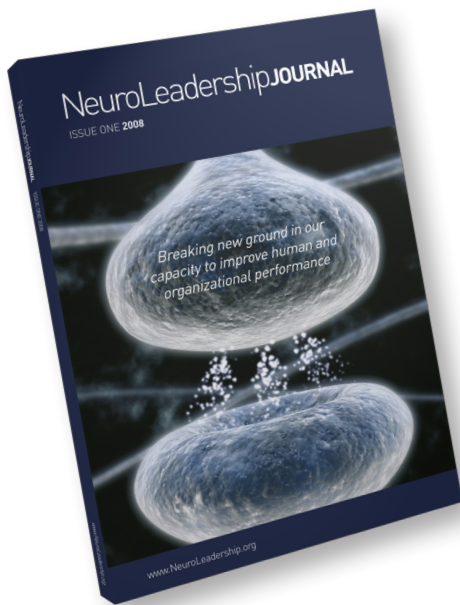


The emerging field of NeuroLeadership

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The emerging field of NeuroLeadership

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Although management and leadership research in the past century has significantly enhanced our understanding of human workplace behavior, recent developments in neuroscience with the potential to significantly advance that research remain largely untapped. Standing upon this rapidly developing body of neuroscience research, and particularly social cognitive neuroscience research, we propose the formalization of a specific new field dedicated and committed to exploring the processes within the brain that underlie or influence human decisions, behaviors, and interactions in the workplace and beyond. Called NeuroLeadership, this interdisciplinary field explores the neural basis of leadership and management practices, effectively bringing about the interface between the tools of social cognitive and affective neuroscience, cognitive neuroscience, integrative neuroscience, neurobiology and other domains within neuroscience, and questions and theories from the leadership and management social sciences. The research objective of this field is to improve leadership effectiveness within institutions and organizations by developing a science for leadership and leadership development that directly takes into account the physiology of the mind and the brain.

The formalization of NeuroLeadership is driven by the overarching need worldwide for the efficient and effective development of leaders and of processes for continuous improvement in leadership quality (Boston Consulting Group, 2008). In the ongoing search for alternative solutions to this leadership crisis, the underlying subtleties and complexities of the leadership development process due to individual differences in the efficiency and sensitivity of brain structures

are increasingly becoming understood and appreciated (Lieberman, 2003). Much of this new comprehension is flowing from a rapid expansion in research on the biological underpinnings of social processes driven by the advent of functional neuro-imaging and other technologies (Ochsner and Lieberman, 2001; Adolphs, 2003). In this light, there are clearly significant benefits to reframing traditional leadership and leadership development theories and concepts through the lens of neuroscience.

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First, neuroscience provides evidence-based, 'hard' science to assist leadership theorists in the development of those leadership skills traditionally considered 'soft' skills

or 'soft' science. As a 'soft' science, leadership skills development has typically been ignored as being beyond the reach of traditional business education and training, with contemporary managers and leadership educators making limited use of the significant and substantial "hard-science" evidence provided by neuroscience and psychology on behaviors relevant and applicable to effective organizational and leadership practices (Rousseau and McCarthy, 2007; Pfeffer and Sutton, 2006). Second, by identifying the active, biological "ingredients" in leadership interventions, the efficacy of those leadership development efforts can be significantly improved. Third, neuroscience provides the necessary scientific rigor to promote the discovery of new and important insights into the leadership development process going forward.

1. History and definition of NeuroLeadership

NeuroLeadership focuses on how individuals in a social environment make decisions and solve problems, regulate their emotions, collaborate with and influence others, and facilitate change; that is, NeuroLeadership engages the "people," as opposed to the functional (Minzberg, 2004), side of business. As a field, NeuroLeadership is emerging in parallel with developments in research technologies which provide researchers with the ability to directly observe brain activity. Those technologies are providing researchers with both confirmation of and new insights into long-held theories and concepts, which to date have largely focused on social psychology theories (Ochsner and Lieberman, 2001). The adaptation of this research to other social sciences in general, and to leadership and leadership development more specifically, is moving much more slowly.

