

**Original citation:**

Hodgkinson, Gerard P., 1961- and Healey, Mark P.. (2014) Coming in from the cold : the psychological micro-foundations of radical innovation revisited. *Industrial Marketing Management*, Volume 43 (Number 8). pp. 1306-1313. ISSN 0019-8501

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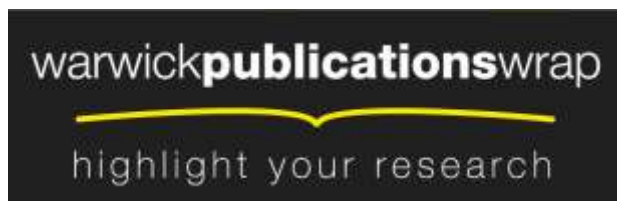
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DOI: <http://dx.doi.org/10.1016/j.indmarman.2014.08.012>

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# **Coming in from the cold: The psychological micro-foundations of radical innovation revisited**

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**To appear in *Industrial Marketing Management* (2014)**

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**Research highlights:**

- Drawing on the insights of social neuroscience, we examine the adaptive behavioral challenges posed by radical innovation
- Radical innovation poses adaptive challenges for individuals, groups, organizations, and organizational collectives
- Addressing the adaptive challenges of radical innovation demands the harnessing of cognitive *and* emotional capacities
- To adapt, firms must nurture self-regulation capabilities at all levels of the enterprise

## **Abstract**

Radical innovation poses a series of well-documented adaptive behavioral challenges for individuals, organizations, and organizational collectives. Drawing on the insights of recent advances in the social neurosciences, the authors demonstrate how theory and research rooted in the cold cognition era of human psychology has laid micro-foundations for practices purporting to help address these challenges that are fundamentally unfit for purpose. Predicated on an outmoded conception of economic actors as affect-free information processors, devoid of emotion, scholars and practitioners alike are unwittingly perpetuating a (bounded) rationality façade. In so doing, they are undermining attempts to foster the requisite transformation of mindsets and behavior. To address these unintended consequences, new theory and research is required to shed light on the generative mechanisms through which firms might create the conditions to enable them to harness the cognitive *and* emotional capacities of individuals and groups, an essential step for overcoming the pitfalls of bias and inertia that so often inhibit adaptation to changing environments, thus slowing progress in the development and diffusion of innovation. To further this end, the present article advances a research agenda that places emotion management center stage, arguing that, to be truly dynamically capable, firms must learn to nurture self-regulation capabilities at all levels of the enterprise.

**Keywords:** behavioral strategy; cognition; dynamic capabilities; emotion; innovation

## 1. Introduction

It is now well-established that the sort of radical innovation that destroys the competencies of firms (Tushman & Anderson, 1990) also poses major adaptive challenges to individuals and groups within and between firms (Abrahamson & Fombrun, 1994; Porac & Thomas, 1990; Teece, 2007; Tripsas & Gavetti, 2000). The defining feature of these adaptive challenges is that managers, employees and other stakeholders of the enterprise are typically unable to break free from the shackles of their extant beliefs and behavior when faced with major environmental shifts such as the introduction of new technologies or the entrance of radically different competitors. These behavioral shackles inhibit the personal and collective adjustments necessary to ultimately ensure the longer-term sustainability of the firm (Alvarez & Busenitz, 2001; Amit & Schoemaker, 1993; Gavetti, 2005; Kaplan, 2008; Teece, 2007; Teece et al., 1997; Tripsas & Gavetti, 2000) and even the entire industry sector in which firms are embedded (Abrahamson & Fombrun, 1994; Hodgkinson, 1997, 2005; Porac et al., 1989, 1995).

Over the past three decades managerial and organizational cognition researchers have made considerable progress in identifying psychological mechanisms that might explain why the behavioral challenges of adapting to radical innovation are seemingly intractable, at both the individual (e.g. Bateman & Zeithaml, 1989; Dutton, 1993; Hodgkinson et al., 1999, 2002; Porac & Thomas, 1990; Schwenk, 1984) and group (e.g. Peteraf & Shanley, 1997; Porac & Thomas, 1990; Reger et al., 1994) levels. At the individual level, these mechanisms range from cognitive simplification strategies such as incorporating radical new developments into preexisting categories (e.g. Dutton & Jackson, 1987; Reger & Palmer, 1996), to the use of heuristics, basic rules of thumb that render decision makers biased in their judgments and hence impervious to the significance of the new developments at hand (Schwenk, 1984; Zajac & Bazerman, 1991). At the group level, research has focused on the constraining influence of collective belief systems, borne of socio-cognitive mechanisms such as vicarious learning and social identification (Peteraf & Shanley, 1997) and of higher level cultural mechanisms that transcend organizational boundaries (Abrahamson & Fombrun, 1994; Hodgkinson & Healey, 2011a).

