NeuroLeadership in 2010

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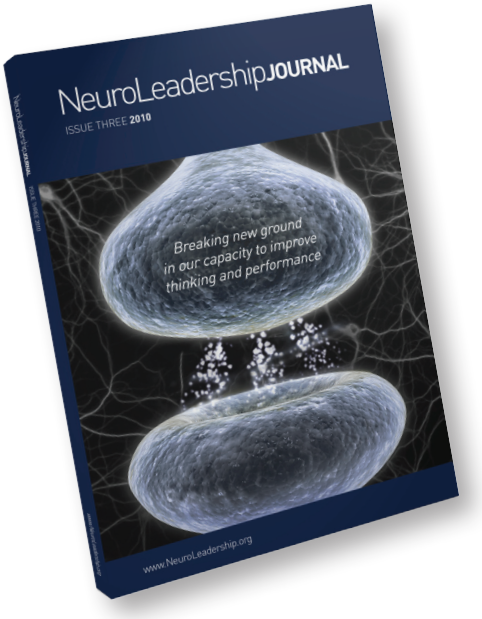

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Dr. Al H. Ringleb, Dr. David Rock and Dr. Jessica Conser

Al H. Ringleb, Director CIMBA/University of Iowa
Co-founder, NeuroLeadership Institute; Editor, NeuroLeadership *Journal*
ringleb@cimba.it

David Rock, CEO, NeuroLeadership Group International, Sydney, Australia
Faculty, CIMBA
Director and Co-founder, NeuroLeadership Institute; Editor, NeuroLeadership *Journal*
davidrock@neuroleadership.org

Jessica Conser, Researcher, Professional Development Practitioner, Contributing Author
jessica.conser@gmail.com

From our initial article defining the field (Ringleb & Rock, 2008) to the present, NeuroLeadership has continued to grow by virtually every measure. Perhaps more importantly, traditional leadership scholars are embracing its teachings (Daft, 2010), applying its dictates (Lawrence, 2010), and thereby assisting in expanding its frontiers. Business schools are looking to add neuroscientists to their faculties and suggesting neuroscience courses to their students. Unquestionably, neuroscience is one of the fastest growing areas of interest in contemporary science and NeuroLeadership is working to disseminate its findings applicable to the effective practice of leadership and leadership development.

As in past *Journals*, the intent of this article is to look back over the past year and reflect upon neuroscience and social psychology research relevant to NeuroLeadership and its applications. In reviewing the available research, and guided by suggestions from the scientists, we will again categorize the research based on the four domains set out in the initial *Journal* (Ringleb & Rock, 2008): *Decision Making and Problem Solving, Emotional Regulation, Collaboration, and Facilitating Change.* As in the past, in selecting research for inclusion, the following basic criteria were followed to the extent possible: significance to the field of NeuroLeadership, likelihood of significantly expanding or creating research linkages between neuroscience and leadership/leadership development, impacts on current thinking as driven by social science research, and, perhaps most importantly, relevance to the interests of practitioners in this growing field. In addition, we will also explore recent research in two areas of growing interest to practitioners that have an impact on all four domains: emotion and culture.

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Both areas were identified as growing areas of interest based on responses to the insightful presentations provided at the Boston Summit by Profs. Lisa Feldman Barrett (Distinguished Professor of Psychology at Northeastern University, where she focuses on the study of emotion) and Ying-Yi Hong (Professor in the division of strategy, management and organization at the College of Business at Nanyang Technological University of Singapore).

The growing importance of emotion

It has been nearly 60 years since Skinner (1953, 1974) declared that emotion – *that what [is] felt or introspectively observed* – was on the list of fictional causes to which an individual's behavior is commonly ascribed. *The Managed Heart* (Hochschild, 1983) and *Emotional Intelligence* (Goleman, 1995) among other publications brought the discussion of leadership emotion into the open, and served to assist both practitioners and academics in overcoming a seemingly unwritten reluctance to acknowledge their contribution to the mix of what constitutes the effective practice of leadership. Over the past two decades, leadership scholars have expressly recognized the importance of emotion and emotion regulation in effective leadership and have begun to define its core elements and components (Gooty *et al.*, 2010). This attention on leader emotion parallels the growing attention placed on emotion in neuroscience, psychology, and organizational behavior (OB) over the same time period. OB scholars have even labeled this period in their discipline as the "affective revolution" (Barsade, Brief, & Spataro, 2003, p. 3), going so far as to claim a "Kuhnian paradigm shift" in OB from purely cognition-focused models to cognition and affective models of behavior. Professor Carroll Izard (2010) perhaps best summarizes the growing interest in emotion and emotion regulation:

"Only three decades ago ... it was difficult to find books and empirically based journal articles on emotion. Now we have a cornucopia of emotion books – amazon.com has 347,272 titles, and it is not unusual for a university library to have more than 400 scholarly books on the topic. Today there are at least five scientific journals with 'emotion' in their titles and there are many more that publish research on emotion, resulting altogether in 2,732 articles in the past decade. There appears to be more agreement on the significance of emotion and much greater acceptance of its place in science than was evident 25 years ago." (Izard, 2010).