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Developments within the neuroscience domain

The neuroscience world is vast, with over 30,000 scientists worldwide studying a wide range of issues. Based on existing research, the neuroscience fields with the most potential to impact NeuroLeadership include cognitive neuroscience, integrative neuroscience, neurobiology, neurophysiology,

and particularly social cognitive and affective neuroscience. The strong potential interface between the leadership and neuroscience domains of study has come about as a direct consequence of several interrelated developments within the neuroscience domain over the past decade. First, neuroscience researchers began to move away from describing what brain functions are impaired in brain-damaged patients, and began applying more sophisticated experimental methods to normal, healthy individuals. Focusing on processes involved in normal social cognition, the second development was the expanded use of the fMRI to explore and study social cognition. Although used by neuroscientists in the 1990s, it was really only from 2000 that the fMRI began to play an integral role in social psychological research. Since then, social cognitive neuroscience research has grown exponentially, covering such diverse topics as empathy, social rejection, self-awareness, social factors in economic decision-making, theory of mind, social connection, and emotion regulation – all of which are of significant interest to leadership theorists.

Developments within the leadership domain

Although several individual leadership and leadership development practitioners made informal links to neuroscience in the 1990s and early 2000s (Goldman, Boyatzis, and McKee, 2002; Wolfe and Brandt, 1998; Master, 2001), the first reference in the broader academic business literature was in the Harvard Business Review in 2005 (Bennis and O'Toole, 2005). There, in an article focused on the limitations of traditional MBA programs in developing students for leadership roles, leadership experts Bennis and O'Toole specifically pointed to the need for NeuroLeadership, stating: 'Oddly, despite B schools' scientific emphasis, they do little in the areas of contemporary science that probably hold the greatest promise for business education: cognitive science and neuroscience (Bennis and O'Toole, p. 103).' In 2006, Rock and Schwartz published an article that first began to define the field (Rock and Schwartz, 2006). Entitled "The Neuroscience of Leadership," the article became one of the most downloaded articles in strategy+business' history, clearly articulating both frustration with the nature and direction of traditional leadership research, and a decided hunger for more effective tools and techniques. Within the academic business community, economics and, to a more limited extent, marketing, began both to cite neuroscience research in support of their theories and concepts, and to utilize neuroimaging in research (Dickhaut, 2005; Rustichini, 2005; Camerer, Lowenstein, and Prelec, 2005).

Sponsored by an executive coaching company, a business school consortium now led by the University of Iowa, and several consulting firms, the first conference on NeuroLeadership convened in Asolo, Italy, and brought together scientists and practitioners to discuss the development of the field. Following the conference, the field began to draw the attention

of mainstream business publications (The Business Brain in Close Up, 2007; The Brain at Work, 2008), the business community, and business schools (Petersen, Waldman, Balthazard, and Thatcher, 2008). In 2008, NeuroLeadership conferences were held to wider audiences in Sydney, Australia, and in New York. Interest in the field is growing rapidly and broadly, with an internet search using the word "NeuroLeadership" yielding less than 10 hits in 2004, yielding more than 8,700 hits today.

2. Organizing the field

A general overview of each domain reveals that neuroscience, and particularly social cognitive neuroscience, has many of the same research objectives as leadership and leadership development. The fundamental difference lies in the research tools brought to bear on those objectives. Understanding the comparative advantages and disadvantages of the primary research tools used in each of the domains can assist in organizing the NeuroLeadership field and identifying research questions of interest going forward.

Using fMRI, social cognitive neuroscience experiments seek to identify the brain region or regions involved in a process of interest – essentially, where the brain "lights up" when engaging in a specified social psychological process. There can be no face-to-face interactions with fMRIs – research subjects must keep their heads absolutely still during imaging and cannot speak. Typical fMRI experiments require the research subject to watch through video goggles and respond to tasks by pressing buttons on a small computer keypad. Because the signals detected in the brain by the fMRI in the performance of such tasks are "noisy" signals, a number of subjects normally must perform the same task several times before good information is extracted. In those situations where the research objective will depend upon a large number of research subjects each performing a task one time, this task repetition may result in loss of meaning. As a consequence, there are some leadership and leadership development questions that cannot be addressed easily through the use of fMRI research data.

On the other hand, there are several ways in which fMRI research data can make significant contributions to leadership and leadership development research. For example, there are leadership situations which practically and experimentally produce similar behavioral results but which actually rely on different underlying brain mechanisms. In very meaningful ways, fMRI research allows the researcher to clearly distinguish between those two underlying brain mechanisms, something very difficult to do using traditional social science behavioral methods which often rely on self-reported and reaction time measures to test hypotheses. Similarly, fMRI research will allow leadership researchers to identify processes that one would not believe rely on the same brain mechanisms, when in fact they do. Finally, in

contrast to traditional behavioral research, fMRI research may allow the researcher to infer the mental processes in which a subject is engaged just from looking at the activity of the subject's brain as opposed to interrupting the subject and asking "how do you feel" to determine their mental state. Relative to traditional social science experiments, this should prove useful because the subject may not want to report their mental state, may not accurately remember what state they were in before the researcher asked, and, perhaps more importantly to the validity of the underlying experiment, simply reporting their mental state may change the subject's current state or affect how the subject performs on the remainder of the experiment.

