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Neurological Correlates to Authentic Leadership

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ABSTRACT

There is an emergent synergy between neuroscience and organizational research which includes theoretical and practical implications for authentic leadership. This article reviews four facets of authentic leadership: self-awareness, relational transparency, balanced processing and internalized moral perspective against the theoretical and empirical backdrop of neuroscience with particular attention to social cognitive and affective neuroscience. A number of insights as to theoretical propositions and developmental initiatives are offered in order to advance our understanding of authentic leadership.

Key Words: authentic leadership, neuroLeadership, social cognitive and affective neuroscience, leadership development

Against the backdrop of financial turmoil, ethical scandal of global proportions, and clashes of culture across age, ethnicity and socio-economic status, the need for effective leadership has become increasingly salient and is now recognized as critical (Charan, 2009). The efficacy of leadership development has been called into question (Haines, 2009) with the suggestion that new skills need to be considered, in particular the ability to cope with stress and uncertainty while maintaining a positive focus on the future (Nicholson, 2009). In addition to new skills, there is a requirement for leadership development to adopt more holistic methodologies beyond traditional emphasis on behavioural change, including emotional and neuroendocrine aspects of learning (Boyatzis, Smith & Blaize, 2006).

Turbulence, uncertainty and complexity have impelled research in leadership theory and leadership development to become more eclectic at organizational (Darling & Heller, 2009), group (Nemanich & Vera, 2009; Rowland & Parry, 2009) and individual (Avolio, Walumbwa & Weber, 2009) levels of analysis. There is much more latitude for exploration beyond behaviour into the realms of biology, cognition, emotion and spirituality. This article explores leadership from a neuroscientific perspective.

Advances in technological innovation (functional magnetic resonance imaging fMRI, positron emission tomography PET, and qualitative electro-encephalography QEEG) have enabled neuroscience, in particular, social cognitive and affective neuroscience, to provide tangible research insights as to the biological and physiological underpinnings of social interaction. Ochsner and Lieberman (2001) define social cognitive neuroscience as an emergent interdisciplinary field which aims to understand human interactions at the intersection of social, cognitive and neural spheres of science.

The contribution of cognitive neuroscience to organizational research has been recognized in the literature. In November 2007, the *Annals of the New York Academy of Sciences* devoted an entire issue (# 1118) to the social cognitive neuroscience of organizations. Butler and Senior (2007) discuss the benefits and limitations of cognitive neuroscience and define the field of organizational cognitive research. A variety of topics were covered, including rewards and social information (Caldu & Dreher, 2007), fairness and cooperation (Tabibnia & Lieberman, 2007), teamwork (Levine, 2007), change (Yeats & Yeats, 2007), and strategy (Klein & D'Esposito, 2007).

This article is based on the proposition that neuroscience has the potential to inform leadership research, including leadership development, with novel theoretical propositions as

well as provide the substantiation of tangible, hard, scientific evidence (S. J. Peterson, Balthazard, Waldman & Thatcher, 2008; Ringleb & Rock, 2008). It is important to acknowledge that the focus of this article is “leader-centric,” while recognizing that leadership has been researched from a variety of perspectives, including: leadership as the product of a relationship between social actors as well as critical and follower perspectives on leadership. Jackson and Parry (2008) provide insights as to the various perspectives from which the phenomenon of leadership has been researched.

Ringleb and Rock (2008) propose an emergent field of scientific inquiry at the nexus between neuroscience and leadership called “NeuroLeadership”. They define NeuroLeadership and its purpose as follows:

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 (Ringleb & Rock, 2008: 3).

