K. A. 1999. Creative expertise as superior reproducible performance: Innovative and flexible aspects of expert performance. ***Psychological Inquiry,*** 10: 329–333.

Ericsson, K. A. 2006. The influence of experience and deliberate practice on the development of superior expert performance. In K. A. Ericsson, N. Charness, P. Feltovich, & R. R. Hoffman (Eds), ***The Cambridge handbook of expertise and expert performance:*** 685–706. Cambridge: Cambridge University Press.

Ericsson, K. A., & Charness, N. 1994. Expert performance: Its structure and acquisition. ***American Psychologist,*** 49: 725–747.

Ericsson, K. A., Charness, N., Feltovich, P., & Hoffman, R. R. 2006. ***The Cambridge handbook of expertise and expert performance.*** Cambridge: Cambridge University Press.

Ericsson, K. A., Krampe, R. T., & Tesch-Romer, C. 1993. The role of deliberate practice in the acquisition of expert performance. ***Psychological Review,*** 100: 363–406.

Ericsson, K. A., & Lehmann, A. C. 1996. Experts and exceptional performance: Evidence of maximal adaptation to task constraints. ***Annual Review of Psychology,*** 47: 273–305.

Ericsson, K. A., Patel, V., & Kintsch, W. 2000. How experts' adaptations to representative task demands account for the expertise effect in memory recall: Comment on Vicente and Wang (1998). ***Psychological Review,*** 107: 578–592.

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. 2007. The making of an expert. ***Harvard Business Review,*** 85(7/8): 114–121.

Ericsson, K. A., Roring, R. W., & Nandagopal, K. 2007. Giftedness and evidence for reproducibly superior performance: An account based on the expert-performance framework. ***High Ability Studies,*** 18: 3–56.

Ericsson, K. A., & Ward, P. 2007. Capturing the naturally occurring superior performance of experts in the laboratory: Toward a science of expert and exceptional performance. ***Current Directions in Psychological Science,*** 16: 346–350.

Ettlie, J. E., Bridges, W. P., & O'Keefe, R. D. 1984. Organization strategy and structural differences for radical versus incremental innovation. ***Management Science,*** 30: 682–695.

Evetts, J., Mieg, H. A., & Felt, U. 2006. Professionalization, scientific expertise, and elitism: A sociological perspective. In K. A. Ericsson, N. Charness, P. Feltovich, & R. R. Hoffman (Eds), ***The Cambridge handbook of expertise and expert performance:*** 105–123. Cambridge: Cambridge University Press.

Farjoun, M. 2010. Beyond dualism: Stability and change as a duality. ***Academy of Management Review,*** 35: 202–225.

Feist, G. J. 1998. A meta-analysis of personality in scientific and artistic creativity. ***Personality and Social Psychology Review,*** 2: 290–309.

Feltovich, P. J., Prietula, M. J., & Ericsson, K. A. 2006. Studies of expertise from psychological perspectives. In K. A. Ericsson, N. Charness, P. Feltovich, & R. R. Hoffman (Eds.), ***The Cambridge handbook of expertise and expert performance:*** 41–67. Cambridge: Cambridge University Press.

Feltovich, P. J., Spiro, R. J., & Coulson, R. L. 1997. Issues of expert flexibility in contexts characterized by complexity and change. In P. J. Feltovich, K. M. Ford, & R. R. Hoffman (Eds.), ***Expertise in context: Human and machine:*** 125–146. Cambridge, MA: MIT Press.

Ferlie, E., Fitzgerald, L., Wood, M., & Hawkins, C. 2005. The nonspread of innovations: The mediating role of professionals. ***Academy of Management Journal,*** 48: 117–134.

Fiske, S. T., & Taylor, S. E. 1991. ***Social cognition*** (2nd ed.). New York: McGraw-Hill.

Focht, D. R., Spicer, C., & Fairchok, M. P. 2002. The efficacy of duct tape vs. cryotherapy in the treatment of verruca vulgaris (the common wart). ***Archives of Pediatric and Adolescent Medicine,*** 156: 971–974.

Frensch, P. A., & Sternberg, R. J. 1989. Expertise and intelligent thinking: When is it worse to know better? In R. J. Sternberg (Ed.), ***Advances in the psychology of human intelligence:*** 157–188. Hillsdale, NJ: Lawrence Erlbaum Associates.

Gandhi, J., & Sauser, B. 2008. Knowledge networks: How independence and subject matter experts can influence project reviews. ***Engineering Management Journal,*** 20: 19–28.

George, J. M. 2007. Creativity in organizations. ***Academy of Management Annals,*** 1: 439–477.

George, J. M., & Jones, G. R. 2001. Towards a process model of individual change in organizations. ***Human Relations,*** 54: 419–444.