Three broad, qualitative studies over the past year have provided us with insight into how far our understanding of emotion and its relationship with leadership and leadership development has progressed. Perhaps more importantly, they also provide direction for the research needed to provide leadership development practitioners with the necessary tools and techniques to make emotion and emotion regulation integral components of consistent, effectual intervention and development strategies. Finally, a comparison of findings to date shows that the current state of theory and research on emotions in psychology, OB, and leadership are quite similar and have all been motivated by developments from neuroscience.

With regard to emotion and the current state of psychology science, Professor Carroll Izard provides us with two interesting works; the first, a broad descriptive overview of emotion theory and research (Izard, 2009), and the second, a survey involving more than 30 distinguished scientists from various disciplines and specialties concerned with emotion theory and research (Izard, 2010).

Unquestionably, neuroscience is one of the fastest growing areas of interest in contemporary science...

His survey shows there is still no consensus on the definition of emotion and, perhaps most important to practitioners seeking to advance their understanding, researchers use the term 'emotion' in ways that reflect different meanings and functions. With regard to neuroscience (and its applications to NeuroLeadership), he shows that scientists are in general agreement that specific neural systems are dedicated at least in part to emotional processes (as we will see later, research indicates that control-related prefrontal cortex (PFC) and their relationship with the amygdala play significant roles). In addition, he finds general agreement among scientists on the *functions* of emotion and, specifically, that emotion functions to recruit response systems to motivate cognition and action. In bringing these notions together, he generates the following definition: emotion consists of neural circuits (that are at least partially dedicated), response systems, and a feeling state/process that motivates and organizes cognition and action. (Izard, 2010). He concludes that, going forward, researchers need to contextualize emotion (by providing a statement of the meaning or meanings the researcher assumes) and adopt a discrete emotion approach (instead of looking at positive and negative emotions as categories, look at specific emotions such as anger, fear), which will be considerably more useful to practitioners.

With regard to emotion and the current state of OB science, Gooty *et al.* (2009) makes note of the explosive growth in the study of emotion in the OB discipline, emphasizing its importance by noting that two reviews of affect and emotion appeared in *Academy of Management* journals in a single year (Elfenbein, 2007; Barsade & Gidson, 2007). Acknowledging that the study of emotion has now taken center stage in organizational behavior, the intent of the article was to consider whether the discipline is on the right path of inquiry. As in the works by Izard, the authors make note of the fact that the OB discipline needs to define emotion consistently, focus more on discrete emotions, and deal with those emotions in context. Past studies have largely focused on generalized states, such as job satisfaction and positive and negative mood (Barsade & Gidson, 2007). In looking back over more than 15 years of research published in 10 leading management journals, the authors also noted that less than 10 percent of published 'emotion' studies were based on field tests of discrete emotions. In conclusion, the authors encourage the profession to move emotion research in a direction more consistent with psychology (and, we would add, neuroscience). In a clear understanding of the importance of emotion research, the authors state that an "examination of discrete emotions in naturalistic settings can no longer be limited to aspirations for the future." (at 837, Gooty *et al.,* 2009), a call for action with which virtually all practitioners would agree.

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As to emotion and the state of leadership science, Gooty *et al.,* (2010) provides an in-depth overview of the progress that has been made in bringing emotion and emotion regulation to the forefront in our understanding of leadership. Their work considers the contributions made to our understanding of emotion in the workplace, making a significant effort to ferret out the important trends from the heretofore seemingly disjointed studies of the past two decades. As in the case of psychology and OB, the authors again make note of the need to define emotions consistently, focus on research design, deal with emotions in context, and study discrete emotions in organizational (as opposed to just individual) contexts. From among a number of important contributions to emotion and leadership thinking, the authors provide a useful means for categorizing ongoing research: (1) leader affect, follower affect, and outcomes; (2) discrete emotions and leadership; and, (3) emotional competencies and leadership (emotional intelligence, empathy, contagion). The work assists in broadening our understanding of the definition problems to which Izard (2009, 2010) and Gooty *et al.,* (2009) relate by providing some guidance into the technical differences between and among *emotion, affect, mood, trait affect, state affect* and the modeling problems associated with emotional capacities such as *empathy, emotion regulation, and emotional intelligence*. Interestingly, the authors make note that research is notably missing in the fundamental areas of leader emotional regulation and leader emotions and decision-making across time, again issues of particular interest to practitioners.

A thorough reading of these articles and the research upon which they are based makes evident the important position neuroscience has played and will continue to play in our understanding of not only leadership, but clearly also OB and psychology. In contrast to traditional social science research, the use of brain imaging serves to fortify our understanding of core concepts and their applications by providing us with 'hard science' understanding of the neural circuitry involved in emotion, emotion regulation, and cognition (e.g., Gyurak *et al.,* 2009). As a consequence, neuroscience is allowing us to better understand and appreciate the role emotion plays in all four of the domains that comprise the field of NeuroLeadership, guiding and assisting us in the selection and application of more effective tools and techniques in developing tomorrow's leaders.

Decision making and problem solving

As an unintended consequence of our 2008 article (Ringleb & Rock, 2008), the Decision Making and Problem Solving domain has come to be narrowly defined as encompassing "the nature, types, conditions, and styles of decision-making." While seemingly consistent with the traditional literature, suggestions provided by practitioners encouraged us to move beyond that early perception to encompass the neural bases of the processes and procedures a leader uses to produce results – making decisions, solving problems, anticipating problems, overcoming obstacles, stimulating creativity and innovation, strengthening teamwork, and achieving goals and objectives, among others. In this sense, it is consistent with the important *Do* (or *Doing)* component of the generally accepted *Be-Know-Do* model of leadership attributes (Snook, 2007; Hesselbein & Shinseki, 2004). Secondly, it allows for a more consistent understanding of what this domain means to the fields of

both NeuroLeadership and traditional leadership (defined, at a minimum, as the interaction among and between leaders and followers; that is, groups making decisions and solving problems in the *Doing* sense) and distinguished from the fields of neuroeconomics and neuromarketing (both of which are more focused on how an *individual* makes decisions).