...neuroscience, and particularly social cognitive neuroscience, has many of the same research objectives as leadership and leadership development.

With this general understanding of research methodologies, after first reviewing separately and then comparing leadership and neuroscience research topics of interest, four general issue categories of mutual research interest emerge:

- Decision-making and problem-solving
- Emotional regulation;
- Collaborating with and influencing others; and,
- Facilitating change.

Decision-making and problem-solving

In traditional leadership and management research, decision-making and problem solving has focused on the nature of decision-making (Harrison, 1999), the types of decisions to be made (Huber, 1980; Collins, Ryan, and Mutuski, 1999), decision-making conditions (Miller and Starr, 1976; Hodgkinson, Brown, Maule, Glaister, and Pearman, 1999), and a leader's decision-making style focusing on subordinate participation in the decision-making process (Vroom and Yetton, 1973; Vroom and Jago, 1988; Vroom, 2000). Research first focused

on probabilistic or prescriptive models equating good decision making with probabilistic reasoning, with decision making a matter of carrying out rational calculations, logical operations, and statistical computations that view the human brain as a complex machine (Edwards, 1954; Gigerenzer, 2000; Mullen and Roth, 1991). More recently, focus has shifted to behavioral models, arguing that a person's computational ability was limited, and began to explore the heuristics and biases decision makers commonly employ in making decisions, many of which were understood to operate below the level of conscious awareness (Simon, 1945; Simon, 1987; Kahneman, Slovic, and Tversky, 1982; Baxerman, 2005; Plous, 1993). Further inquiries within the bounds of the behavioral models have looked to the roles intuition (Brousseau, Driver, Hourihan, and Larsson, 2006; Hayashi, 2001), commitment (Shaw and Ross, 1988; Bobocel and Meyer, 1994), and risk propensity (McNamara and Bromiley, 1999) play in a leader's decision-making process.

...innovation is another important leadership and management thinking process.

How can neuroscience add to the body of traditional leadership research on problem solving and decision making? There is a tendency in the leadership and management literature (and in the real world) to view decision-making and problem solving as identical activities (Huber, 1986), with the terms often used interchangeably (Costello and Zalkind, 1963). If we view decision-making as a managerial response to the question "What are my choices?" and problem solving as a managerial response to the question "What has gone wrong?," can neuroscience tell us whether the brain uses the same algorithm in bringing about a solution? Can knowing this answer assist leaders in getting the most from organizational members' mental resources?

Several theorists suggest a more systematic process approach to decision-making and problem solving to combat the implicit nature of these processes in group settings (Hammond, Keeney, and Baffa, 1999; Kepner and Tregoe, 1965). Although decision making in social settings has only just begun to receive attention amongst neuroscientists (Izuma, Saito, and Sadato, 2008), a number of important questions with potential to significantly impact leadership and leadership development have emerged. Does "making thinking visible" through the use of such processes when

explicated serve to overcome the processing limits of the prefrontal cortex and increase performance within those limits (Shiffrin and Nosofsky, 1994; Miller, 2001; Halford, Cowan, and Andrews, 2007; Halford, Baker, McCredden, and Bain, 2005; Pashler and Christian, 1994; Gailliot, Baumeister, DeWall, Maner, Plant, Tice, Brewer, and Schmeichel, 2007; Pashler, Johnston, and Ruthruff, 2001)? With leadership and management theorists showing that an overwhelming majority of top managers consider it a sign of immaturity to express sentiments during decision-making meetings (Argyris, 1966; Argyris, 1971; Holloman, 1992; Martin, 1993), what does social cognitive neuroscience have to say about the use of such suppression mechanisms to inhibit personal feelings, particularly in those situations where personal values and organizational objectives conflict (Ray, Ochsner, Cooper, Robertson, Gabrieli, and Gross, 2005)?

As evidenced by the volume of leadership and management literature and research spent in defining it, innovation is another important leadership and management thinking process. As in decision-making and problem solving, the creative process is in large measure an implicit process. To the extent performance gains can be had by making these processes explicit (Herbig, Muller, and Petrovic, 2007; Bussing and Herbig, 2003), how can cognitive neuroscience assist us in the explication process?