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.

Gerver, I., & Bensman, J. 1954. Towards a sociology of expertness. ***Social Forces,*** 32: 226–235.

Getzels, J. W. 1979. Problem finding: A theoretical note. ***Cognitive Science,*** 3: 167–172.

Gick, M. L. 1986. Problem-solving strategies. ***Educational Psychologist,*** 21: 99–120.

Gioia, D. A., & Poole, P. P. 1984. Scripts in organizational behavior. ***Academy of Management Review,*** 9: 449–459.

Gladwell, M. 2008. ***Outliers: The story of success.*** New York: Little, Brown and Company.

Glaser, R., & Chi, M. T. H. 1988. Overview. In M. T. H. Chi, R. Glaser, & M. J. Farr (Eds.), ***The nature of expertise:*** xv–xxviii. Hillsdale, NJ: Lawrence Erlbaum Associates.

Glynn, M. A. 1996. Innovative genius: A framework for relat-

ing individual and organizational intelligences to innovation. ***Academy of Management Review,*** 21: 1081–1111.

Gobet, F., & Simon, H. A. 1996. Templates in chess memory: A mechanism for recalling several boards. ***Cognitive Psychology,*** 31: 1–40.

Gobet, F., & Simon, H. A. 2000. Five seconds or sixty? Presentation time in expert memory. ***Cognitive Science,*** 24: 651–682.

Goldstein, A. G., & Chance, J. E. 1980. Memory for faces and schema theory. ***Journal of Psychology,*** 105: 47–59.

Gonzalez, C. 2005. Decision support for real-time, dynamic decision-making tasks. ***Organizational Behavior and Human Decision Processes,*** 96: 142–154.

Gonzalez, C., Lerch, J. F., & Lebiere, C. 2003. Instance-based learning in dynamic decision making. ***Cognitive Science,*** 27: 591–635.

Greenwood, R., Suddaby, R., & Hinings, C. R. 2002. Theorizing change: The role of professional associations in the transformation of institutionalized fields. ***Academy of Management Journal,*** 45: 58–80.

Gupta, A. K., Tesluk, P. E., & Taylor, M. S. 2007. Innovation at and across multiple levels of analysis. ***Organization Science,*** 18: 885–897.

Haerem, T., & Rau, D. 2007. The influence of degree of expertise and objective task complexity on perceived task complexity and performance. ***Journal of Applied Psychology,*** 92: 1320–1331.

Hambrick, D. C., Cho, T., & Chen, M. 1996. The influence of top management team heterogeneity on firms' competitive moves. ***Administrative Science Quarterly,*** 41: 659–684.

Hargadon, A. 2006. Bridging old worlds and building new ones: Toward a microsociology of creativity. In L. Thompson & H.-S. Choi (Eds.), ***Creativity and innovation in organizational teams***: 199–216. Mahwah, NJ: Lawrence Erlbaum Associates.

Hargadon, A., & Sutton, R. I. 1997. Technology brokering and innovation in a product development firm. ***Administrative Science Quarterly,*** 42: 716–749.

Harris, S. G. 1994. Organizational culture and individual sensemaking: A schema-based perspective. ***Organization Science,*** 5: 309–321.

Hassin, R. R., Bargh, J. A., & Zimerman, S. 2009. Automatic and flexible: The case of nonconscious goal pursuit. ***Social Cognition,*** 27: 20–36.

Heath, C., & Staudenmayer, N. 2000. Coordination neglect: How lay theories of organizing complicate coordination in organizations. ***Research in Organizational Behavior,*** 22: 155–193.

Hecht, H., & Proffitt, D. R. 1995. The price of expertise: Effects of experience on the water-level task. ***Psychological Science,*** 6: 90–95.

Henderson, J. M. 2007. Regarding scenes. ***Current Directions in Psychological Science,*** 16: 219–222.

Henderson, J. M., & Hollingworth, A. 1999. High-level scene perception. ***Annual Review of Psychology,*** 50: 243–271.

Hill, C. W. L., & Rothaermel, F. T. 2003. The performance of incumbent firms in the face of radical technological innovation. ***Academy of Management Review,*** 28: 257–274.

Hinds, P. J. 1999. The curse of expertise: The effects of expertise and de-biasing methods on predictions of novice performance. ***Journal of Experimental Psychology: Applied,*** 5: 205–221.

Hinds, P. J., Patterson, M., & Pfeffer, J. 2001. Bothered by abstraction: The effect of expertise on knowledge transfer and subsequent novice performance. ***Journal of Applied Psychology,*** 86: 1232–1243.

Hinds, P. J., & Pfeffer, J. 2003. Why organizations don't "know what they know": Cognitive and motivational factors affecting the transfer of expertise. In M. S. Ackerman, V. Pipek, & V. Wulf (Eds.), ***Sharing expertise: Beyond knowledge management:*** 3–26. Cambridge, MA: MIT Press.