When taken together along with the fact that structuring work around teams has become an omnipresent ingredient of organizational life, the importance of this broader definition of the Decision Making and Problem Solving domain becomes more manifest. In the interest of gaining competitive advantage, all organizations are working to understand and adapt processes and procedures to improve productivity, enhance creativity, and improve problem solving and decision making.

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To this end, neuroscience has taught us to appreciate explicit (versus implicit) process (Herbig *et al.,* 2007; Bussing & Herbig, 2003) in overcoming the working limitations of the PFC (Halford *et al.,* 2007; Halford *et al.,* 2005; Shiffrin & Nosofsky, 1994); in managing individual SCARF emotions (ven den Bos *et al.,* 2009; Rock, 2008; Miu *et al.,* 2008; Collaros & Anderson,1969); and, more recently, in understanding the emotions of a group or organization (Mui, *et al.,* 2008; Adolphs, 2009; Rilling & Sanfry, 2011). With explicit process, individual group members are relieved from the demanding mental task of holding thoughts and ideas in working memory and from being engaged in the continuous mental resolution of SCARF issues that will naturally arise when team and organizational processes are not explicit. The brain is then able to reallocate scarce cognitive resources to far more productive creative or other higher-level thinking tasks (Mather *et al.,* 2006; Arnsten,1998).

Several studies in both social psychology and neuroscience have added to our understanding in this domain, providing insights to better assist our clients and provocation to stimulate further thinking and research. In working to demonstrate the existence of 'collective intelligence', social psychologists found convincing evidence of a general *collective intelligence* factor that explains a group's performance on a wide variety of tasks. (Woolley *et al.,* 2009) Interestingly, the research team found that while collective intelligence is not strongly correlated with the average or maximum individual intelligence of group members, it is correlated with the average social sensitivity of group members, the quality in the distribution of conversational turn taking, and the proportion of females in the group. One of the researchers, Dr. Alexander Pentland, was a speaker at this year's Summit in Boston and it was his technology that was used to measure the distribution of conversational turn taking. Given the importance of social sensitivity to group success, the project raises an interesting question for practitioners: is team success a function of social sensitivity (the ability to read and understand the emotion of others) for the purpose of controlling emotion, or does a well-defined process or procedure play a similar, more consistent, role? One could argue the latter, given that prior research has indicated that providing group members with specific instructions designed to control apprehension bias are not always successful. In managing teams the findings do seem to suggest it would be much easier to raise the intelligence of the team than that of an individual team member. Interestingly, the authors further hypothesize that on the basis of their study a collective intelligence test might be a strong predictor of a sales team's or a top management team's long-term effectiveness.

Mojzisch & Schulz-Hard (2010) demonstrated that if team procedures require disclosure of individual preferences in advance of open discussions the quality of group decisions will be degraded. While alluding implicitly to processing limitations associated with information overload and SCARF concerns in such a procedure (most specifically with status in terms of the intensity of the discussion needed to arrive at a solution), the study demonstrated that 'learning others' preferences at the beginning of a discussion, which usually happens in ***unstructured*** discussions, reduces the attention devoted to encoding the information exchanged, which, in turn, negatively affects decision quality." (Mojzisch & Schulz-Hard, (emphasis added)). Tested in an actual, face-to-face group decision-making situation, the study demonstrates that in the case of unstructured decision-making processes opening with team members sharing initial preferences, team members pay less attention to relevant information during subsequent group discussion and thereby risk reaching suboptimal decisions. The study also brings in to question leadership development programs that place emphasis on a leader's style (e.g., as measured through *Myers-Briggs* Type Indicator or DISC assessment) as a means for improving team collaboration (see, e.g., Offermann & Spiros, 2001).

The leadership and management literature (and in real-world experience) tend to view decision-making and problem-solving issues as identical cognitive activities (e.g., Huber, 1986), with the terms often used interchangeably (e.g., Costello & Zalkind, 1963). If we view decision making as a response to the specific issue "What are my choices?" and problem solving as a response to the specific issue "What has gone wrong?" can neuroscience tell us whether the brain uses the same neural circuitry in bringing about the most effective resolution? Can knowing the answer assist leaders in getting the most from team members' cognitive resources? If we do not expressly differentiate, and there is distinct (or partially distinct) neural circuitry involved, are we pulling down on team-limited cognitive resources by asking the brain to engage in unproductive, taxing mental activities until it settles on a thinking process (Vohs *et al.,* 2008)? Brain-imaging studies over just the past few years have begun to show interest in understanding the neural bases of problem solving and decision making (Gold & Shadlen, 2007; Chiavaras *et al.,* 2001; Dombrowski *et al.,* 2001; and Petrides & Pandya, 1999). Anderson, Albert, & Fincham (2005) employed traditional fMRI techniques to explore complex decision making and problem solving using the Tower of Hanoi task assessment. They identified three left cortical areas of the brain that were consistently involved in information processing (prefrontal, motor, and parietal areas) but did not distinguish between decision making and problem solving.