To the extent the explication process proves difficult, can neuroscience assist leadership theorists in developing ways to maximize unconscious processes to better facilitate breakthrough thinking (Bowden, Jung-Beeman, Fleck and Kounios, 2005; Ohlsson, Carter, MacDonald, Botvinick, Ross, Stenger, and Noll, 1984; Kounios, Frymiare, Bowden, Fleck, Subramaniam, Parrish, and Jung-Beeman, 2006; Lehrer, 2008; Rock, 2006)? In the same regard, can neuroscience assist leadership theorists in better understanding the role of dopamine (interest) and norepinephrine (alertness) in mental performance, and their management through novelty, reward, visualization and other tools (Vijayraghavan, Wang, Birnbaum, Williams, and Arnsten, 2007; Schultz, 2001; Waelti, Dickinson, and Schultz, 2001)?

Emotional regulation

Early research on leader's emotions and emotional regulation focused on identifying those personal traits and behaviors which, among other things, allowed effective leaders to stay cool and confident under pressure (Yukl, 1981; Kohs and Irle, 1960; Kirkpatrick and Locke, 1991; Likert, 1961; Likert, 1967; Stogdill and Coons, 1957). Advancements in the field of psychology led to the use of aptitude and personality tests in the 1950s and 1960s, allowing investigators to probe deeper for insights into the leader mind (Stogdill, 1948). Broadly speaking, this early lineage of research focused on conflict and stress

management as personal traits that seemed to contribute most to effective leadership (Stogdill, 1974; Bass, 1990). This inquiry was extended in the 1980s to teams and teambuilding, again with considerable attention being placed on conflict and conflict management at both the organization and organizational member level (Rahim, 1990).

...organizational members most experience conflict in situations or circumstances which bring about role conflict...

It was generally concluded that organizational members most experience conflict in situations or circumstances which bring about role conflict (Kahn, Wolf, Quinn, and Snoek, 1964; Tubre and Collins, 2000) or role ambiguity (Kets de Vries, 1989; Van Sell, Brief, Schuler, 1981). This interpersonal conflict was seen as being dysfunctional by creating anger, distrust, fear, rejection, or resentment in and among organizational members (Fillely, 1975; Blake and Mouton, 1984). In working to develop effective leadership skills, theorists observed conflict management styles representing various combinations of assertiveness and cooperativeness a leader might use in a conflict situation (Van de Vliert and Kabanoff, 1990; R. Likert and J. G. Likert, 1976; Lee, 1990). More recently, certain kinds of conflict have come to be viewed as being beneficial, with the leader's goal being to find and maintain the optimal amount of conflict that best fosters organizational member or group performance as the case may be (Eisenhardt, Kahwajy and Bourgeois III, 1997; Pinkley and Northcraft, 1994).

With regard to stress and stress management, research initially observed leaders (and also followers) subjected to extreme conflicts, ambiguity, or the ineffective conflict management styles of others in defining work-related stress (Mattesson and Ivancevich, 1987). Stress was understood to create a nonspecific response in the leader, which meant that certain emotional, physical, and cognitive responses occurred unconsciously (Seyle, 1980). Individual stress management actions included, among other things, disciplining oneself not to overreact emotionally, learning how to relax, exercising, and modifying one's behaviors and attitudes in confronting stressful situations (Nelson, J. C.

Quick, J. D. Quick, 1989; Williams, 1989; Swanbrow, 1989; Baron, 1989). Organizational stress management actions included setting clear objectives to reduce ambiguity, providing emotional support, and developing "wellness" programs (Nykodym and George, 1980; Jayaratne and Chess, 1984; Baron, 1989).

More recently, both leadership researchers and psychologists have come to explicitly recognize the importance of emotion and emotional stability in effective leadership (Goleman, 1998). This lineage of research suggests that emotion, more so than intellectual ability, drives a leader's thinking in decision-making and in interpersonal relationships (Goleman, Boyatzis and McKee, 1995; Goleman, 1995; Boyatzis and McKee, 2005; Goleman, 2006). The leadership literature characterizes a leader who is emotionally stable as being someone who handles stress well, is able to manage criticism, and generally does not take mistakes personally (Daft, 2008). Emotional intelligence has come to refer to a person's abilities to perceive, identify, understand, and successfully manage their emotions and the emotions of others. In this sense, it is generally understood that effective leaders harness and direct the power of emotion to build trust and improve follower satisfaction, morale, and motivation, and thus enhance overall organizational effectiveness. Current research is focusing on understanding the role of a leader's emotion and emotion management skills and abilities in managing change (Megerian and Sosik, 1996; Ashkanasy and Daus, 2002), motivation (Hatfield, Cacioppo, and Rapson, 1994), and leadership development (Boyatzis, Smith, and Blaize, 2006).