Hirst, G., van Knippenberg, D., & Zhou, J. 2009. A cross-level perspective on employee creativity: Goal orientation, team learning behavior, and individual creativity. ***Academy of Management Journal,*** 52: 280–293.

Hoch, S. J. 1988. Who do we know: Predicting the interests and opinions of the American consumer. ***Journal of Consumer Research,*** 15: 315–324.

Hodgkinson, G. P. 1997. Cognitive inertia in a turbulent market: The case of UK residential estate agents. ***Journal of Management Studies,*** 34: 921–945.

Hoffman, R. R. 1992. ***The psychology of expertise: Cognitive research and empirical AI.*** New York: Springer-Verlag.

Hogarth, R. M. 2001. ***Educating intuition.*** Chicago: University of Chicago Press.

Holyoak, K. J. 1991. Symbolic connectionism: Toward third-generation theories of expertise. In K. A. Ericsson & J. Smith (Eds.), ***Toward a general theory of expertise:*** 301–335. Cambridge, UK: Cambridge University Press.

Honeck, R. P., Firment, M., & Case, T. J. S. 1987. Expertise and categorization. ***Bulletin of the Psychonomic Society,*** 25: 431–434.

James, W. 1890. ***The principles of psychology.*** New York: Holt.

Jansson, D. G., & Smith, S. M. 1991. Design fixation. ***Design Studies,*** 12: 3–11.

Jaussi, K. S., Randel, A. E., & Dionne, S. D. 2007. I am, I think I can, and I do: The role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. ***Creativity Research Journal,*** 19: 247–258.

Joas, H. 1996. ***The creativity of action.*** (Translated by J. Gaines & P. Keast.) Chicago: University of Chicago Press.

Kahneman, D., & Klein, G. 2009. Conditions for intuitive expertise: A failure to disagree. ***American Psychologist,*** 64: 515–526.

Karsten, P. 1998. ***The training and socializing of military personnel.*** New York: Garland.

Kasof, J. 1995. Explaining creativity: The attributional perspective. ***Creativity Research Journal,*** 8: 311–366.

Kaufman, S. B. 2007. Investigating the role of domain general

mechanisms in the acquisition of domain specific expertise. ***High Ability Studies,*** 18: 71–73.

Kimball, D. R., & Holyoak, K. J. 2000. Transfer and expertise. In E. Tulving & F. I. M. Craik (Eds.), ***The Oxford handbook of memory:*** 109–122. New York: Oxford University Press.

Kirton, M. 1976. Adopters and innovators: A description and measure. ***Journal of Applied Psychology,*** 6: 622–629.

Klein, G. 1998. ***Sources of power: How people make decisions.*** Cambridge, MA: MIT Press.

Kolb, D. A. 1984. ***Experiential learning: Experience as the source of learning and development.*** Englewood Cliffs, NJ: Prentice-Hall.

Krampe, R. T., & Ericsson, K. A. 1996. Maintaining excellence: Deliberate practice and elite performance in young and older pianists. ***Journal of Experimental Psychology: General,*** 125: 331–359.

Kuhn, T. S. 1962. ***The structure of scientific revolutions.*** Chicago: University of Chicago Press.

Kurtzberg, T. R., & Amabile, T. M. 2000–2001. From Guilford to creative synergy: Opening the black box of team-level creativity. ***Creativity Research Journal,*** 13: 285–294.

Labianca, G., Gray, B., & Brass, D. J. 2000. A grounded model of organizational schema change during empowerment. ***Organization Science,*** 11: 235–257.

Langer, E. J. 1989a. ***Mindfulness.*** Cambridge, MA: De Capo.

Langer, E. J. 1989b. Minding matters: The consequences of mindlessness-mindfulness. ***Advances in Experimental Social Psychology,*** 22: 137–173.

Langer, E. J., & Piper, A. I. 1987. The prevention of mindlessness. ***Journal of Personality and Social Psychology,*** 53: 280–287.

Larkin, J. H., McDermott, J., Simon, H. A., & Simon, D. P. 1980. Expert and novice performances in solving physics problems. ***Science,*** 208: 1335–1342.

Larson, D. W. 1994. The role of belief systems and schemas in foreign policy decision-making. ***Political Psychology,*** 15: 17–33.

Latour, B., & Woolgar, S. 1979. ***Laboratory life: The construction of social facts.*** Beverly Hills, CA: Sage.

Lehman, H. C. 1958. The chemist's most creative years. ***Science,*** 127: 1213–1222.

Lehman, H. C. 1960. The age decrement in outstanding scientific creativity, ***American Psychologist,*** 15: 128–134.