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A more recent study published in the *Journal, Mind, Brain, and Education* reveals that certain types of thinking are better suited to solving certain types of problems (Anderson *et al.,* 2008). As we begin to understand the neural circuitry involved in social interaction and emotion, we are becoming additionally interested in social decision-making and social decision-making processes (Rilling & Sanfry, 2011). This lineage of research has potential to pay important dividends to practitioners working with organizations to create and manage more productive teams. A more recent contribution to the domain description came at this year's Summit in Boston. Dr. Lisa Feldman Barrett made us realize that an important consequence of having explicit processes and procedures is their inherent regulatory impact on team or organizational emotion (See also, Gibson & Callister, 2009).

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Providing teams and organizations with an explicit, mutually agreed upon, process or procedure for issue resolution arguably decreases team member SCARF concerns, thereby increasing overall organizational engagement (Rock & Tang, 2009). In the absence of explicit processes and procedures, addressing difficult issues can often be influenced by emotional contagion (Johnson, 2008), as well as all of the accompanying negative consequences on limited organizational cognitive resources that flow directly from subsequent SCARF influences. As we saw with Professor Ochsner's presentation at the Summit and his paper in this *Journal*, such unstructured approaches to issue resolution are likely to be driven by habitual responses, which may be having unintended consequences on employee threat circuitry. Importantly, just as individuals who find themselves confronting stressful situations that take them into

unproductive emotional states, teams and organizations can be similarly diagnosed (Gibson & Callister, 2009); both need tools and techniques to assist in emotional regulation in order to bring about consistent, predictable, and productive issue resolution (Järvenoja & Järvelä, 2009; Gerben *et al.,* 2009). Explicit processes and procedures serve to control emotional contagion within teams and organizations. Still, emotion has only recently begun to be analyzed as an important component of collaborative activities (Li *et al.,* 2010; Rilling & Sanfry, 2011; Gibson & Callister, 2010).

In leading into the Emotion Regulation domain discussion, it is also important to note that the study of the role emotion regulation plays in decision making is beginning to attract attention among social psychologists and neuroscientists. Both Heilman *et al.* (2010) & Van't Wount *et al.* (2010) found that a reappraisal strategy was significantly more effective than a suppression strategy in social interactions involving choice. Heilman *et al.* (2010) found that, while negative emotions increased risk aversion, the use of cognitive reappraisal of emotions impedes this effect. Clearly, and as we shall see in the next section, research to date on the use and application of emotion regulation tools and techniques strongly suggests practitioners consider its inclusion in leadership development programs.

Emotion regulation

Within neuroscience and NeuroLeadership the most predominant model and definition of emotion regulation is that articulated by Gross (1998; Gross & Thompson, 2007): *Emotion regulation involves attempts to influence what emotions one experiences, when and how they are experienced and expressed.* It is now generally accepted that an effective leader is defined by his/her ability to perceive, identify, understand, and successfully manage his/her emotions and the emotions of others. In this sense, he/she harnesses and directs the power of emotion to build trust and improve follower satisfaction, morale, and motivation, and thus enhance overall organizational effectiveness (Daft, 2008; Rock & Tang, 2009). Yet, as stated earlier, Gooty, Shane, *et al.* (2010) found that leadership research is notably missing in the fundamental area of how leaders regulate their own and follower emotions.

In prior reviews, we focused on the neuroscience-validated techniques of mindfulness (Farb, *et al.,* 2007), meditation (Tang, *et al.,* 2007), mental training (Slater, *et al.,* 2007), labeling (Lieberman, *et al.,* 2007), and reappraisal (Ray, *et al.,* 2005) as vehicles for leaders to gain greater personal control over their emotions. As in the case of the term 'emotion', there is broad and seemingly inconsistent use of terminology in describing emotion regulation and emotion regulation strategies (Amelia *et al.,* 2010; Izard, 2010; Hartley *et al.,* 2010). Izard (2010) provides a more encompassing list of processes for emotion regulation:

1. Spontaneous neural/neurophysiological processes (e.g., changes in levels of hormones, neurotransmitters).
2. Other emotions (e.g., interactions among emotions within the individual and emotion contagion in social situations).
3. Cognitive processes, including executive functions (monitoring, effortful control, learning/training) reappraisal, and cognitive restructuring.
4. Adaptive/constructive utilization of the energy and motivation derived from the neurobiological processes of the emotion itself.
5. Learning and developmental processes that make effective emotion-response patterns a part of personality/character.
6. Social processes: social approval/disapproval, use of shared social appraisals, seeking social support, emotion contagion.
7. Behavioral processes: managing expressive behavior, changing/shaping situations, avoidance.
8. Regulatory processes may differ for different discrete emotions.[1]

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Given reappraisal's significant potential in leadership development and intervention strategies as they relate to leader and follower emotion regulation, this area of neuroscience and social psychology research has garnered considerable interest amongst both practitioners and researchers. As a consequence, it is not surprising to find studies linking emotion regulation and the other domains (e.g., Mascha *et al.,* 2010; Hellman *et al.,* 2010).

[1] "Category" eight was added by the author after several scientists participating in his survey indicated that "different discrete processes may involve or require different regulatory processes." (at 336 Izard, 2010).