The purpose of this article is to hypothesize as to the potential contribution of NeuroLeadership to increased insight and understanding of authentic leadership, including the future development of leaders as to greater authenticity and self-awareness. Authenticity is not a new construct. Inscribed in the stone at the Oracle of Delphi was the admonition: γνωθι σεαυτόν (gnothi seauton = know thyself). Set in the middle ages, Polonius (Shakespeare’s Hamlet) advises his son who is leaving for France: “to thine own self be true”. Within the corporate world, the writings of American business executive, Chester Barnard (1938), have been used as exemplary perspectives on authentic leadership (Novicevic, Harvey, Ronald & Brown-Radford, 2006). There has, however, been a marked increase in the salience of this construct in light of recent catastrophic leadership failures, including Bernie Ebbers at Worldcom (Scharff, 2005), Kenneth Lay and Jeffrey Skilling at Enron (Stein, 2007), and more recently, and perhaps most tragically, Bernard Madoff and his \$65 billion Ponzi fraud (Kranacher, 2009). The resurgence of interest in authentic leadership has been evident in both applied (George, Sims, McLean & Mayer, 2007) and academic management literatures (Gardner, Avolio, Luthans, May & Walumbwa, 2005); see also *The Leadership Quarterly*, Volume 16, Number 3, 2005.

Hartner (2002) defines authenticity as: “owning one’s personal experiences, be they thoughts, emotions, needs, preferences, or beliefs, processes captured by the injunction to know oneself” (p. 382) and behaving in accordance with the true self. Luthans and Avolio (2003) define authentic leadership as: “a process that draws from both positive psychological capacities and a highly developed organizational context, which results in both greater self-awareness and self-regulated positive behaviours on the part of leaders and associates, fostering positive self-development” (p. 243). There is general consensus in the literature that the construct of authentic leadership is multi-dimensional, however, debate ensues as to its component elements. Prominent in the literature is a four-component model (Ilies, Morgeson & Nahrgang, 2005) building from Kernis’ (2003) conceptualization. This model comprises the capabilities of self-awareness, unbiased processing, authentic behaviour/acting, and authentic relational orientation.

This article relies on the development and validation of a theory-based measure of authentic leadership by Fred Walumbwa, Bruce Avolio and their colleagues (2008) which builds on the earlier work of Ilies and colleagues (Ilies, et al., 2005). Walumbwa, Avolio and colleagues (2008) developed and tested a theory-based measure of authentic leadership called the Authentic Leadership Questionnaire (ALQ). The theory of a multidimensional construct has been supported by confirmatory factor analysis. Four factors were confirmed as follows: self-awareness, relational transparency, balanced processing and internalized moral perspective. In order to address cross-cultural validity and generalisability, five separate samples were used in their study from China, Kenya and the United States.

This article applies the resultant conceptualization of authentic leadership as follows:

Authentic leadership is a pattern of leader behaviour that draws upon and promotes both positive psychological capacities and a positive ethical climate, to foster greater self-awareness, an internalized moral perspective, balanced processing of information, and relational transparency on the part of leaders working with followers, fostering positive self-development (Walumbwa, et al., 2008: 94).

In this research each of the four facets of authentic leadership are examined against the neuroscience literature with the goal to identify relevant theoretical propositions and developmental insights. The central proposition is that neuroscience has the potential to contribute to our understanding of authentic leadership. With respect to this central proposition, neuroscience has shown that the brain characterizes the opposing attributes of neural plasticity and rigidity. The brain, in its default network, favours well-worn neural pathways (a.k.a. habits).

However, there is significant evidence (Alvaro, Amir, Felipe & Lotfi, 2005) that the brain is plastic and capable of creating new patterns. A lot has to do with teaching individuals the practice of focused attention. One tangible methodology in this regard is neurofeedback in which participants are hooked up to an EEG device and asked to watch a video screen which monitors brain and central nervous system activity (S. J. Peterson, et al., 2008). Through a prescribed set of exercises participants can learn to reinforce positive neural networks and extinguish negative / dysfunctional neural networks. The research of Robert Thatcher is exemplary in this area (Thatcher, Walker, Biver, North & Curtin, 2003). EEG methodology is now being applied to leadership development. For example, Arizona State University offers brain mapping as part of its leadership development for MBA students (S. J. Peterson, et al., 2008).

SELF-AWARENESS

The first component of authentic leadership is self-awareness. A defining characteristic of humans is that they are cognitively self-aware. Each individual is capable of building a mental model of self within his or her environment; one that has meaning and influences day-to-day behaviour. This mental model is multidimensional. It includes a sense of positive and negative attributes. Self-awareness is informed internally through introspection and personal insight and externally through social interaction and attention to one's social impact. Kernis (2003) defines self-awareness as: "awareness and trust in one's motives, feelings and desires, and self-relevant cognitions. It includes, but is not limited to, being aware of strengths and weaknesses, trait characteristics and emotions" (p. 13).