Current research is focusing on understanding the role of a leader's emotion and emotion management skills and abilities in managing change.

How can neuroscience add to the body of traditional leadership research on emotional regulation? Social cognitive neuroscientists and psychologists have begun to

more clearly articulate the deleterious consequences of stress (Dickerson and Kennedy, 2004; Ray, 2004; Segerstrom and Miller, 2004) and responsive management theories and approaches are beginning to emerge (Boyatzis and McKee, 2005). With stress clearly a driver for arousing the limbic system (McClelland and Jemmott III, 1980; Sapolsky, 1996; McEwen, 1998; LaDoux, 2002), how can neuroscience assist leadership theorists in better understanding the “minimize danger - maximize reward response,” and particularly the strength of the “minimize danger” response (Gordon, 2000; Baumeister, Bratslavsky, and Vohs, 2001; Klein, 2002; Fredrickson, 2001; Naccache, Gaillard, Adam, Hasboun, Clemenceau, Baulac, Dehaene, and Cohen, 2005)? Can it assist leadership theorists in better understanding optimal levels of stress and productivity in the workplace (Vijayraghavan et al., 2007)?

Leadership researchers have come to understand that managing emotions does not mean suppressing or denying them...

With leadership and management beginning to more fully explore and address the behavioral, psychological, and medical consequences of workplace stress and its impact on performance (Landy, Quick, and Kasl, 1994), how can neuroscience research on the complex dynamic between the prefrontal cortex and the limbic system, and on how limbic system arousal impacts thinking and performance, more clearly define this important area of leadership and leadership development research (Mather, Mitchell, Raye, Novak, Greene and Johnson, 2006; Hariri, Bookheimer and Mazziotta, 2000; Phelps, 2006; Arnsten, 1998; Birnbaum, Yuan, Wang, Vijayraghavan, Bloom, Davis, Gobeske, Sweatt, Manji and Arnsten, 2004)? With a growing recognition of emotions and emotional stability as core ingredients in the effective leadership process within the leadership literature, how will neuroscience’s understanding of the effects and consequences of those experiences that generate strong emotions in organizational members – including experiences that create strong, negative autobiographical

memories (LeBoux, 1998), uncertainty (Hedden and Gabrieli, 2006; Mason, Norton, Van Horn, Wegner, Grafton and Macrae, 2007), and a lack of autonomy (Donny, Bigelow and Walsh, 2006; Dworkin, Mirkis, and Smith, 1995; Mineka and Hendersen, 1985) – impact leadership and leadership development research? Leadership researchers have come to understand that managing emotions does not mean suppressing or denying them, but rather means understanding and using that understanding to deal with situations productively (Weisinger, 1998). In this sense, how can the neuroscience-validated techniques of mindfulness (Farb, Segal, Mayberg, Bean, McKeon, Fatima and Anderson, 2007; Tang, Ma, Wang, Fan, Feng, Lu, Yu, Sui, Rothbart, Fan and Posner, 2007; Slagter, Lutz, Greischar, Francis, Nieuwenhuis, Davis and Davidson, 2007), labeling (Lieberman, Eisenberger, Crockett, Tom, Pfeifer and Way, 2007), and reappraisal (Ray, Ochsner, Cooper, Robertson, Gabrieli, and Gross, 2005; Gross and John, 2003; Ochsner, Ray, Cooper, Robertson, Chopra, Gabrieli and Gross, 2004; Richards and Gross, 2006) provide leaders with greater personal control over negative emotionality and stress, and thereby enhance well being?

Collaborating with and influencing others

Leadership theorists initially placed research focus on the leader’s power and influence, defining power as “an individual’s ability to influence another person to bring about desired outcomes” and influence as “the affect a person’s actions had on the attitudes, values, beliefs or actions of others (Burns, 1978; Hitchner, 1992; Dahl, 1957).” Much of the early work was small-group, sociological research on roles (Katz and Kahn, 1978; Stewart and Barrick, 2000), norms (Feldman, 1984), cohesiveness (Bishop and Scott, 1997), and group size (Lawless, 1972). Within the context of leading and leadership, theorists then explored influence and collaboration by examining teams and teamwork, looking first to the reasons why people join and why they behave as they do within groups or teams (Shaw, 1985; Roethlisberger and Dickson, 1939; Homans, 1950; Maier, 1967), and then later to group dynamics and stages of group development (Tuckman, 1965). Building on research on motivation (Maslow, 1943), research moved toward behavioral models to build theories of leadership which focused on differences in the actions or behaviors of effective versus ineffective leaders and how those behaviors influence teams or followers (McGregor, 1960). From the 1980s, research moved toward participative management and team building (Block, 1994; McCarthy, Faerman and Hart, 1995), leading to more recent inquiries into the concept of high-performance teams (Pfeffer, 1994; Katzenbach and Smith, 1993).