While category 3 is clearly within this domain as we have focused it, categories 2 and 6 are discussed under the Collaboration domain and categories 4, 5, and 7 are discussed under the Facilitating Change domain.

Research has repeatedly demonstrated in animals that the experience and expression of fear is mediated by the amygdala (LeBoux, 1996; Mobbs *et al.,* 2007). Although scientific observations have suggested that the amygdala plays the same role in humans (e.g., Hurleman, *et al.,* 2009), and in fact it has generally been so assumed (e.g., LeDoux, 2007), it has not been systematically investigated until now. Working with a 44-year-old woman (named SM) with rare focal bilateral amygdala lesions, researchers at the University of Iowa were able to examine the amygdala's role in the experience of fear (Feinstein *et al.,* 2011). In observing SM's response to frightening stimuli such as a haunted house, snakes, spiders, and horror films, the researchers found that without a functioning amygdala SM was unable to experience fear, although, importantly, she was not emotionless. The study led the researchers to speculate that the amygdala's role in the induction and experience of emotion may be more specific to fear (*cf.* Harman, *et al.,* 2002). Perhaps most interestingly, SM's reaction to fear-inducing stimuli was characterized by heightened arousal and interest *coupled* with a complete lack of caution – something she described as an overwhelming feeling of 'curiosity'. In an interesting possible connection, Izard has hypothesized that the brain's default state may be interest. (Izard, 2010)

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Gyurak *et al.* (2009) considered the relationship between executive function (working memory, inhibition, task switching, and cognitive flexibility) and emotion regulation. Successful emotion regulation draws heavily on executive function – for example, in regulating a response to a fear-eliciting stimulus, perceptual cues are integrated, responses to those cues are anticipated, an action plan is devised, and behavior is continuously monitored and adjusted. The authors hypothesized that deficits in executive functioning would be associated with poor ability to regulate emotion. Participants were presented with a loud noise that came through two loudspeakers located behind each participant's head – producing a sound much like a gunshot. The study showed that executive function, and specifically cognitive flexibility, predicts the ability to regulate emotion, both when participants were implicitly requested to regulate and when they were explicitly instructed to suppress. Given that there were no differences between executive function and emotional regulation when participants responded to an unwarned startle, the authors were comfortable in concluding there are different circuits for emotional responses and for regulating those responses. This finding may hold particular promise for practitioners if, as the research in facilitating change suggests, it is easier to identify and change (strengthen) the latter circuitry.

Mak *et al.* (2010) investigated the neural activity associated with regulating positive and negative emotions using fMRI methodology. Using female Chinese subjects, the study confirms that shared, as well as distinct neural systems, are involved in regulating positive and negative emotions. The regulation of positive and negative emotions commonly involve the left superior and lateral frontal regions. Regulation of negative emotions involved increased activation in the left orbitofrontal gyrus, the left anterior cingulate, and the left superior frontal gyrus, indicating that the networks used for the regulation of negative emotions engaged more cognitive control. This finding supports a basic tenet of the SCARF model, that threat circuitry is far more developed than reward circuitry (and arguably, therefore, more difficult to change).

Continuing a line of research that has gained interest and importance, several studies over the past year looked into the neural basis of various emotional regulation strategies (e.g., McRae *et al.,* 2011; Hartley & Phelps, 2010, McRae *et al.,* 2010;) and compared their relative effectiveness. In past reviews we cited key research showing that reappraisal decreases activation in the amygdala (e.g., Ochsner *et al.,* 2004) and increases activation in a network of brain regions associated with verbal processing, attention, and cognitive control such as the anterior cingulate cortex (ACC), ventrolateral prefrontal cortex (vlPFC), dorsal lateral prefrontal cortex (dlPFC), medial prefrontal cortex (mPFC), and orbitofrontal cortex (OFC) (Ochsner & Gross, 2005). In addition, functional connectivity analyses suggest that activity in prefrontal regions is inversely related to amygdala activation (Goldin, *et al.,* 2008). McRae *et al.* (2009) compared to two commonly used forms of cognitive emotion regulation: reappraisal and distraction (the use of selective attention to limit the extent to which the emotionally evocative aspects of an event are attended and appraised). Although both forms have been well studied, no study had directly compared them to determine whether they draw upon the same or different neural mechanisms and have different emotional consequences. The study found that both reappraisal and distraction resulted in decreased negative affect, decreased activation in the amygdala, and increased

activation in prefrontal and cingulate regions. Reappraisal, however, led to greater decreases in negative affect and to greater increases in those brain regions associated with processing affective meaning (medial prefrontal and anterior temporal cortices). Distraction, on the other hand, led to greater decreases in amygdala activation. The authors concluded that distraction and reappraisal engage neural systems involved in attentional deployment and cognitive reframing differently and, as a consequence, have different emotional consequences.

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Wager *et al.* (2010) showed evidence for a distributed set of lateral frontal, medial frontal, and orbitofrontal regions that together bring about reappraisal of the meaning of emotional events. The results of the study identified two separable pathways that link prefrontal cortical activity with reductions in negative emotion during reappraisal: (1) through the nucleas accumbens that may generate positive appraisals, and (2) through ventral amygdala that may generate or enhance negative appraisals. Interestingly, the study provides evidence that the right ventrolateral prefrontal region is involved in both the generation and regulation of emotion through different subcortical pathways.