There is a considerable body of literature in neuroscience devoted to the concept of self-awareness. Gusnard (2005) reviews functional imaging in the representation of self and concludes that there is empirical convergence on: "a set of brain areas that appear to play a significant role in permitting conscious access to representational content having reference to self as an embodied and independent experiencer and agent" (p. 679). Morin (2006) provides conceptual clarity as to self-awareness by reconciling levels of consciousness from a neurocognitive perspective. In his article, self-awareness spans from meta-self-awareness (being aware that one is self-aware) to self-awareness, to consciousness, to unconsciousness. Focquaert and colleagues (2008) integrate evolutionary and neuroscience perspectives on self-awareness. They propose that humans have an evolutionary edge in self-awareness due to our unique ability to introspect.

This article discusses the neuroscience literature in three specific areas relevant to leadership theory: self-knowledge, mindfulness and personal insight. Recommendations are made as to how neuroscience can be applied to develop greater self-awareness in leaders.

Self-Knowledge – Self-knowledge emanates from a variety of sources. We rely on direct appraisals which involve introspection into first-hand experiences and specific life events. In addition, we use reflected appraisals based on interpretation of how we are seen by others. Ochsner and colleagues (2005) conducted two fMRI experiments into the neural correlates of direct and reflected self-knowledge. They found evidence that neural systems mediate how we use direct and reflected knowledge: “the neural systems ... involved in direct appraisals of self and close others may have more in common than those supporting direct appraisals of self and non-close others” (p. 808). The implication for leadership development is that we are prone to ignore data about self from people we don’t know in favour of data about self from those close to us. Furthermore, there is evidence that direct and reflected appraisals of self use the same neural pathways to create self-knowledge. The implication here is that reflected appraisals may be interpreted and biased through the cognitive filter of our own beliefs about self.

Therefore, authentic leadership development needs to recognize the importance of reflected data about self, including data from unfamiliar sources and to instil a sense of caution as to potential bias from existing self beliefs.

Mindfulness - The neuroscientific study of mindfulness has theoretical and practical implications for developing enhanced self-awareness in leaders. Mindfulness is defined as: “awareness of one’s present thoughts, emotions and actions” (Tang & Posner, 2008: 33). These researchers go on to state: “Mindfulness may include strong self-awareness and self-observation, or ‘waking up’ and seeing things as they are” (p. 33). Subsumed under mindfulness is the practice of meditation, sometimes called “right-mindfulness” which emphasizes focus on the present moment. Meditation – focused attention on a particular thought or object – is now being taught to medical professionals to improve performance and alleviate stress (Hassed, 2008; Saunders, Tractenberg, Chaterji & Amri, 2007). It is reasonable to suggest that similar programs should be available to business professionals as part of authentic leadership development.

Personal Insight - Personal insight is a requirement of self-awareness. Neurological research (Jung-Beeman, Collier & Kounios, 2008; Kounios, et al., 2008) has shown that positive mood and rest are the best conditions to facilitate insight. In this regard, one might postulate whether stressed executives, dealing real-time with complexity and competing external demands, have the

physiological capacity to attend to internal thoughts and achieve valuable personal insights. Added to this, neuroscience research has shown that the brain needs a good supply of glucose to work well. When glucose levels drop our ability to make decisions and self-regulate deteriorates (Rosenthal, et al., 2001). Further, research needs to be conducted as to whether physiological deficits (stress, lack of sleep, low blood sugar) in the intense, complex and fiercely competitive financial sector had causal implications for the current financial crisis and the paucity of authentic leadership.