Common to all of these developments, however, is an underlying set of psychological assumptions that tend to downplay the potential role of affect and emotion as the fundamental inhibitors or enablers of individual and collective ability to respond to the adaptive behavioral challenges of radical innovation. In the wake of the Nobel Prize winning work of Simon (e.g. 1947) and Kahneman (e.g. Kahneman & Tversky, 1979), researchers have privileged effortful forms of reasoning and dispassionate analysis as a means of overcoming bias and inertia in strategic thinking, predicated on the assumption that the mere effortful processing of information that is inconsistent with prevailing mental representations disconfirms expectations and jolts decision makers into conscious reflection, thereby forcing them to revise their beliefs (see, e.g., Dutton, 1993; Hodgkinson et al., 1999, 2002; Louis & Sutton, 1991; Reger & Palmer, 1996).

Responding to recent calls in the organization sciences to provide accounts of strategic adaption that have greater behavioral plausibility (Gavetti, Levinthal & Ocasio 2007; Hodgkinson & Healey, 2008a), in this article we draw on the insights of recent advances in the social neurosciences, more specifically neuroeconomics (e.g. Brocas & Carrillo 2008; Loewenstein, Rick & Cohen, 2008) and social cognitive neuroscience (e.g. Lieberman, 2007; Ochsner & Lieberman, 2001), to demonstrate why the time has come for a fundamental rethink of the psychological micro-foundations underpinning this body of work as a whole. Departing from the ‘cold cognition logic’ currently prevailing, our alternative account of mental model and behavior change (explicated more fully in Hodgkinson & Healey, 2011b) conceives metacognition, emotion management, and self-regulation as core dynamic managerial capabilities essential for meeting the behavioral challenges of radical innovation. The article is structured in five main sections as follows. Following this introduction, the next section outlines in more detail the cold cognition logic currently prevailing as the central foundation for advancing understanding of and intervening in processes for fostering radical innovation and more effective responses to the behavioral challenges it poses. The third section summarizes more recent developments that challenge this foundation. Building on these insights, in the fourth section we consider the implications for research and practice. The fifth and final section summarizes our main conclusions.

## 2. The Psychological foundations of dynamic capabilities

Dynamic capabilities are at the core of organizational learning and innovation (see, e.g., Alvarez & Busenitz, 2001; Amit & Schoemaker, 1993; Gavetti, 2005; Kaplan, 2008; Teece et al., 1997; Tripsas & Gavetti, 2000). They are the mechanisms (‘skills, processes, procedures, organizational structures, decision rules and disciplines’) that enable learning and innovation at the organizational level by first **sensing** opportunities and threats, **seizing** them, and then **transforming/reconfiguring** the organization in the light of what has been learned via sensing and seizing (Teece, 2007). The economic, and to a lesser extent psychological, microfoundations of dynamic capabilities have received growing scholarly attention over recent years. Teece’s (2007) contribution constitutes the most comprehensive framework to date for the analysis of capabilities development in organizations. However, as demonstrated by Hodgkinson and Healey (2011b) behavioral plausibility is not its strength – the core psychological assumptions underpinning this (and other) dynamic capability framework(s) need revising in the light of recent advances in social cognitive neuroscience and Neuroeconomics.

Current dynamic capability conceptions, epitomized by Teece’s (2007) formulation, have been heavily influenced by the work of the late Herbert Simon and related developments in behavioral decision making, the overarching logic of which can be summarized as follows:

- Due to processing limitations reality is encoded in the form of a simplified representation (i.e. a schema or mental model);

- These models act as a filter, screening out potentially important but weak signals;
- Hence, blind spots and inertia are likely to be endemic whenever new ideas and practices are introduced in organizations;
- The key to anticipating radical innovation and change, therefore, is in first understanding the cognitive limitations of decision makers and then designing tools and processes to overcome those limitations.

A growing body of theory and research amassed from the late 1980s onwards seemingly supports the foregoing assertions. For instance, work examining the evolution of competitive positioning strategies has demonstrated that, when sensing, strategists typically focus on a small subset of competitors (around 7 in number), located within one or two categories (e.g. de Chernatony, Daniels, & Johnson, 1993; Daniels, Johnson & de Chernatony, 1994; Hodgkinson & Johnson, 1994; Porac et al, 1989). Furthermore, longitudinal (and anecdotal) evidence indicates that mental models of competition are highly resistant to change (Hodgkinson, 1997, 2005; Porac & Thomas, 1990; Reger & Palmer, 1996).