The Wager findings, in combination with Professor Lieberman's study on the role the ventrolateral PFC played in self-regulation in last year's *Journal* (Lieberman, 2009), support the growing notion that strengthening an individual's self-regulatory abilities will result in improvement in an individual's emotional capabilities, including emotion regulation. The underlying validity of this notion rests on, and raises the importance of, our understanding of individual differences. The success of development plans and intervention strategies for the purpose of leader development can often be a function of the coach understanding differences between individuals. As fundamental, more macro, neuroscience issues are better understood, researchers have begun to look at individual differences in further calibrating their understanding. For example, Schmeichel and Demaree (2010) found that people with higher working memory capacity more effectively engaged in spontaneous emotion regulation following negative feedback, relative to those with lower working memory capacity. As practitioners, as we learn to better measure (e.g., through neurobiofeedback) and assess such individual differences, this lineage of research has the potential to assist us in better targeting our development efforts. We will see further supportive research on individual differences in the research reviews within the remaining two domains.

Collaboration

In looking for research from the past year impacting the Collaboration domain, the criteria were again driven by the principle that the brain is "deeply social" (Lieberman, 2007; Decety & Ickes, 2009). As we discussed in prior reviews, the human brain has adapted to a complex social environment and seemingly evolved dedicated neural mechanisms acutely sensitive to social context, particularly to any signs that social group membership is endangered. Since self-interested behavior has the potential for negative social group consequences, inhibition is clearly important for harmonious social interactions. Controlling oneself to be socially accepted involves an awareness of how one is thinking, feeling, or behaving and the ability to alter any of those to satisfy the expectations of the social group.

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The ability to inhibit implies a need for self-awareness, social awareness (theory of mind; mirror neurons;

SCARF), threat and reward detection, and self-regulation. The failure of any one of these can lead to an unacceptable outcome and social exclusion. Self regulation is defined as *the capacity to override (or change) natural and automatic tendencies, desires, or behaviors; to pursue long-term goals, even at the expense of short-term attractions; and to follow socially prescribed norms and rules* (Bauer & Baumeister, 2011), research on this important topic is reviewed in the Facilitating Change domain discussion.

Lending considerable credence to the importance of these underlying notions, Jaremka *et al.* (2010) shows convincingly that our best and worst experiences in life are much more likely to involve interactions with others and our need for social connection rather than individual accomplishments. Compounding the situation for coaches and practitioners, psychologists at UCLA determined for the first time that a gene previously linked with sensitivity to physical pain is also linked with social pain sensitivity (Way *et al.,* 2009). Perhaps of some assistance, psychology researchers have found that acetaminophen (the active ingredient in Tylenol) blunts social pain in much the same way it blunts physical pain. (DeWall *et al.,* 2010). With further regard to pain, psychologists at the University of Toronto have shown that the nature of the social interaction has the ability to immediately influence an individual's sensitivity to physical pain. The authors conclude that social relationships may be of such critical importance to human health and wellbeing that even a mild threat to our social connectivity can be stressful (Borsook and MacDonald, 2010).

One of the driving tenets of SCARF and the notion of engagement (Rock and Tang, 2009) is the consequences of a 'SCARF event' on cognitive resources. DeWall, Twenge *et al.* (2009) found that social exclusion increases the inclination to perceive neutral information as hostile, which has implications for aggression (the causal path between social rejection and aggression had been noted, but not explained, by prior research (e.g., Leary *et al.,* 2006)). Compared to socially accepted control participants, socially excluded participants in the study were more likely to rate aggressive and ambiguous words as similar. According to the tenets of SCARF, cognitive resources are over-allocated to managing the threat, leaving fewer for more rational thinking processes.

Ybarra *et al.* (2011) looked to the impact on executive function (working memory, inhibition, self-monitoring) resulting from episodes of social contact, finding that cooperative interactions had cognitive benefits while competitive interactions had no cognitive benefits. However, if the parties made an effort to "read each other's minds", to take in the other's perspective, both cooperative and competitive interactions generated cognitive benefits. If in such conversations, you find the other person agrees with your opinion, Campbell-Meiklejohn *et al.* (2010) shows that such agreement produces activity in a region of ventral striatum that also responds when a person receives an object of value. This finding provides clear evidence that social influence mediates very basic value signals in known reinforcement learning circuitry. Social influence at such a basic level may contribute to the rapid learning and spread of values throughout an organization or population – all observable through a quantifiable physiological process. Implicit in these findings is the importance of increasing SCARF in the organization to increase levels of engagement (Rock & Tang, 2009).

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As reflected in the SCARF model, status plays an important, complex role in human interaction. People typically view the benefits that accrue with social status primarily from the perspective of external rewards. Martinez *et al.* (2010) found that increased social status and increased social support correlated with the density of dopamine D2/D3 receptors in the striatum, a region of the brain that plays a central role in reward and motivation, where dopamine plays a critical role in both of these behavioral processes. This data suggests that people who achieve greater social status are more likely to be able to experience life as rewarding and stimulating because they have more targets for dopamine to act upon within the striatum. The current data suggest that individuals with low D2/D3 receptors may be vulnerable to lower social status and social supports, social factors previously suggested as contributors to the risk for alcohol and substance use. For practitioners, implementing this finding, individual differences and measurement and assessment tools and techniques await further research.