Leung, A. K.-Y., Maddux, W. W., Galinsky, A. D., & Chiu, C.-Y. 2008. Multicultural experience enhances creativity. ***American Psychologist,*** 63: 169–181.

Levay, C., & Waks, C. 2009. Professions and the pursuit of transparency in healthcare: Two cases of soft autonomy. ***Organization Studies,*** 30: 509–527.

Lewandowsky, S., & Kirsner, K. 2000. Knowledge partitioning: Context-dependent use of expertise. ***Memory and Cognition,*** 28: 295–305.

Lewandowsky, S., Little, D., & Kalish, M. L. 2007. Knowledge and expertise. In F. T. Durso (Ed.), ***Handbook of applied cognition*** (2nd ed.): 83–109. Chichester, UK: Wiley.

Lewandowsky, S., & Thomas, J. L. 2009. Expertise: Acquisition, limitations, and control. In F. T. Durso (Ed.), ***Reviews of human factors and ergonomics***, vol. 5: 140–165. Santa Monica, CA: Human Factors and Ergonomics Society.

Lewicki, P., Hill, T., & Bizot, E. 1988. Acquisition of procedural knowledge about a pattern of stimuli that cannot be articulated. ***Cognitive Psychology,*** 20: 24–37.

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

Lippman, L. G. 1994. Rule-governed performance and sensitivity to contingencies: What's new? ***Journal of General Psychology,*** 121: 353–360.

Locke, K., Golden-Biddle, K., & Feldman, M. S. 2008. Making doubt generative: Rethinking the role of doubt in the research process. ***Organization Science,*** 19: 907–918.

Lonergan, D. C., Scott, G. M., & Mumford, M. D. 2004. Evaluative aspects of creative thought: Effects of appraisal and revision standards. ***Creativity Research Journal,*** 16: 231–246.

Lord, R. G., & Kernan, M. C. 1987. Scripts as determinants of purposeful behavior in organizations. ***Academy of Management Review,*** 12: 265–277.

Louis, M. R., & Sutton, R. I. 1991. Switching cognitive gears: From habits of mind to active thinking. ***Human Relations,*** 44: 55–76.

Lovett, M. C., & Anderson, J. R. 1996. History of success and current context in problem solving. ***Cognitive Psychology,*** 31: 168–217.

Lubart, T. I. 2000–2001. Models of the creative process: Past, present and future. ***Creativity Research Journal,*** 13: 295–308.

Luchins, A. S. 1942. Mechanization in problem solving—The effect of Einstellung. ***Psychological Monographs,*** 52(6): 95.

Luchins, A. S., & Luchins, E. H. 1959. ***Rigidity of behavior.*** Eugene: University of Oregon Press.

Lurigio, A. J., & Carroll, J. S. 1985. Probation officers' schemata of offenders: Content, development, and impact on treatment decisions. ***Journal of Personality and Social Psychology,*** 48: 1112–1126.

Maddux, W. W., & Galinsky, A. D. 2009. Cultural borders and mental barriers: The relationship between living abroad and creativity. ***Journal of Personality and Social Psychology,*** 96: 1047–1061.

Madjar, N., Oldham, G. R., & Pratt, M. G. 2002. There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance. ***Academy of Management Journal,*** 45: 757–767.

Madjar, N., & Shalley, C. E. 2008. Multiple tasks' and multiple goals' effect on creativity: Forced incubation or just a distraction? ***Journal of Management,*** 34: 786–805.

Maitlis, S., & Sonenshein, S. 2010. Sensemaking in crisis and change: Inspiration and insights from Weick (1988). ***Journal of Management Studies,*** 47: 551–580.

March, J. 1994. ***A primer on decision making: How decisions happen.*** New York: Free Press.

Marchant, G., Robinson, J., Anderson, U., & Schadewald, M. 1991. Analogical transfer and expertise in legal reasoning. ***Organizational Behavior and Human Decision Processes,*** 48: 272–290.

Markus, H., & Zajonc, R. B. 1985. The cognitive perspective in social psychology. In G. Lindzey & E. Aronson (Eds.), ***The handbook of social psychology***, vol. 1: 137–230. New York: Random House.

Marshall, S. P. 1995. ***Schemas in problem solving.*** Cambridge: Cambridge University Press.

McCloy, R. A., Campbell, J. P., & Cudeck, R. 1994. A confirmatory test of a model of performance determinants. ***Journal of Applied Psychology,*** 79: 493–516.

McCrae, R. R. 1987. Creativity, divergent thinking, and openness to experience. ***Journal of Personality and Social Psychology,*** 52: 1258–1265.

McVee, M. B., Dunsmore, K., & Gavelek, J. R. 2005. Schema theory revisited. ***Review of Educational Research,*** 75: 531–566.