Drawing on the insights of self- and social-categorization theory (Turner & Oakes, 1986; Turner et al., 1987) and social identity theory (Tajfel & Turner, 1979, 1986), organizational behavior and strategic management researchers have argued that the desire for a positive self-concept will lead decision makers to evaluate information more favorably if it contributes to their personal sense of self (personal identity) and/or if it contributes to their group-based sense of self (social identity) (for overviews see Haslam, 2004; Haslam & Ellemers, 2005; Hodgkinson & Healey, 2008a, 2008b). Self/social categorization and identification make group decision making units highly cohesive and over identification with the (sub) group can lead to biased processing of strategically important information offered by ‘outgroup’ members (van Knippenberg et al., 2004; Hodgkinson & Healey, 2008b). Similar processes occur at the inter-organizational level, leading to the formation of groups of firms or even entire industries following similar strategies (Lant & Baum, 1995; Porac et al., 1989). Groups of firms look inwardly and become impervious to the actions of rival firms beyond the ‘cognitive strategic group’ (Peteraf & Shanley, 1997). Hence, over time strategists’ beliefs become highly convergent, leading firms to imitate one another’s competitive positioning strategies and what begin as highly lucrative niche positions rapidly become over populated (Abrahamson & Fombrun, 1994; Hodgkinson, 2005; Porac et al., 1989, 1995).

The tendency of interorganizational macrocultures to homogenize over time explains the all too frequent failure of entire industries to adapt to radically new competitors and technological innovations, clinging instead to outmoded practices and competitive positioning strategies (Hodgkinson & Healey, 2011a). Homogeneous macrocultures restrict the inventiveness of, and diffusion of radical innovations among, member organizations, thereby driving them toward collective inertia, and increasing the similarity of their strategic profiles (Abrahamson & Fombrun, 1994).



According to Teece (2007), the primary behavioral barrier to effective seizing is the danger of organizational decision makers succumbing to basic cognitive biases of the sort highlighted in the classic heuristics and biases program of work stimulated by Kahneman, Tversky and colleagues (e.g. Kahneman & Tversky, 1979; Tversky & Kahneman, 1974, 1981). Evidence supporting the idea that organizational decision makers engaged in strategy formulation processes are indeed susceptible to such effects has been well documented over the years (see, e.g., Hodgkinson et al., 1999, 2002; Maule & Hodgkinson, 2002; Schwenk, 1984).

In a similar vein, the translation of strategy into action (i.e. transforming/reconfiguring) poses significant psychological challenges re: the management of employees. Employees actively frame organizational events, objects and issues as they attempt to make sense of change and their cognitive frameworks may or may not match those of the managers whose task is to explain the rationale of the organizational decision to its wider stakeholders. Hence, new ideas and practices, especially radically innovative ones that challenge the beliefs an individual holds about the organization's identity, will be actively resisted (Haslam et al., 2003; Reger et al., 1994; Teece, 2007).

The foregoing analysis has clear implications for anticipating the potentially deleterious effects of radical innovation in organizations. To the extent that actors' individual and collective information processing simplification strategies filter out weak signals indicative of the need for fundamental innovation and change, interventions are required that will challenge their taken for granted assumptions and beliefs, thereby facilitating the required shift in their mental models to conceive of viable alternatives (sensing) and embrace the attendant changes necessary at all levels of the organization (seizing and transforming). Support tools and processes such as scenario planning (van der Heijden et al., 2006) and innovation road maps (Phaal, Farrukh, & Probert, 2004) are seemingly ideal for this purpose. However, as will be demonstrated in the remaining sections, these tools are predicated on a bounded rationality conception of organizational decision makers as 'cognitive misers' — affect free and devoid of emotion — that is rapidly being outmoded by more recent advances in the social neurosciences. Hence, recent 'design science' attempts to draw on the insights of the literature reviewed in the previous sections of this article, to identify appropriate generative mechanisms (basic processes) and attendant design principles, to meet the design imperatives of enriched mental models through cognitive elaboration and effective team working (e.g. Healey & Hodgkinson, 2008; Hodgkinson & Healey, 2008a, 2008b) are unlikely to succeed. Like much of strategic management practice, they are based on a model of rationality that does not stand up to theoretical and empirical scrutiny. Going forward, we maintain that advances in the conceptualization and assessment of intuition and related affective processes in social cognitive neuroscience and the emerging field of neuroeconomics need to be incorporated in order to develop a more complete and adequate portrayal of the processes of individual and collective learning that support radical innovation and organizational adaptation.