In a study of 80 participants in repeated public goods game, Eckel *et al.* (2010) found that players were more likely to mimic the actions of a leader they perceived as a high-status individual. They ignored leaders perceived as low-status and even punished them for attempting to lead when they had the opportunity. The authors concluded that the status of the leader – particularly the way in which the leader is chosen – determines the extent to which the rest of the

group will follow. In addition, after introducing punishment, the authors found that high-status leaders did not need to punish because they were followed. In contrast, leaders perceived as low-status needed to rely on punishment to motivate followers.

In a study of 215 adults with an average of nearly 12 years' work experience, Bowles *et al.* (2010) found that status-linked social identities, such as gender, do indeed influence the evaluation of workplace deviance. Consistent with classic sociological theory, the study indicated that biases in the evaluation of workplace deviance reinforce the social hierarchy by granting more lenience to higher-status individuals. Interestingly, the status of the evaluator moderated this effect, with higher-status evaluators significantly more inclined toward biased evaluation of misbehavior than those with lower status.

Perhaps the most significant growth area in the Collaboration domain has been in emotional capabilities. Emotional intelligence has been controversial, in part, because only a few studies have tested whether it is associated with criteria beyond cognitive intelligence and personality traits (Landy, 2005). Côté *et al.* (2010) undertook to explore this concern in a study involving 165 participants. Study participants were given the emotion ability test MSCEIT, as well as a self-analysis of their emotional skills, organized into small groups (self-assigned or randomly assigned) and then given a group project to complete. At the end of the project, they were asked to identify who they thought had shown the greatest penchant for leadership. Those identified by their peers as leaders had scored high on the emotion-ability test. Interestingly, people's perceptions of their own emotional skills did not predict leadership as reliably. The findings provide some support for the use of ability tests for assessing emotional intelligence in applied settings.

As reflected in the SCARF model, status plays an important, complex role in human interaction.

O'Boyle *et al.* (2010) in a large meta-analysis of emotional intelligence using the latest statistical techniques, found a significant relationship between emotional intelligence and job performance: emotionally intelligent people make better workers. Importantly, in contrast to Cote *et al.* (2010), the results hold whether the measurement is undertaken by ability-based tests, self-reports, or 'mixed models' of emotional intelligence. Importantly, Nelis *et al.* (2009) in a study of 37 participants (19 in training and 18 in a control group) found that those in the study's emotional intelligence training program were able to increase their emotional identification and emotional management abilities relative to the control program. In addition, the skills showed considerable persistence in a six-month follow-up.

...structured or explicated processes tend to result in improved productivity and social interaction.

After more than three decades of research, the efficacy of collaboration in general and brainstorming more specifically continue to be the focus of research. As we discussed in the Decision Making and Problem Solving domain, structured or explicated processes tend to result in improved productivity and social interaction. Over the past year, three studies seem to confirm this result in the case of brainstorming (Stroebe *et al.,* 2010; Brazel *et al.,* 2010; Kavadias & Sommer, 2009), finding that without defined structure, individuals operating independently are often more effective than groups in unstructured brainstorming sessions. While collaboration is often encouraged within organizations, it clearly has its limitations. At the Summit in Boston, Dr. Jonathan Schooler discussed the differences between normative and collaborative approaches to problem solving and creativity. He suggested that problem solving within a group setting takes longer and the solutions are typically less creative and innovative than the normative approach. To prove his point, he used an interesting in-class challenge clearly demonstrating his proposition. He suggested that the better approach might be a combination, where individuals first identify solutions independently and then work collaboratively to choose the best alternative.

Facilitating change

Leadership, psychology, and neuroscience scholars all recognize the challenges in changing long-entrenched habits. Professor Ochsner provides valuable insight into the extent to which we rely on those habits and habitual behavior in his article in this *Journal* just as he did in his

presentation at the Summit in Boston. In an effort to improve or change employee motivation and performance with the intent to bring about organizational change, leadership theorists have long touted the importance of organizational learning (e.g., Garvin *et al.,* 2008) through such tools and techniques as coaching (e.g., Rock & Donde, 2008), training (e.g., Huselid *et al.,*1997), and development programs (e.g., Jacobs & Washington, 2003; Kaiser & Kaplan, 2006). In an academic sense, change has typically implied skills development. While practitioners will be the first to express their appreciation for the importance of technically trained leaders, they will also be the first to express their frustration with the effectiveness of skills- or content-based approaches to leadership development. It is not surprising then, that practitioners are reacting with such enthusiasm to recent research in psychology, leadership, organizational behavior, and, particularly, neuroscience revealing the importance of emotion and emotion management as fundamental ingredients in effective social interactions.

Leadership, psychology, and neuroscience scholars all recognize the challenges in changing long-entrenched habits.

Perhaps due in part to the euphoria associated with Emotional Intelligence, effective individual change has become associated with an individual's level of self-awareness – a personal sense of strengths and weaknesses, and vision of continuous advancement and personal growth. As we discussed in prior reviews and again in the Collaboration domain above, controlling oneself to be socially-accepted does involve an awareness of how one is thinking, feeling, or behaving *and* the ability to alter any of those to satisfy the expectations of the social group. An individual's ability to inhibit certainly implies a need for self-awareness, but also social awareness, threat and reward detection, and self-regulation, as the failure of any one of these potentially leads to perceived or actual social exclusion. The ability to inhibit is a core feature of self-regulation and refers to a process by which individuals initiate, adjust, interrupt, stop, or otherwise change thoughts, feelings, or actions to effect realization of personal goals or plans or to maintain current standards (Bauer & Baumeister, 2011). In the broadest sense, self-regulation refers to intentional or purposeful acts that are directed from within the individual. From this perspective, learning, physiology, and culture predispose certain behaviors, thoughts, or emotions in specific circumstances, but self-regulation allows the individual to change or overcome them. O'Connor & Gordon's study in this *Journal* certainly provides compelling evidence of the importance of enhancing an individual's self-regulatory abilities.