Meacham, J. A. 1983. Wisdom and the context of knowledge: Knowing that one doesn't know. In D. Kuhn & J. A. Meacham (Eds.), ***Contributions to human development***, vol. 8: 111–134. Basel, Switzerland: Karger.

Mednick, S. A. 1962. The associative basis of the creative process. ***Psychological Review,*** 69: 220–232.

Mendenhall, M., & Oddou, G. 1985. The dimensions of expatriate acculturation: A review. ***Academy of Management Review,*** 10: 39–47.

Mobley, M. I., Doares, L. M., & Mumford, M. D. 1992. Process analytic models of creative capacities: Evidence for the combination and reorganization process. ***Creativity Research Journal,*** 5: 125–155.

Motowidlo, S. J., Borman, W. C., & Schmit, M. J. 1997. A theory of individual differences in task and contextual performance. ***Human Performance,*** 10: 71–83.

Motowidlo, S. J., & Van Scotter, J. R. 1994. Evidence that task performance should be distinguished from contextual performance. ***Journal of Applied Psychology,*** 79: 475–480.

Mumford, M. D., Baughman, W. A., Maher, M. A., Costanza, D. P., & Supinski, E. P. 1997. Process-based measures of creative problem-solving skills. IV: Category combination. ***Creativity Research Journal,*** 10: 59–71.

Mumford, M. D., Blair, C., Dailey, L., Leritz, L. E., & Osburn, H. K. 2006. Errors in creative thought? Cognitive biases in a complex processing activity. ***Journal of Creative Behavior,*** 40: 75–109.

Mumford, M. D., & Gustafson, S. B. 1988. Creativity syndrome: Integration, application, and innovation. ***Psychological Bulletin,*** 103: 27–43.

Mumford, M. D., Mobley, M. I., Uhlman, C. E., Reiter-Palmon, R., & Doares, L. M. 1991. Process analytic models of creative capacities. ***Creativity Research Journal,*** 4: 91–122.

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

Murray, K. B., & Häubl, G. 2007. Explaining cognitive lock-in: The role of skill-based habits of use in consumer choice. ***Journal of Consumer Research,*** 34: 77–88.

Nadkarni, S., & Barr, P. S. 2008. Environmental context, managerial cognition, and strategic action: An integrated view. ***Strategic Management Journal,*** 29: 1395–1427.

Narvaez, D., & Bock, T. 2002. Moral schemas and tacit judgement or how the defining issues test is supported by cognitive science. ***Journal of Moral Education,*** 31: 297–314.

Neal, D. T., Wood, W., & Quinn, J. M. 2006. Habits—A repeat performance. ***Current Directions in Psychological Science,*** 15: 198–202.

Neale, M. A., & Northcraft, G. B. 1990. Experience, expertise, and decision bias in negotiation: The role of strategic conceptualization. ***Research on Negotiation in Organizations,*** 2: 55–75.

Nee, C., & Meenaghan, A. 2006. Expert decision making in burglars. ***British Journal of Criminology,*** 46: 935–949.

Newell, A., & Simon, H. A. 1972. ***Human problem solving.*** Englewood Cliffs, NJ: Prentice-Hall.

Nickerson, R. S. 1998. Confirmation bias: A ubiquitous phenomenon in many guises. ***Review of General Psychology,*** 2: 175–220.

Norman, G., Eva, K., Brooks, L, & Hamstra, S. 2006. Expertise in medicine and surgery. In K. A. Ericsson, N. Charness, P. Feltovich, & R. R. Hoffman (Eds), ***The Cambridge handbook of expertise and expert performance***: 339–353. Cambridge: Cambridge University Press.

Nystrom, P. C., & Starbuck, W. H. 1984. To avoid organizational crises, unlearn. ***Organizational Dynamics,*** 12(4): 53–65.

Okhuysen, G. A., & Eisenhardt, K. M. 2002. Integrating knowledge in groups: How formal interventions enable flexibility. ***Organization Science,*** 13: 370–386.

Oldham, G. R., & Cummings, A. C. 1996. Employee creativity: Personal and contextual factors at work. ***Academy of Management Journal,*** 39: 607–634.

Ouellette, J. A., & Wood, W. 1998. Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. ***Psychological Bulletin,*** 124: 54–74.

Peirce, C. S. 1931–1958. ***Collected papers of Charles Sanders Peirce***, vols. 1–8. (Edited by C. Hartshorne, P. Weiss, & A. Burks.). Harvard, MA: Cambridge University Press.

Perry-Smith, J. E. 2006. Social yet creative: The role of social relationships in facilitating individual creativity. ***Academy of Management Journal,*** 49: 85–101.