### 3. Contemporary developments in the social neurosciences

Perhaps the overriding message of contemporary social neuroscience is that human behavior reflects the functioning of two distinct neurological, cognitive, and emotional systems. According to a growing body of work in social cognitive neuroscience, a reflexive system underpins more automatic and basic affective forms of social cognition such as implicit attitudes, automatic categorization, and empathizing with others, while a reflective system, a more controlled system that developed latterly in evolutionary terms, underpins so-called higher forms of cognition, such as logical reasoning, planning, and hypothetical thinking (Lieberman, 2007; Lieberman *et al.*, 2002).

Particularly apposite for the current analysis, many reflexive processes are driven by affect, neurophysiological feeling states characterized by pleasure-displeasure and arousal (Russell, 2003). Their reflective counterparts are, in themselves, relatively affect-free (although reflective appraisal can trigger emotional reactions; see Frijda, 1989). This distinction has led scholars to differentiate hot and cold modes of operation. More specifically, in the emerging subfield of neuroeconomics, Bernheim and Rangel (2004) view the brain as operating in either a ‘cold’ cognitive mode or a ‘hot’ emotional mode. Loewenstein and Small (2007) similarly distinguish between ‘emotional’ and ‘deliberative’ systems. Indeed, one of the key contributions of neuroeconomics has been to shed light on the conditions under which visceral feelings overcome deliberative thinking in judgment and decision making (for an overview, see Loewenstein *et al.*, 2008).

In recent years, there has been a shift in psychology from ‘default-interventionist’ to ‘parallel-competitive’ dual-process models (Evans, 2008). **Default-interventionist** dual-process models claim that the role of cortical/higher mental functions is to correct the ‘primitive’ limbic system’s automatic and affective responses (which are viewed as sources of bias and irrationality to be minimized). Within these models, the automatic system provides default behaviors (e.g. automatic attitudes and intuitive judgments) that the analytical system refines. **Parallel-competitive** models, in contrast, assume more complex interactions between the controlled and automatic systems, each operating simultaneously and competing for control. In these models, reflexive processes are not relegated to mere source of error and bias to be overcome with effort; rather, they are integral to human cognition and critical for skilled processes such as intuition (Lieberman, 2000). These and related developments such as the somatic marker hypothesis, the idea that memories embodied as resonating emotions are activated in context-congruent situations (Bechara, Damasio, Tranel, & Damasio, 2007; Damasio, 1994) and the affect heuristic and affect as information (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2004) point to the need for a fundamental rethink in the design of tools and processes for fostering radical innovation and concomitant adaptive strategic change.

As discussed in Hodgkinson and Healey (2011b), recent research in neuroeconomics shows that people actively try to shield themselves from information that causes psychological

discomfort, the so-called ‘ostrich effect’ (Karlsson et al., 2009). In keeping with this observation, studies in social cognitive neuroscience show that conflicting information is not the fundamental mechanism of belief revision, but rather how decision makers handle the affective response to that conflicting information (Lieberman, 2000, 2007; Lieberman *et al.*, 2001). Capitalizing on these recent theoretical advances (developed more extensively in Hodgkinson & Healey, 2011b), we posit the fostering of self-regulatory skills throughout the organization as an essential prerequisite for creating the enabling conditions to respond effectively to the behavioral challenges of radical innovation.

As outlined in Hodgkinson and Healey (2011b, p. 1508), “self-regulation involves controlling internal ego-protective goals,” which can help managers to avoid fixating on suboptimal choices and generate better ones instead. We maintain that when decision makers are presented with the opportunity to regulate their own feelings in relation to the problems at hand, all else being equal, they are better able to sense the need for mental model change and adapt their behavior accordingly.

### *3.1 Affective foundations of sensing under radical innovation*

Given that affect directs attention to opportunities or threats (or possibly even controls attention), utilizing affect as information is essential to sensing capabilities. Capabilities in diagnosing and acting on emotional signals, not suppressing them, thus differentiate dynamic firms from their less responsive counterparts. ‘Cold cognition’ approaches to schema change, through effortful reasoning and analysis per se, are thus an insufficient basis for fostering the required changes to actors’ mental models as a foundation for radical innovation and change. Rather, it seems plausible that differences in emotional processes may explain why some individuals and organizations view the same new technology or new business model as an opportunity, whereas others view them as a threat. Hence, organizations need to put systems, structures and tools in place to enable emotion learning from dissonance – that is, learning from disconfirmatory information, rather than discounting such information, especially when that information is potentially painful in terms of the implications it may signal for individuals and/or the wider firm.