What can NeuroLeadership add to the body of traditional leadership research on collaborating with and influencing others? The potential contributions in this area are particularly interesting, with current neuroscience research

overlapping a broad range of leadership behavior. The driving force of social cognitive neuroscience research is the simple principal that the brain is “deeply social (Ochsner and Lieberman, 2001).” From this perspective, social cognitive neuroscientists argue persuasively that “belongingness” is misplaced in the middle of Maslow’s needs hierarchy and would be more accurately positioned at its very foundation (Lieberman, 2007). Seemingly consistent with this social cognitive neuroscience belief, both the academic and business communities recognize the need to be a team player is so strong today that many organizations actively resist hiring someone who does not want to work with others (How to avoid hiring the prima donnas, Wall Street Journal, 2000).

Brain scans are clearly showing there is relatively little difference between physical pain and social pain...

Brain scans are clearly showing there is relatively little difference between physical pain and social pain (Eisenberger and Lieberman, 2004). If social pain has evolved much like hunger, thirst, or any other form of pain – as a signal to change behavior – and, as in the case of hunger or thirst, if the social pain goes unheeded it takes a serious toll on mind and biology and becomes increasingly difficult to overcome, what can social cognitive neuroscience tell us about the key drivers of social pain (and pleasure) in the workplace and particularly from the standpoint of workplace status (Zink, Tong, Chen, Bassett, Stein and Meyer-Lindenberg, 2008; Eisenberger and Lieberman, 2004; Chiao, Bordeaux, and Ambady, 2004), relatedness (Cacioppo and Patrick, 2008; Kosfeld, Heinrichs, Zak, Fischbacher, and Fehr, 2005; Mitchell, Macrae and Banaji, 2006), and fairness (Tabibnia, Satpute, and Lieberman, 2008; Seymour, Singer and Dolan, 2007)? Can social cognitive neuroscience assist leadership and leadership development research by offering a deeper understanding of the workplace consequences of various leadership styles, and particularly as differences in those styles relate to how the work environment, and thus performance, is impacted (Baumeister, Twenge, and Nuss, 2002)? With

neuroscience research showing that disruptions in the social environment most affects an individual’s higher-order thinking (Baumeister, et.al. 2002), what does it tell leadership theorists about the impacts of such a workplace environment on creativity and innovation? With much of an organization’s culture and workplace cohesion driven by trust, integrity, and shared values (Whitmire, 2005; Kouzes and Pozner, 1993), how can neuroscience research on values (Takahashi, Kato, Matsuura, Koeda, Yahata, Suhara and Okubo, 2008) and trust (Zahn, Moll, Paiva, Garrido, Krueger, Huey, and Grafman, 2008) guide leadership and leadership development theorists in building more productive work environments?

Within the leadership literature, social awareness relates to one’s ability to understand others – socially aware leaders practice empathy, which means being able to put oneself in other people’s “shoes,” sense their emotions, and understand their perspective. Clearly, our brains respond to other people in ways that are involuntary and automatic. As Adam Smith observed more than 300 years ago, we all wince when someone else cuts their finger (Smith, 1752). Neuroscientists refer to this phenomenon in the brain as “mirror neurons (Rizzolatti, Fadiga, Fogassi and Gallese, 1999).” That is, observing an action being performed by another activates the observer’s mirror neuron system, bringing about a reaction in the observer’s brain very much the same as the person performing the action. Importantly, not only is the mirror neuron system activated through the observation of a physical act but also through facial expressions associated with such emotions as guilt or embarrassment (Wicker, Keysers, Plailly, Royet, Gallese, and Rizzolatti, 2003).

Clearly, our brains respond to other people in ways that are involuntary and automatic.

How can an understanding of mirror neurons assist leaders in better interpreting and appreciating facial expressions, body language, intonation in speech, and other social cues that allow them to form impressions of other people, including the ability to adapt another person’s perspective and assign mental states and intentions to that person (Phillips, Young, Senior, Brammer, Andrew, and Calder, 1997; Norris and Cacioppo, 2007; Iacoboni, Molnar-Szakacs, Gallese, Buccino, Mazziotta, and Rizzolatti, 2005; Montgomery and

Haxby, 2008). And, how is that impacted by the degree to which a person is in social pain (Gardner, Pickett, Jefferies, and Knowles, 2005) or, as in the case of a business meeting, performance evaluation, or other incidences of feedback, in expectation of social pain (Pickett and Gardner, 2005)? In the same sense, with social interaction leading to social cohesion, can social cognitive neuroscience assist leadership theorists in understanding what affects the increased use of e-mail, texting and particularly video conferencing are having on both organizational and organizational member performance (Kraut, Patterson, Landmark, and Keisler, 1999)?