RELATIONAL TRANSPARENCY

The second component of authentic leadership is relational transparency. This component defines the degree to which individuals are willing to be open and truthful with others as to the real motives, thoughts and feelings behind their personality and behaviour. Kernis (2003) discusses relational transparency as being genuine and allowing others to see the real you, including both positive and negative aspects of self. It requires the ability to trust others, develop intimacy and share personal knowledge. Avolio and Gardner (2005) note that leaders need to be authentic with their followers which demands trust through personal disclosure. The concept of relational transparency is cognitively complex as there are competing motives at play. On one hand, people want to be accepted and liked. To this end, fear of rejection can motivate individuals to engage in duplicity and deception. On the other hand, people, particularly people with a high sense of self-worth, have a need to be cognitively consistent, minimizing dissonance, thereby remaining true to internal thoughts, feelings and emotions.

Traditionally, neuroscience research stayed away from explicated modelling of human social interactions, but this trend has reversed in recent years (Kosfeld, 2007). There are now significant advances in our understanding of social relationships from a neuroscience perspective. The following neuroscientific research streams are of particular interest to relational transparency: neural basis to social knowledge, neurobiology of trust, genuineness and transparency, theory of the mind, and neural responses to rejection and loneliness.

Neural Correlates to Social Knowledge – Adolphs (2009) has conducted extensive research in social neuroscience. He proposes that the brain organizes knowledge in three domains: non-social knowledge, knowledge of the minds of others, and knowledge of one's own mind. It has been acknowledged that social thinking in the brain can be both automatic (reflexive) and conscious (reflective) and that there are neural processes that mediate between the two

(Lieberman, 2007). Social knowledge may be biased towards visual modality which may explain why visually attractive people are more likely to be perceived as competent leaders (Criswell & Campbell, 2008; Zebrowitz & Montepare, 2005). Adolphs (2009) summarizes the social neuroscience literature as follows: insight into how others think may be a unique human capacity, this insight has enabled human civilization to grow, there are automatic and controlled social thinking processes, the brain processes social information differently than non-social information, the amygdala maintains social vigilance and can be activated by negative / fearful visual patterns, the orbitofrontal cortex helps humans delay immediate social gratification to gain longer-term rewards, the insula controls empathy for others, and context is important in how the brain makes social judgments. Building on this neuroscientific foundation from a leadership development standpoint, further research is called for to understand the impact of a leader's visual salience in a manner that does not trigger an emotional threat response.

Neurobiology of Trust – Trust is an essential element to facilitate social interaction, including the ability of authentic leaders to trust their followers which in turn promotes openness, transparency and truthfulness. In the field of neurobiology, the peptide oxytocin found in the brain has been shown to be a chemical antecedent to trust (Zak, Kurzban & Matzner, 2005). A deficit in this simple molecule, as a result of loneliness, anxiety and/or stress, can cause one's capacity to trust to decline. In addition, fMRI studies have shown that the brain has automatic schema to evaluate others. For example, certain facial characteristics can activate a fear response in the amygdala which in turn produces a judgment that someone is untrustworthy (Bar, Neta & Linz, 2006; Said, Baron & Todorov, 2009). Given these findings, authentic leadership research may benefit from the study of first impressions, including a leader's ability to establish personal warmth and demonstrate professional competence early on during interpersonal interactions.

Genuineness and Transparency – An abstract model of associative cognition and emotion has been developed (AMACE) to explain person-centred communications as defined by Carl Rogers (Motschnig & Nykl, 2003). This model builds from a variety of cognitive perspectives, including cognitive neuroscience (long-term memory, working memory, emotional salience, brain region activation, emotional contagion, feelings and consciousness). These research findings suggest neural correlates to congruence, genuineness, realness and transparency; all of which are relevant to improved understanding of relational transparency as it pertains to authentic leadership.

Theory of the Mind – Theory of the mind refers to the distinction between what one knows, thinks, intends or feels versus what others know, think, intend or feel (Premack & Woodruff, 1978). In a study of the neurobiological functioning of interpersonal processes, Heisel and Betty (2006) recognize theory of the mind as essential to interpersonal communication and social relationships. Their research measured changes in electrical activity in two regions of the cortex (orbitofrontal cortex and dorsolateral prefrontal cortex) associated with theory of the mind operations. Empirical findings support the fact that individuals produce distinct neurological signatures when they think about others' mental states. This research may facilitate theoretical advancements such that a variety of scenarios might be empirically tested to gauge the degree to which individuals envision others' mental states as part of their own thinking processes. In this manner, future research may be able to empirically address a leader's efficacy in constructing cognitive representations as to the state of mind of his or her followers.