A key question for sensing and shaping radical innovation thus becomes what types of systems, structures and processes enable emotion learning? In terms of organizational characteristics and processes, it would seem that an important first step is to identify how the organization predominantly reacts in cognitive and emotional terms to the early signals of radical innovation; what we might term its adaptive-affective style. Kets de Vries and Miller (1984) observed that some organizations develop certain pathologies or neurotic styles that predispose key individuals to act in a maladaptive manner when faced with change; for example, to treat new technology with distrust, retreat to an inward focus, and fall back on rules and regulations when dealing with industry changes, or adopt a pessimistic outlook when dealing with competitive moves. Such pathologies characterize many incumbent firms

facing radical innovation, as illustrated in studies of the digital imaging (Tripsas & Gavetti, 2000) and newspaper (Gilbert, 2005) industries.

In fundamental terms, identifying the firm's predominant adaptive-affective style involves diagnosing how extant norms, routines and cultural practices predispose individuals and groups toward approach-avoidance, including the culture and incentive systems surrounding risk and reward. Innovation researchers might draw a useful analogy with research on the mechanisms of self-regulation at the individual level, which suggests that distinct cognitive and affective systems underpin approach and avoidance tendencies (Higgins, Roney, Crowe, & Hymes, 1994). To the extent that the adaptive affective-style analogy holds at the organizational level, it suggests that systems and practices that cultivate a risk-averse culture will undermine learning and innovation because they likely foster avoidance emotions, while inhibiting the requisite approach emotions.

### *3.2 Intuitive foundations of sensing under radical innovation*

Conventional wisdom in strategic management theory posits that effective sensing demands detailed analysis, as a basis for the stimulation of deliberative learning (Porter, 1980; Teece, 2007; Zollo & Winter, 2002). However, reflexive processes are also required, in order to cut through detail. For example, research has shown that experts use non-conscious pattern matching to yield affectively charged, intuitive judgments (Dane & Pratt, 2007; Hodgkinson et al., 2008, 2009; Lieberman, 2000; Salas et al., 2010). Reflexive processes enable decision makers to see the 'big-picture', vital to strategic situational awareness (Hodgkinson & Clarke, 2007), which in turn enables rapid identification of important developments for exploitation. Reflexivity is thus essential to sensing, especially given "the inability of the analytical mode to synthesize," as observed by Mintzberg (1994: 320) some two decades ago.

As argued by Hodgkinson and Healey (2011b), the implications of this analysis are two-fold:

- Sensing capabilities are *not* rooted in elaborate knowledge management systems per se, which can exacerbate rather than ameliorate information overload (Griffith, Northcraft, & Fuller, 2008);
- Organizations must, accordingly, develop appropriate architectures/technology to support reflexion (cf. Thaler & Sunstein, 2008).

A key means of developing organizational architectures that support reflexion is via the design of discrete innovation teams. Independent innovation teams that are loosely coupled to the organization are less constrained by long-standing organizational routines and less prone to the behavioral shackles imposed by the firm (Bain, Mann, & Pirola-Merlo, 2001; Moenaert, Caeldries, Lievens, & Wauters, 2000; Van de Ven & Polley, 1992). When considering the composition of such teams, it is important to take account of individual differences in cognitive style. Cognitive style refers to an individual's predominant preferred

approach or approaches to gathering, organizing and evaluating information. Recently, researchers have begun to address the issue of how to configure teams for successful innovation by managing cognitive style. Two possibilities have emerged from this endeavor.

First, Hodgkinson and Clarke (2007) suggested that individuals' chronic preferences pertaining to two distinct information processing styles – low versus high intuitive-experiential thinking and low versus high analytical-rational thinking (Epstein, Pacini, DenesRaj, & Heier, 1996) – predispose team members more or less favorably to the type of creative activities undertaken by innovation teams. 'Detail conscious' individuals are driven by the minutia of available data and tend to approach problems in a step-by-step manner; however, they may struggle to go 'beyond the data' in the manner required for generating and pursuing creative insights. In contrast, 'big picture conscious' individuals rely more heavily on intuitive processes to generate holistic insights; however, such individuals may overlook important detail. A logical inference from this work is that, compared to innovation teams composed predominantly of detail-conscious members, innovation teams comprising a higher proportion of big picture conscious individuals will engage with the creative process more effectively and be more effective in conceiving of, and pursuing, fundamental rather than incremental developments. The latter individuals will be more comfortable with the mental leaps and cross-category thinking associated with such radical advances. However, it also seems plausible that attaining an appropriate mix of intuitive and analytic individuals, preferably by selecting or developing individuals who are adept at switching back and forth from analytic to intuitive processing strategies (i.e. cognitively versatile individuals) should help teams blend free-thinking and constraint satisfaction in a manner conducive to effective innovation.