...it is well understood and appreciated that providing feedback to subordinates about their performance is one of the most important tasks confronting any leader.

To illustrate research overlaps more specifically, it is well understood and appreciated that providing feedback to subordinates about their performance is one of the most important tasks confronting any leader. Giving and receiving feedback is often difficult for both leaders and followers, with leaders being concerned that even the slightest criticism will provoke anger or tears and subordinates terrified they will hear nothing but complaints (Jackson and Strober, 1987; Eisenberg and Witten, 1987). While the leadership literature does recognize that proper training can assist leaders in conducting more effective feedback interviews (Nathan, Mohrman, and Milliman, 1991), can the social cognitive neuroscience concept of social pain resulting from feedback's impact on the status and relatedness of the follower receiving it give leadership theorists insights into different and more effective feedback techniques? If organizations profit when

followers at any level seek feedback and are able to deal well with criticism, can the neuroscience concepts of "labeling" and "reappraisal" discussed in the Emotional Regulation section above further impact the development of those same feedback techniques from the follower's perspective? If empathy is truly one of the leader's most powerful tools during the feedback process (Daft, 2008), can the neuroscience concept of mirror neurons assist leaders in both understanding and accentuating this important leadership attribute both inside and outside the feedback process (Carr, Iacoboni, Dubeau, Mazziota, and Lenzi, 2003)?

Facilitating change

Research on change initially focused on organizational change (Armenakis and Bedeian, 1999), examining the forces of change (Hitt, 2000; Beer and Nohria, 2000) and processes for bringing about change within the organization (Levin, 1951; Porras and Silvers, 1991; Weick and Quinn, 1999). In understanding the success or failure of an organization to change, attention focused on the organization's resistance to change and the programs that could be put in place to promote acceptance (Lawrence, 1954; Kotter and Schlesinger, 1979; Sculley, 1987; Drucker, 1989). More recently, theorists have focused on the processes and key characteristics of leaders who accomplish successful change projects (Kotter, 1996; Vas, 2001). In drawing a distinction between leading for change and leading for stability, a "transformational leader" has been defined by theorists as a leader with the ability to bring about significant change by focusing on such qualities as vision and shared values in order to build relationships rather than on the use of rules, directions, and incentives (Burns, 1985; Tichy and Devanna, 1986; Kuhnert and Lewis, 1987).

Whether from a management or leadership perspective, much of the research on facilitating change has focused on motivating organizational member behavior (Vroom, 1964). That is, much of the research has been behavior-based, focused on investigating the psychological nature of organizational member behavior, including studies on key personality traits (Goldberg, 1990; Mount, Barrick and Strauss, 1994; Judge, Martocchio and Thoreson, 1997), functional differences (Jung, 1971; McCrae and Costa, 1989), attitudes (Smith, Kendal and Hulin, 1969; Steers, 1977; George and Jones, 1996), perceptions (Kelley, 1971), and creativity (Woodman, Sawyer, and Griffin, 1993; Tabak, 1997). A clearer understanding of organizational member behavior was thought to provide leaders with the ability to motivate people appropriately in the interest of organizational change and performance (Pfeffer, 1998). This lineage of research focused first on economic gain (Taylor, 1911) and then on the social needs of the individual (Mayo, 1945; Rothlisberger and Dickson, 1939). A variety of models were offered by motivational theorists (Allderfer, 1972;

Herzberg, 1987), and research identified individual needs such as achievement, affiliation, and power as important drivers (McClelland, 1961).

...much of the research on facilitating change has focused on motivating organizational member behavior.

Concerns about how motivation occurs generated considerable research on the process of motivation emphasizing expectations (Vroom, 1964; Porter and Lawler III, 1968), fairness (Adams, 1963), goal setting (Locke, 1968; Latham and Baldes, 1975; Fried and Slowik, 2004), and reinforcement (Skinner, 1971; Luthans and Kreitner, 1985; Stajlovis and Luthans, 1997) in explaining the various approaches used by leaders in bringing about behavioral change. Research into the application of motivational strategies focused on empowerment (Quinn and Spreitzer, 1997), participation (Glew, O'Leary-Kelly, Griffin and Van Fleet, 1995), alternative forms of work arrangements (Graham, 1996; Cohen and Gadon, 1978), and performance-based rewards systems (Wiley, 1993; DeMatteo, Eby and Sundstrom, 1998).