Neural Responses to Rejection and Loneliness – Neuroimaging has been used to investigate differences in neural patterns between individuals with different rejection sensitivity (Kross, Egner, Ochsner, Hirsch & Downey, 2007). Following from this research, it appears that individuals who are highly sensitive to rejection may have difficulty in accessing prefrontal cortex (PFC) regions of the brain which provide conscious cognitive control of social behaviour. Therefore, with respect to relational transparency, it may be illustrative to study a subset of leaders who manifest high sensitivity to rejection.

A second mediating variable influencing social cognitive processes is social isolation (loneliness). An fMRI study on loneliness in relation to neural patterns found evidence of individual differences (Cacioppo, Norris, Decety, Monteleone & Nusbaum, 2009). These research findings suggest that pleasant social stimuli produce less activation in the brain reward centers of lonely people relative to others. Therefore, lonely individuals will be less motivated to attend to social group exchange. From a neurological perspective, loneliness shapes expectations as to what we expect from and think about others. Given these findings from neuroscience, further leadership research is recommended to understand loneliness as a leadership phenomenon, one that may be an inherited trait, and its implications for creating relational transparency with followers.

BALANCED PROCESSING

The third component of authentic leadership is balanced processing. When a leader makes a decision, he or she accesses a variety of perspectives, both internal and external. The relevant consideration with respect to balanced processing is the degree to which the individual avoids denial, distortion and/or exaggeration and remains objective in his or her analysis of all relevant data. Kernis (2003) notes that ego defence mechanisms may compel individuals to engage in self-delusion both in terms of private self-knowledge and externally based evaluative information. Gardner and colleagues (2005) propose that an authentic leader will solicit views that challenge his or her own deeply held positions. Balanced processing is critical if the leader is to achieve congruence between his or her ideal and actual self.

Neuroscience can enlighten theoretical and developmental aspects of balanced processing with findings as to: what constitutes relevant data from a neurological viewpoint, neural impediments to balanced processing, and the brain's limitations as to the scope and span of human attention.

Relevant Data - Balanced processing according to authentic leadership theory requires the objective analysis of data. For example, one of the ALQ scale items measures the degree to which a leader will: "analyze relevant data before coming to a decision" (Walumbwa, et al., 2008). Note the adjectival emphasis in the words "relevant data". In this regard, neuroscience can provide valuable theoretical and empirical insights as to how the human brain determines relevance. In our sensory world, relevant data are construed as hard data which means phenomena we can physically see, hear, touch, etc. In the corporate world, we appreciate hard facts in order to make good decisions. Consider for the sake of example the hypothetical case of two employees, both of whom have requested a lighter work load during the next few weeks. One employee suffered a broken leg while skiing on the weekend. The other employee broke up with his long-term girlfriend on the weekend. The question here is: what does the authentic leader in the role of decision-maker deem as relevant data? It is suggested that the employee with the broken leg will fare much better than the employee with the broken relationship. However, neuroscience has shown that the brain processes soft, intangible data in the same way as hard, tangible data. Specifically, emotional pain (i.e. social rejection) is represented in the brain in the same manner as physical pain (i.e. a broken leg) (Lieberman & Eisenberger, 2008). In addition, Izuma and colleagues (2008) demonstrated that social reward (i.e. enhanced reputation) is processed in the brain in the same manner, anatomically and functionally, as monetary reward. In

light of these neuroscientific findings, further leadership research of an applied nature is recommended to understand how leaders utilize various types of data in their decision-making, in particular the distinction between social data and non-social data.

Neural Impediments to Balanced Processing – Aside from neuroscience research, decision-making research has shown that humans rely on the efficiency of heuristics rather than extensive analytical processes (Gilovich, Griffin & Kahneman, 2002). Of particular interest in neuroscience are affect heuristics emergent from emotions. Neurobiology presents evidence to suggest that there are neural impediments to balanced processing. The brain's limbic system, in particular the amygdala, has been shown to be instrumental in a number of studies of decision biases. Fear and threat can trigger the amygdala which in turn causes considerable disruption to cognitive processing (Davidson, 2001).