The idea of blending cognitive styles is important to a second line of inquiry concerning organizing for reflexion, instigated by Miron-Spektor and colleagues (Miron-Spektor, Erez, & Naveh, 2011). These researchers used a modified version of Kirton's (1976) adaptation-innovation inventory (KAI) to assess the proportion of individuals in R&D and manufacturing teams who were variously creative, conformist and attentive to detail. As expected, they found that teams most effective in radical innovation (e.g. developing breakthrough technologies) contained a high proportion of creative individuals. However, when such teams also contained a small proportion of conformists, radical innovation was even higher; conformists seemed to help reduce conflict and strengthened team potency, thus serving as a necessary antidote to the well-documented behavioral challenges confronting leaders, when seeking to manage the attendant dynamics of teams composed of individuals with contrasting cognitive styles (cf. Hodgkinson & Clarke, 2007; Kirton & McCarthy, 1988). Taken together, these two lines of inquiry offer important insights into methods of organization that boost innovation by supporting reflexive processes, in conjunction with the analytical rigor afforded by reflective processes.

### *3.3 Psychological foundations of seizing under radical innovation*

According to Teece (2007), effective seizing centers on managers' ability to override certain dysfunctional features of established decision making processes. Translated into the context of radical innovation, a primary dysfunction characterizing incumbent firms is that they struggle to commit fully to seizing new directions because of emotional commitment to the prevailing assumptions and beliefs underpinning existing areas of activity. Scholars have described this dysfunction variously as a problem of unlearning (Nystrom & Starbuck, 1984) or of the blinding effect of dominant logic (Prahalad, 2004). In the light of the foregoing recent advances in the social neurosciences, it is clear that, like the fostering of effective sensing capabilities, unlocking strategic fixations entails targeting emotional mechanisms. However, with some notable exceptions (e.g. Pratt & Barnett, 1997) the role of emotion in unlocking commitment to old ideas and activities has been largely overlooked. We suggest that analyzing the emotional roots of unlearning will ultimately help illuminate the mechanisms by which firms can facilitate radical innovation.

Research on the familiar problem of escalation of commitment (Staw, 1976), illustrates how greater appreciation of the role of affect and hot cognition can shed light on the means of tackling the more general class of commitment dysfunctions. Recent escalation research draws attention to the fact that merely thinking harder is not sufficient for alleviating escalation. Rather, alleviation involves basic affective ego-protective mechanisms. More specifically, disengagement from a failing course of action requires self-regulatory processing to reduce emotional engagement (Henderson, Gollwitzer, & Oettingen, 2007; Wong, Yik, & Kwong, 2006). For instance, given that self-justification is a primary driver of escalation (decision makers continue with a failing course of action to justify that they were right all along), assuaging decision makers' need for self-justification by providing opportunities for positive self-affirmation can reduce escalation and facilitate novel choice (Sivanathan, Molden, Galinsky, & Ku, 2008). This body of research illustrates that self-regulatory processes are required to reduce emotional engagement and that emotion needs to be incorporated skilfully into the unlearning process.

Our analysis suggests that, in addition to reducing emotional commitment to outmoded ideas and activities, the seizing of radical innovation requires building emotional commitment to the new ideas and activities that will replace the old ones. Emotional commitment is paramount because visceral (felt) reactions to choice alternatives often overpower evaluations based on subjective probability assessment (Bechara, Damasio, Tranel, & Damasio, 1997; Loewenstein, Weber, Hsee, & Welch, 2001; Rottenstreich & Hsee, 2001). Hence, cold cognitive assessments of new investment alternatives, including calculations of expected financial returns, are likely to be insufficient for seizing breakthrough innovations.

Christensen (1997) has drawn attention to the cognitive challenges associated with managers' attempts to choose between a given new direction and familiar alternatives, which arise because stakeholders are deeply entrenched in worldviews based on the past and thus struggle to envisage the benefits of disruptive innovation. However, it seems likely that the challenges associated with making such decisions are also emotional in nature, given that emotion provides the motivating force driving strong commitment to novel choices. Put simply,

making and sustaining innovative choices requires excitement, enthusiasm and inspiration as much as estimation, calculation and deliberation. Although examples of firms that are able to capitalize on radical innovations are rare, it seems that these select firms are able to adapt not merely because they accurately assess monetization prospects but also because they are adept at valuing exciting but uncertain projects, articulating and communicating inspirational visions, and being passionate about small but growing markets (Leifer et al., 2000).