Perry-Smith, J. E., & Shalley, C. E. 2003. The social side of creativity: A static and dynamic social network perspective. ***Academy of Management Review,*** 28: 89–106.

Pratt, M. G. 2000. The good, the bad, and the ambivalent: Managing identification among Amway distributors. ***Administrative Science Quarterly,*** 45: 456–493.

Pratt, M. G., Rockmann, K. W., & Kaufmann, J. B. 2006. Constructing professional identity: The role of work and identity learning cycles in the customization of identity

among medical residents. ***Academy of Management Journal,*** 49: 235–262.

Prietula, M. J., & Simon, H. A. 1989. The experts in your midst. ***Harvard Business Review,*** 67(1): 120–124.

Reber, A. S. 1989. Implicit learning and tacit knowledge. ***Journal of Experimental Psychology: General,*** 118: 219–235.

Reger, R. K., & Palmer, T. B. 1996. Managerial categorization of competitors: Using old maps to navigate new environments. ***Organization Science,*** 7: 22–39.

Reiter-Palmon, R. 2009. A dialectic perspective on problem identification and construction. ***Industrial and Organizational Psychology,*** 2: 349–352.

Reiter-Palmon, R., & Illies, J. J. 2004. Leadership and creativity: Understanding leadership from a creative problem-solving perspective. ***Leadership Quarterly,*** 15: 55–77.

Robertson, M., Scarbrough, H., & Swan, J. 2003. Knowledge creation in professional service firms: Institutional effects. ***Organization Studies,*** 24: 831–857.

Root-Bernstein, R., Allen, L., Beach, L., Bhadula, R., Fast, J., Hosey, C., Kremkow, B., Lapp, J., Lonc, K., Pawelec, K., Podufaly, A., Russ, C., Tennant, L., Vrtis, E., & Weinlander, S. 2008. Arts foster scientific success: Avocations of Nobel, National Academy, Royal Society, and Sigma Xi members. ***Journal of Psychology of Science and Technology,*** 1(2): 51–63.

Root-Bernstein, R. S., Bernstein, M., & Garnier, H. 1995. Correlations between avocations, scientific style, work habits, and professional impact of scientists. ***Creativity Research Journal,*** 8: 115–137.

Rothman, R, A., & Perrucci, R. 1970. Organizational careers and professional expertise. ***Administrative Science Quarterly,*** 15: 282–293.

Rousseau, D. M. 2001. Schema, promise and mutuality: The building blocks of the psychological contract. ***Journal of Occupational and Organizational Psychology,*** 74: 511–541.

Rudolph, J. W., Morrison, J. B., & Carroll, J. S. 2009. The dynamics of action-oriented problem solving: Linking interpretation and choice. ***Academy of Management Review,*** 34: 733–756.

Rumelhart, D. E. 1984. Schemata and the cognitive system. In R. S. Wyer & T. K. Srull (Eds.), ***Handbook of social cognition***, vol. 1: 161–188. Hillsdale, NJ: Lawrence Erlbaum Associates.

Runco, M. A. 2004. Creativity. ***Annual Review of Psychology,*** 55: 657–687.

Runco, M. A., & Smith, W. R. 1992. Interpersonal and intrapersonal evaluations of creative ideas. ***Personality and Individual Differences,*** 13: 295–302.

Saariluoma, P. 1992. Error in chess: The apperception-restructuring view. ***Psychological Research,*** 54: 17–26.

Salas, E., Rosen, M. A., & DiazGranados, D. 2010. Expertise-based intuition and decision making in organizations. ***Journal of Management,*** 36: 941–973.

Schmidt, F. L., Hunter, J. E., & Outerbridge, A. N. 1986. Impact of job experience and ability on job knowledge, work sample performance, and supervisory ratings of job performance. ***Journal of Applied Psychology,*** 71: 432–439.

Scott, G. M., Lonergan, D. C., & Mumford, M. D. 2005. Conceptual combination: Alternative knowledge structures, alternative heuristics. ***Creativity Research Journal,*** 17: 79–98.

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.

Scott, W. A. 1962. Cognitive complexity and cognitive flexibility. ***Sociometry,*** 25: 405–414.

Shalley, C. E. 1995. Effects of coaction, expected evaluation, and goal setting on creativity and productivity. ***Academy of Management Journal,*** 38: 483–503.

Shalley, C. E., Gilson, L. L., & Blum, T. C. 2000. Matching creativity requirements and the work environment: Effects on satisfaction and intentions to leave. ***Academy of Management Journal,*** 43: 215–223.

Shalley, C. E., & Perry-Smith, J. E. 2001. Effects of social-psychological factors on creative performance: The role of informational and controlling expected evaluation and modeling experience. ***Organizational Behavior and Human Decision Processes,*** 84: 1–22.