For example, fMRI scans have shown that individuals have an emotional reaction to risk which distorts the logic of their decisions (De Martino, Kumaran, Seymour & Dolan, 2006). Hsu and colleagues (2005) found neural distinctions between risk (probabilities known) and ambiguity (relevant information missing). Such results refute standard decision theory's unified treatment of these two uncertainty conditions. Peterson (R.L. Peterson, 2007) applied recent findings from neuroscience to study affective influences on financial decisions. He concluded that risk-seeking (i.e. gambling) and risk-averse (i.e. insurance) behaviour may be driven by two distinct neural mechanisms. For example, the nucleus accumbens NAcc, a part of the brain which mediates positive affect, can be cued by situational variables (free drinks, food, gifts in a casino setting) in order to trigger an increase in risk-seeking behaviour. Such conceptual distinctions found at the level of brain neurology have implications for the development of authenticity in leaders. Neuroscience research suggests that the situational and emotional contexts in which balanced processing takes place are of significant relevance and worthy of further research.

Neurological Limits to Attention – Implicit in the definition of balanced processing is the notion of an expansive scope and span of attention. Neuroscience suggests that there are neural correlates which mediate the scope and span of our attention. For example, anxiety can truncate attention, including disruption to the functioning of the prefrontal cortex and working memory (Shackman, et al., 2006). Neurobiology has shown that the brain is not capable of attending to its environment in a distributed, equal manner. Items in our environment with an emotional tag receive attention priority (Vuilleumier & Huang, 2009). Items that follow too quickly behind earlier information tend to be missed via a neural process called "attentional blink" (Martens &

Valchev, 2009). Positive emotions increase span of attention, including seeking out new information (Rowe, Hirsh & Anderson, 2007). Negative emotions reign in attention causing it to concentrate on limited actions and stimuli (Fredrickson & Branigan, 2005). Individuals for whom information becomes routine and repetitive suffer from mental satiation which manifests itself in the brain as reduced activity in reward centers and increased activity in centers controlling aversion (Mojzisch & Schulz-Hardt, 2007). From a leadership development perspective, there may be benefit in training leaders to explicitly direct the focus of their thinking (meta-cognition) while recognizing and accommodating neural propensities such as attentional blink. In addition, further research might shed light on the developmental value of simple attention control exercises such as “pause and redirect” as a means to enhance balanced processing.

INTERNALIZED MORAL PERSPECTIVE

The final component of authentic leadership is internalized moral perspective. This component comprises the theoretical amalgamation of two prior sub-elements: self-regulation with reference to the degree to which an individual behaves in accordance with internal values, beliefs and moral standards as opposed to external social pressures from relevant organizational, group and societal spheres, and positive moral perspective whereby an individual has reserves of moral capacity, efficacy, courage and resiliency in order to sustain behaviour in an authentic and moral manner (Avolio & Gardner, 2005). Internal moral perspective manifests itself in the leader’s behaviour, in particular the consistency of behaviour in support of a set of internal values and standards. There is debate in the leadership literature as to requirement for a moral dimension. Luthans and Avolio (2003) propose that authentic leadership must comprise an inherent ethical/moral dimension. Shamir and Eilam (2005) take the counter-position that a leader can be authentic (“true to self”) without that referent self being moral or displaying high standards of ethical behaviour. Sparrowe (2005) advises that it might actually be undesirable for leaders to achieve authenticity in the case of narcissistic or dysfunctional personalities.

Neuroscience has much to offer to our understanding of the concept of internalized moral perspective. The following topic areas are considered from a neuroscience perspective: self-regulation, the neurological basis for morality, and the brain in relation to ethical decision-making.

Self-Regulation - The ability to consciously regulate one’s responses to his or her environment is a critical function; one which enables productive social interaction and the

progression of human civilization. Self-regulation becomes even more critical for leaders who exist under the spotlight of social attention and who are expected to be exemplary role models. Moss and colleagues (2009) focus on self-regulation in relation to leadership. They propose self-esteem as an antecedent variable. Individuals with “fragile”, as opposed to “secure”, self-esteem tend towards lower adaptability and social cohesion, particularly in diverse, unfamiliar contexts.