How can neuroscience add to the body of traditional leadership research on facilitating change? With estimates that some two thirds of all organizational change efforts fail or at best deliver mediocre results (Beer and Nohria, 2000; Kotter, 2008), leadership theorists assert that both organizations and organizational members view such initiatives as being more threat than opportunity (Gilbert and Bower, 2002). In assisting leadership theorists in understanding organizational member perceptions and expectations of change initiatives, how can neuroscientific understanding of the brain's approach-avoidance response – its fundamental organizing principle to “minimize danger and maximize reward” – provide insight (Gordon, 2000; Cogill, McHaffie, and Yen, 2003; Arslan, 2006; Beauregard, 2007)? With leadership research showing that communication helps organizational members in coping with change (Jaffe, Scott and Tobe, 1994; Schweiger and DeNisi, 1991), how can social cognitive neuroscience research on uncertainty (Hedden and Gabrieli, 2006), autonomy (Donny, Bigelow, and Walsh,

2006), and status (Zink, Tong, Chen, Bassett, Stein, and Meyer-Linenderg, 2008; Chiao, Bordeaux and Ambady, 2003) improve leadership theorists' understanding of what makes such communications effective in reducing organizational member resistance? With most organizational change models or frameworks emphasizing the importance of establishing and communicating the goals and objectives of the change initiative (Kotter, 1996), how can social cognitive neuroscience and its research on the importance of goals on brain function, impact the importance of goals and goal setting in leading change (Berkman and Lieberman, in press)? Or, similarly, by explaining functional differences in leader communications that would move organizational member thinking away from a resistive problem-solving orientation toward a far more receptive goal orientation (Darnon, Harackiewicz, Butera, Mugny, and Quiamzade, 2007).

...getting people to change long entrenched habits, such as changing the way they work together in an organization, is not easy.

Through their research on resistance to change, leadership theorists understand that getting people to change long entrenched habits, such as changing the way they work together in an organization, is not easy. In providing guidance to organizations in overcoming such resistance, theorists have long touted the importance of organizational learning (Simonin, 1997; Senge, 1990; Garvin, Edmondson, and Gino, 2008) through such tools and techniques as coaching (Boyatzis, Smith and Blaize, 2006; Rock and Donde, 2008; Passmore, 2007; Feldman, 2005), mentoring (Bell, 2000; Kram, 1988; Roche, 1979), training (Huselid, Jackson and Schuler [1997], employee development programs (Jacobs and Washington, 2003), executive development programs (Griffin, 2003; Kaiser and Kaplan, 2006), work assignments (Brown and Reich, 1997), and corporate universities (Meister, 1998) as efforts to bring about improved employee performance, and therefore to facilitate organizational change. In each case, the underlying research suggests that the success of such programs is some function of the organizational member's level of

self-awareness – a personal sense of strengths and weaknesses, and vision of continuous advancement and personal growth. How can neurosciences' growing understanding of the relationship between cognitive control and mindfulness assist theorists in defining more effective leadership development change tools and techniques (Bishop, Lau, Shapiro, Carlson, Anderson, Carmody, Segal, Abbey, Specia, Velting and Devins, 2004; Brown and Reich, 1997; Schwartz, Stapp and Beauregard, 2005; Libet, 1999)? How can neuroscience's growing understanding of neuroplasticity in the context of volition, interest and attention provide insights and guidance to leadership theorist's development quest, particularly in the growth areas of coaching and mentoring (Schwartz and Begley, 2002; Schwartz, 1999)?

*Neuroscience
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3. Conclusion

Although the research linkages between psychology and leadership are long-held and productive, the formal research linkages between leadership and neuroscience are much less developed. Still, the contributions which social cognitive neuroscience research have and can make to social psychology differ little from the contributions it can make to furthering and deepening our understanding of leadership and leadership development. The potential for substantive advances in both domains is significant and important. Neuroscience is very rapidly beginning to show the anatomy and physiology of the social science research on leadership. Still, while the interface between neuroscience and leadership research seems clear, a quick survey of the leading management and a leading leadership textbook shows few if any cites to neuroscience literature and research. Given the potential benefits to both domains, the authors would like to emulate the words of the leading social cognitive neuroscientist Matthew Lieberman: "It may be time for leadership theorists to take a neuroscientist to lunch".

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