Shalley, C. E., & Perry-Smith. 2008. The emergence of team creative cognition: The role of diverse outside ties, sociocognitive network centrality, and team evolution. ***Strategic Entrepreneurship Journal,*** 2: 23–41.

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.

Shenk, D. 2010. ***The genius in all of us.*** New York: Doubleday.

Sherer, P. D., & Lee, K. 2002. Institutional change in large law firms: A resource dependency and institutional perspective. ***Academy of Management Journal,*** 45: 102–119.

Simonton, D. K. 2009. Varieties of (scientific) creativity: A hierarchical model of domain-specific disposition, development, and achievement. ***Perspectives on Psychological Science,*** 4: 441–452.

Smith, E. R. 1998. Mental representation and memory. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), ***The handbook of social psychology,*** vol. 1 (4th ed.): 391–445. Boston: McGraw-Hill.

Smith, S. M. 1995a. Fixation, incubation, and insight in memory and creative thinking. In S. M. Smith, T. B. Ward, & R. A. Finke (Eds.), ***The creative cognition approach:*** 135–156. Cambridge, MA: MIT Press.

Smith, S. M. 1995b. Getting into and out of mental ruts: A theory of fixation, incubation, and insight. In R. J. Sternberg & J. E. Davidson (Eds.), ***The nature of insight:*** 229–251. Cambridge, MA: MIT Press.

Smith, S. M., & Blankenship, S. E. 1991. Incubation and the persistence of fixation in problem solving. ***American Journal of Psychology,*** 104: 61–87.

Smith, S. M., Ward, T. B., & Finke, R. A. 1995. ***The creative cognition approach.*** Cambridge, MA: MIT Press.

Sonnentag, S. 1998. Expertise in professional software design: A process study. ***Journal of Applied Psychology,*** 83: 703–715.

Sonnentag, S., & Kleine, B. M. 2000. Deliberate practice at work: A study with insurance agents. ***Journal of Occupational and Organizational Psychology,*** 73: 87–102.

Srikantia, P., & Pasmore, W. 1996. Conviction and doubt in organizational learning. ***Journal of Organizational Change Management,*** 9: 42–53.

Stacey, M., Eckert, C., & Wiley, J. 2002. Expertise and creativity in knitwear design. ***International Journal of New Product Development and Innovation Management,*** 4: 49–64.

Stanovich, K. E., & West, R. F. 1997. Reasoning independently of prior belief and individual differences in actively open-minded thinking. ***Journal of Educational Psychology,*** 89: 342–357.

Starbuck, W. H. 1996. Unlearning ineffective or obsolete technologies. ***International Journal of Technology Management,*** 11: 725–737.

Staw, B. M., Sandelands, L. E., & Dutton, J. E. 1981. Threat-rigidity effects in organizational behavior: A multilevel analysis. ***Administrative Science Quarterly,*** 26: 501–524.

Sternberg, R. J. 1996. Costs of expertise. In K. A. Ericsson (Ed.), ***The road to excellence:*** 347–354. Mahwah, NJ: Lawrence Erlbaum Associates.

Sternberg, R. J. 1997. Cognitive conceptions of expertise. In P. J. Feltovich, K. M. Ford, & R. R. Hoffman (Eds.), ***Expertise in context: Human and machine:*** 149–162. Cambridge, MA: MIT Press.

Sternberg, R. J., & Frensch, P. A. 1992. On being an expert: A cost-benefit analysis. In R. Hoffman (Ed.), ***The psychology of expertise: Cognitive research and empirical AI:*** 191–203. New York: Springer-Verlag.

Sternberg, R. J., & Lubart, T. I. 1995. ***Defying the crowd.*** New York: Free Press.

Stimson, J. 1975. Belief systems: Constraint, complexity and the 1972 election. ***American Journal of Political Science,*** 19: 393–417.

Sutton, R. I. 2001. The weird rules of creativity. ***Harvard Business Review,*** 79(8): 94–103.

Sutton, R. I., & Hargadon, A. 1996. Brainstorming groups in context: Effectiveness in a product design firm. ***Administrative Science Quarterly,*** 41: 685–719.

Sweller, J., Mawer, R. F., & Ward, M. R. 1983. Development of expertise in mathematical problem solving. ***Journal of Experimental Psychology: General,*** 112: 639–661.

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.

Thaler, R. H. 2000. From Homo Economicus to Homo Sapiens. ***Journal of Economic Perspectives,*** 14: 133–141.

Tzabbar, D. 2009. When does scientist recruitment affect technological repositioning? ***Academy of Management Journal,*** 52: 873–896.

Unsworth, K. 2001. Unpacking creativity. ***Academy of Management Review,*** 26: 289–297.