From the perspective of neuroscience, there is consensus that the conscious control functions of the brain, the so-called “executive brain”, are located in the frontal lobes (Goldberg, 2001). This area is responsible, in coordination with other regions, for behaviour, including moral behaviour. This is the neural region where future actions are assessed, decisions between “good” and “bad” are made, and unacceptable social responses are controlled. Ochsner and Gross (2008) note that functional imaging has permitted the development of multilevel models of emotional regulation (behaviour, information processing and neural substrate) such that neuroscience data can inform and support behavioural data. In their study of reappraisal – rethinking the meaning of affectively charged stimuli to alter emotional impact – they recognize the efficacy of tactics such as reinterpretation and distancing. In a related, and subsequent, regulatory thought process – suppression of expressive behaviour, O’Hara and colleagues (2006) demonstrated the centrality of the prefrontal regions. Future research will be necessary to articulate the efficacy of various suppression strategies.

In addition, the propensity to ruminate – focus on negative aspects of self or one’s life – diminishes individual ability to self-regulate by reducing access to prefrontal regions implicated in self-focused thought (Ray et al., 2005). Neuroimaging studies empirically support the effectiveness of conscious and voluntary use of meta-cognition and cognitive re-contextualization to enhance self-regulation (Beauregard, 2007). These research studies are indicative of neuroscience’s strong empirical foundation and implications for self-regulation with respect to authentic leadership behaviour. Future research has the potential to demonstrate the efficacy of teaching regulatory strategies as part of leadership development.

The Neurological Basis for Morality - Neuroscience is a recent and valuable addition to our understanding of moral reasoning. Not only is this research relevant to authentic leadership theory, it has become quite salient in legal studies with *Behavioral Sciences and Law* devoting a recent issue to the topic (Erickson & Felthous, 2009). Neuroimaging has found evidence of three anatomical locations in the prefrontal cortex (PFC) involved in moral judgment (Knabb, Welsh, Ziebell & Reimer, 2009). The medial-frontal cortex (MFC) processes moral emotions such as

compassion and guilt. The orbital-frontal cortex (OFC) is involved with emotions such as indignation. The dorsolateral prefrontal cortex (DLPFC) is implicated in evaluations of fairness. Dysfunction to these locations can result in a variety of moral deficiencies, including: apathy, impulsiveness, lack of consideration, and inability to maintain goal-directed behaviour. Knabb and colleagues (2009) recommend Moll and colleagues' EFEC (Event-Feature-Emotion Complexes) model (2005) based on the proposition that: "moral cognitive phenomena emerge from both content-dependent and context-independent representations in the cortical as well as limbic networks" (p.255). The EFEC model allows for prediction of moral emotions, moral values and long-term goals. Future advances in this research have the potential to empirically substantiate that some people may be anatomically less capable than others of moral behaviour.

In addition, brain processes have been shown to mediate the degree to which a person decides between abstracted principles for the greater good (a utilitarian moral response) and their own individual needs (a personal moral response). There is an element of cognitive conflict in this regard (Greene, Nystrom, Engell, Darley & Cohen, 2004). Control processes in the lateral prefrontal cortex compete with affective/emotional processes in the superior temporal sulcus (STS), posterior cingulated cortex (PCC), and medial-frontal cortex (MFC).

From the perspective of developing authentic leaders, recent research linking neuroscience and moral cognition shows considerable promise. Moral values can be predicted using neuroimaging technology based on activation of different brain regions (Moll, et al., 2005). In this manner, future advances in neurofeedback may enable leaders to explore, using hard empirical data, their own moral thinking processes, including their propensity to engage in utilitarian moral behaviour versus personal moral behaviour.