The implication of the foregoing analysis is that successful radical innovation requires organizational decision processes and attendant support systems conducive to the development of appropriate emotional commitment to the new opportunities at hand. Although such a climate is anathema in many organizations ruled by fear of failure, concern for security and low-risk resource allocation, scholarly research points to important means of developing emotional architectures for supporting the requisite decision processes. Huy (1999) advanced the term emotional capability to describe organizational level dynamics that instil emotion-arousing behaviors that facilitate the realization of radical choices. Specialized support groups, the use of experiments to facilitate playfulness, and formal mechanisms for encouraging novel behaviors within the organization are all highly promising techniques to support the development of this capability. Techniques based on visual imagery can also play a key role, given that mental imagery begets emotion (Loewenstein et al., 2001). Such techniques include the use of scenario planning and road-mapping exercises designed specifically to encourage emotional experiencing of radical new directions (Healey & Hodgkinson, 2008).

### *3.4 Psychological foundations of transforming under radical innovation*

Stakeholders frequently kill novel ideas when those ideas do not fit with the organization's identity, i.e. organizational actors' enduring sense of who the organization is and what it stands for (Reger, Gustafson, Demarie, & Mullane, 1994; Tripsas, 2009; Tripsas & Gavetti, 2000). Given such identity barriers, pursuing radical innovation often requires actors to change their understanding of the organization's identity, with attendant consequences for their personal and social identities. For this reason, managing social and organizational identity processes is an integral component of reconfiguring/transforming the organization to pursue new ideas and activities.

Traditional approaches to the problem of identity-based resistance to organizational change advocate identity change via cold cognition remedies such as re-categorizing extant subunit identities into a common superordinate identity and building fluid identities (Fiol, 2002; Gioia, Schultz, & Corley, 2000; Haslam, Eggins, & Reynolds, 2003). However, these approaches are problematic because they downplay the nature and extent of emotional responses to identity threat. Basic research illustrates that identity threat leads to heightened activity in the emotion-regulation centers of the brain (Derks, Inzlicht, & Kang, 2008) and that (social) identity threat from ostracism and social exclusion activates the same neural networks as physical pain (Lieberman & Eisenberger, 2009). It is likely, therefore, that the

pain of identity threat acts as a strong trigger of both active forms of resistance to identity-threatening change such as hostility, conflict and infighting and passive resistance such as withdrawal and avoidance behavior.

Based on the foregoing analysis, it is clear that a fundamental rethink is required in relation to interventions for managing identity threats in the face of radical innovation and strategic transformation. Specifically, addressing the identity change problem requires remedies that foster identity change via affective and reflexive mechanisms, ones that foster the requisite change while affirming the self by promoting new collective identities that maintain enduring sources of pride consonant with employees' senses of self-hood (Heath & Heath, 2010; Hodgkinson & Healey, 2011b).

A recent case reported by van Dijk and colleagues (2011) illustrates how established firms can manage self-regulatory dynamics in identity transitions. These researchers studied how the medical electronics division of a European electronics firm struggled to bring to market a novel molecular diagnostics device for monitoring infections. The device in question was based upon competences in biochemistry and molecular biology, which differed strongly from the firm's existing competences in electronic imaging and radiation technology. Hence, engineers and managers were initially resistant to the biologists' unfamiliar ways of thinking and working and to the idea that their hardware company could excel in 'fluids' (i.e. biological materials). However, stakeholders ultimately managed to reframe the innovation in question, essentially by affirming enduring sources of self-regard. For instance, champions of the new device pointed out that the company had worked with fluids in other technologies for several years, thereby reinforcing how the new device fitted with key aspects of the established identity. In addition, champions highlighted the relatedness and familiarity of the new capability in fluids by linking this general capability to past achievements, thereby integrating the new capability with previously acknowledged attributes and strengths to produce an augmented identity. This case illustrates how assuaging rather than raising emotional barriers born of identity threats can facilitate the internalization of radical innovation within firms.

#### **4. Implications for research and intervention**

As summarized in the previous section, our latest research draws on social cognitive neuroscience and neuroeconomics, highlighting the interaction of reason and emotion to revisit the psychological foundations of dynamic capabilities (Hodgkinson & Healey, 2011b). Our central message is that emotion/affect and less deliberative forms of cognition are integral to the adaptive capabilities of economic actors and their firms. Departing from the 'cold cognition logic' currently prevailing, our alternative account of mental model and behavior change demands a series of empirical studies to test the basic hypothesis that when decision makers are presented with the opportunity to regulate their own feelings in relation to the problems at hand, all else being equal, they are better able to sense the need for mental model change and shift their strategic choices accordingly. Similarly, those affected by the



introduction of radically innovative practices should fare better when presented with the opportunity to reflect actively on their cognitive and affective reactions, through the use of tools that equip them to do so.