Vera, D., & Crossan, M. 2004. Theatrical improvisation: Lessons for organizations. ***Organization Studies,*** 25: 727–749.

Verplanken, B., & Faes, S. 1999. Good intentions, bad habits, and effects of forming implementation intentions on health eating. ***European Journal of Social Psychology,*** 29: 591–604.

Verplanken, B., Myrbakk, V., & Rudi, E. 2005. The measurement of habit. In T. Betsch & S. Haberstroh (Eds.), ***The routines of decision making:*** 231–247. Mahwah, NJ: Lawrence Erlbaum Associates.

Vicente, K. J., & Wang, J. H. 1998. An ecological theory of expertise effects in memory recall. ***Psychological Review,*** 105: 33–57.

von Nordenflycht, A. 2010. What is a professional service firm? Toward a theory and taxonomy of knowledge-intensive firms. ***Academy of Management Review,*** 35: 155–174.

Vul, E., & Pashler, H. 2007. Incubation benefits only after people have been misdirected. ***Memory and Cognition,*** 35: 701–710.

Wallas, G. 1926. ***The art of thought.*** New York: Holt.

Walsh, J. P. 1995. Managerial and organizational cognition: Notes from a trip down memory lane. ***Organization Science,*** 6: 280–321.

Ward, T. B. 1994. Structured imagination: The role of category structure in exemplar generation. ***Cognitive Psychology,*** 27: 1–40.

Ward, T. B. 2007. Creative cognition as a window on creativity. ***Methods,*** 42: 28–37.

Ward, T. B., Smith, S. M., & Vaid, J. 1997. Conceptual structures and processes in creative thought. In T. B. Ward, S. M. Smith, & J. Vaid (Eds.), ***Creative thought: An investigation of conceptual structures and processes:*** 1–27. Washington, DC: American Psychological Association.

Weber, R., & Crocker, J. 1983. Cognitive processes in the revision of stereotypic beliefs. ***Journal of Personality and Social Psychology,*** 45: 961–977.

Weick, K. E. 1993. The collapse of sensemaking in organizations: The Mann Gulch disaster. ***Administrative Science Quarterly,*** 38: 628–652.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. 2005. Organizing and the process of sensemaking. ***Organization Science,*** 16: 409–421.

Weisberg, R. W. 1999. Creativity and knowledge: A challenge to theories. In R. J. Sternberg (Ed.), ***Handbook of creativity:*** 226–250. Cambridge: Cambridge University Press.

Weisberg, R. W. 2006. Modes of expertise in creative thinking: Evidence from case studies. In K. A. Ericsson, N. Charness, P. Feltovich, & R. R. Hoffman (Eds), ***The Cambridge handbook of expertise and expert performance:*** 761–787. Cambridge: Cambridge University Press.

West, M. A., & Richter, A. W. 2008. Climates and cultures for innovation and creativity at work. In J. Zhou & C. E.

Shalley (Eds.), ***Handbook of organizational creativity:*** 211–236. New York: Lawrence Erlbaum Associates.

Wilensky, H. L. 1964. The professionalization of everyone? ***American Journal of Sociology,*** 70: 137–158.

Wiley, J. 1998. Expertise as mental set: The effects of domain knowledge in creative problem solving. ***Memory and Cognition,*** 26: 716–730.

Wood, W., & Neal, D. T. 2007. A new look at habits and the habit-goal interface. ***Psychological Review,*** 114: 843–863.

Wood, W., Quinn, J. M., & Kashy, D. A. 2002. Habits in everyday life: Thought, emotion, and action. ***Journal of Personality and Social Psychology,*** 83: 1281–1297.

Woodman, R. W., Sawyer, J. E., & Griffin, R. W. 1993. Toward a theory of organizational creativity. ***Academy of Management Review,*** 18: 292–321.

Wray, K. B. 2003. Is science really a young man's game? ***Social Studies of Science,*** 33: 137–149.

Zell, D. 2003. Organizational change as a process of death, dying, and rebirth. ***Journal of Applied Behavioral Science,*** 39: 73–96.

Zhang, L. F., & Sternberg, R. J. 2009. Intellectual styles and creativity. In T. Rickards, M. A. Runco, & S. Moger (Eds.), ***The Routledge companion to creativity:*** 256–266. London: Routledge.

Zhong, C. B., Dijksterhuis, A., & Galinsky, A. D. 2008. The merits of unconscious thought in creativity. ***Psychological Science,*** 19: 912–918.

Erik Dane (erikdane@rice.edu) is an assistant professor of management at the Jesse H. Jones Graduate School of Business, Rice University. He received his Ph.D. from the University of Illinois at Urbana-Champaign. His current research explores the effects of domain expertise on cognitive flexibility, intuition, and mindfulness in the workplace.