Brain and Business Ethics - Salvador and Folger (2009) review theoretical developments and empirical evidence from cognitive neuroscience research on ethical decision-making. They suggest that "Neuroethics, the study of cognitive and neural mechanisms underlying ethical decision-making, is a growing field of study" (Salvador & Folger, 2009: 1). Their summary of the neuroethics literature produced several informative conclusions. First, decision-making in general, including ethical decision-making, is a distributed function within the brain relying on the interplay of several regions. However, it is important to note that ethical decision-making has a unique neuroimaging signature such that it is considered an independent intellectual ability distinct from other forms of cognitive decision-making. Using Rest's (1986) ethical decision sequence of: identification-judgment-intention-behaviour, neurological evidence has been found

in support of distinctive neural patterns characterizing each element of the sequence, with the exception of intention. Second, neuroscientists (Satpute & Lieberman, 2006) have proposed separate reflective (conscious) and reflexive (unconscious) systems supported within brain anatomy. Ethical concerns based on stimuli can be triggered unconsciously and, in the case of high pattern similarity against stored memory, the whole decision sequence right out to behaviour may remain unconscious (Reynolds, 2006). When high pattern similarity does not occur, then the issue becomes reflective and active judgment takes place. These findings suggest that some ethical judgments may not be well-thought out in the conscious sense. They may result from instantaneous and unconscious processes (Haidt & Bjorklund, 2008). Paradoxically, attempts to circumvent unconscious processes using rule-based ethical decision-making protocols may result in normatively worse decisions (Woodward & Allman, 2007).

It is clear that neuroscience research makes a valuable contribution to the moral dimensions of authentic leadership, both in terms of its future research agenda and the practicality of leadership development. Neuroscientific findings suggest that prescriptive approaches to ethical decision-making, especially those that ignore affect (mood and emotion), may be suboptimal. From the perspective of authentic leadership development, further research is called for in order to determine whether training interventions to develop moral awareness and judgment should be treated as distinct from general analytical interventions under the related concept of balanced processing. Neuroscience research appears to suggest that moral competence should not be treated singularly as rational and utilitarian. Recent studies show interesting potential. For example, Immordino-Yang and Damasio (2007) have developed a process with which participants can reflect on body sensations, perceptions and emotions when faced with ethical dilemmas.

CONCLUDING COMMENTS

This article has focused on the contribution of neuroscience to four factors of authentic leadership: self-awareness, relational transparency, balanced processing, and internalized moral perspective. Under each factor, a number of research intersections have been recognized with both theoretical and developmental implications. It is important to recognize that authentic leadership research (Walumbwa, et al., 2008) devotes considerable attention to additional constructs such as organizational culture, climate and the nature of relations between authentic

leaders and their followers. It is beyond the scope of this article to explore these additional constructs in detail, save to note, in closing, their potential for future research.

For example, neuroscience research on mirror neurons (Gazzaniga, 2004) has the potential to inform the development of authentic followers. Mirror neurons exist throughout the brain. The interesting point is that they fire, not only when we behave, but also when we observe the behaviour of others. Watching an action creates the same neural signatures as doing the action ourselves. Therefore, the challenge to authentic leaders is to develop followers in a manner that utilizes our knowledge of mirror neurons, including: acting as a mentor, being visible as a role model and coach, and using salient visual (as well as auditory and word) data to communicate expectations (Goleman & Boyatzis, 2008).

The application of social cognitive and affective neuroscience to organizational theory is a novel field of inquiry which holds much promise for theoretical integration and empirical substantiation. In particular, the emergent realm of neuroLeadership has a valuable contribution to make to our understanding of authentic leadership and the practicalities of enhancing authenticity in leaders. It is still early days, both in terms of theory development and empirical generalisability, but the potential is evident.

On a closing note, in addition to the evident potentiality of neuroscience outlined in this article, it is important to anticipate the potential contribution of novel, synergistic research intersections that will further illuminate leadership and organizational theory. Of significant research interest in the future will be the three-way integration of neuroscience, genetics and leadership research (Mattay, Meyer-Lindenberg & Weinberger, 2006). There is early evidence (Lee & Chamberlain, 2007) that genetic markers may influence brain processes such as efficiency of the prefrontal cortex and sensitivity of the amygdala which will in turn affect leadership behaviours. Future research may be able to inform social scientists as to the age old question concerning the degree to which leaders are “born versus made” as well as the efficacy of leadership development versus innate, natural ability.

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