Ultimately, a new program of work is required to test our basic hypothesis that when decision makers are presented with the opportunity to regulate their own feelings in relation to the problems at hand, via a process known as emotional reframing, all else being equal, they are better able to sense the need for mental model change (sensing) and shift their strategic choices accordingly (seizing). Powell (2011) points to a number of social neuroscience studies (Gross, 1998; Lieberman et al., 2007; Oschner et al., 2004; Schaeffer et al., 2003) that lend credence to this overall approach, showing that it stimulates the pre-frontal cortex (PFC), a key structure implicated in the reflective system underpinning executive judgment, while, via the right ventrolateral PFC, dampening the actions of the amygdala, a crucial part of the limbic system implicated in the processing of negative affect and associated negative emotions inimical to creative problem solving.

However, extant techniques for enabling actors to explore their understanding of strategic issues and problems by “mapping” their relevant knowledge structures are limited because, ordinarily, they yield representations devoid of emotional content (for representative examples see Daniels et al., 1995; Fiol & Huff, 1992; Hodgkinson, 1997, 2005; Hodgkinson et al., 2004; Huff, 1990). New or modified techniques predicated on ‘hot cognition principles’ (Hodgkinson & Healey, 2011b) are thus required, to enable decision makers to reflect actively on their cognitive and affective reactions, thereby integrating multiple modalities of thought.

## **5. Concluding remarks**

More than a decade has elapsed since Hodgkinson and Sparrow (2002) argued the case for the centrality of the psychological contribution to organizational learning and learning organization notions as a vehicle for enhancing the psychological analysis of strategic adaptation. Over the ensuing years organizational learning scholars and strategic management researchers have continued to over-privilege conscious (‘cold’) cognitive processes and tools and techniques that seek to foster learning through active reflection on explicit knowledge, with only a passing consideration of affective and non-conscious cognitive processes.

Drawing on recent advances in the social neurosciences, this article has questioned further the ‘behavioral plausibility’ of dominant social cognitive strategic management theory pertaining to radical innovation and strategic change. We have offered an alternative, social neuroscience view of human functioning that offers vital prescriptions for successful adaption, thus avoiding rationality facades of the sort highlighted at the outset of this article and illustrated in the case examples throughout.

Our analysis overall adds to the growing body of work demonstrating that dynamic capabilities entail reason and emotion in tandem. As we have seen, emotion is central to enabling radical innovation. However, current organizational practices are predicated on a (bounded) rationality façade, rooted in the cold cognition era. This has unintended consequences for organizations, both in respect of formulation (sensing and seizing) and implementation (transformation) attempts to foster radical innovation.

Contrary to mainstream organizational theory and research pertaining to radical innovation, our analysis suggests that strategic decision makers are unable to sense potential threats and opportunities with sufficient alacrity, primarily due to emotional rather than cognitive reasons; they shield themselves from weak signals and are driven to status quo thinking. Hence, they are unable to grasp opportunities and mitigate threats. Rather, they escalate commitment to failing courses of action. Hence, standard tools and techniques need to be adapted to address this reality, converting them from cold to hot cognition enhancing technologies.

When organizations embark upon programs of competency destroying radical innovation, those affected by the transformative changes in play struggle similarly to adapt with alacrity, again primarily for emotional, as opposed to cognitive, reasons. More precisely, the ensuing threats to their personal and social identities trigger emotional mechanisms inimical to functional adaptation. It thus follows that organizations need to consider anew how they prepare employees for radical innovation, embracing change management tools and processes that enable the effective management of the emotional processes in play. Current approaches to identity management under radical innovation that emphasize cold cognition solutions to the threats posed by transformation are unfit for purpose and, like tools for promoting effective sensing and seizing, need to be adapted to hot cognition enhancing technologies.

In sum, organizational adaptability to the challenges of radical innovation requires architectures and support systems that embrace and augment, rather than ignore or militate against, 'less deliberative' and 'hot' cognitive processes. To deny these biological and psychological 'facts', is to perpetuate a (bounded) rationality façade; that is an approach to decision making that, while acknowledging the cognitive limitations of managers and employees, denies the primary drivers of human behavior in the workplace and beyond.

## **Acknowledgements**

We are grateful to Kevin Daniels, Vicky Story and three anonymous reviewers for their helpful and constructive comments and suggestions on previous drafts.

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