With regard to the neuroscience behind self-regulation, and thus the ability to regulate emotion, it is activated through a variety of cognitive skill-based strategies used to modulate experience and reaction (Ochsner & Gross, 2005). Neuroscience and social psychology research has established that a network of neural regions mediates these cognitive skills, with the lateral prefrontal cortex (LPFC) being a key component (Miller & Cohen, 2001). More recently, the LPFC, and particularly the ventrolateral prefrontal cortex (VLPFC), has been shown to facilitate emotion regulation by influencing the temporal course and intensity of emotional experience through cognitive, skill-based strategies, including affect labeling, attentional control, and reappraisal (Lieberman, Eisenberger *et al.,* 2007; Ochsner, Bunge *et al.,* 2002). Importantly, in implementing these strategies to control emotion, individuals shown to have greater LPFC activity in response to stimuli-provoking negative affect report less distress resulting from those stimuli (Drabant *et al.,* 2009; Lieberman, Eisenberger *et al.,* 2007; Salomons *et al.,* 2007; Lieberman, Jarcho *et al.,* 2004; Ochsner, Bunge *et al.,* 2002). In addition, greater LPFC activity in response to emotional stimuli has been shown to be related to better impulse control (Brown *et al.,* 2007). That is, a LPFC dysfunction may be a biological vulnerability, disposition, or tendency that interacts with a stressor (such as an event eliciting a SCARF response) to produce problematic mood and behavioral symptoms (cf., Hooley, 2007, Davidson *et al.,* 2002).

With regard to leadership development, and coaching more specifically, Hooker *et al.* (2010) found that *individual differences* in ventrolateral PFC activity provided a basis for predicting emotional responses to conflict. Based on prior research, elevated levels of ventrolateral PFC activity correlates with elevated cognitive control skills. The research team first assessed the lateral prefrontal cortex activity in response to negative facial expressions using fMRI. Participants were then monitored for the response to conflict situations in interpersonal relationships over a two-week period. Interestingly, people with high VLPFC activity had an improvement in mood and maladaptive behavior

after conflict. Drabant *et al.* (2009) found that individual differences in reappraisal use are similarly associated with decreased activation in ventral emotion generative regions and increased activation in prefrontal control regions in response to negative stimuli. Both findings are also consistent with evidence showing that cognitive control skills provide protection for people at elevated risk for difficulties after a negative event (Ayduk *et al.,* 2008). For practitioners, such individual differences in self-regulation and emotion regulation predict successful coping with emotional challenges.

Boyatzis *et al.* (2010) looked to explore coaching styles and approaches to see what kind of interactions can contribute to, or detract from, effectiveness. Building in prior Intentional Change Theory research, the intent was to look at the physiological reactions to positive and negative stimuli within those coaching interactions. In the study, participants met with two coaches, who intentionally used different coaching methods. One approach encouraged participants to envision a positive future while the other took a more standard approach, exploring the participant's feelings and discussing what could be done about them. Within a week, participants were brought in for an fMRI session to participate in a designed experiment involving the coaches and others that allowed the researchers to see how the interpersonal relationship was affecting the neural response. The data allowed the researchers to conclude that coachees respond much better to a coach they find inspiring and who shows compassion for them, than to one they perceive to be judging them. Talking about a person's desired, personal vision caused those parts of the brain associated with cognitive, perceptual and emotional openness and better cognitive functioning to light up.

A growing empirical literature supports the efficacy of mindfulness...

There are a number of tools and techniques available to the practitioner in assisting with an individual's self-regulatory abilities. The most widely available tool, and increasingly subject to research scrutiny particularly as it relates to emotion regulation, is mindfulness. In addition, research is beginning to show that neuro-feedback has promise as a tool for the self-regulation of emotion. Finally, as illustrated through the O'Connor & Gordon article in this *Journal*, brain exercises delivered via the computer are also beginning to show considerable promise.

Mindfulness is conceptualized as a self-regulatory process, thought to operate as a top-down mechanism to reduce negative affect and promote wellbeing (Lutz *et al.,* 2008). Dispositional mindfulness refers to the tendency to be mindful in everyday life, in which individuals may differ from one another (Brown & Ryan, 2003) and is considered to imply emotion regulation abilities (Lutz *et al.,* 2008). Growing empirical literature supports the efficacy of mindfulness for a wide range of populations, disorders, and consequences (e.g., Lykins & Baer, 2009). For example, Jha *et al.* (2010) suggests that sufficient mindfulness training practice may protect against functional impairments associated with high-stress contexts. Interestingly, the available neuroimaging literature on meditation indicates an association with increased activity in brain regions involved in cognitive control and attention, i.e. PFC and Anterior Cingulate Cortex (ACC) (Cahn & Polich, 2006). With regard to the limbic system, some studies have reported decreased activity in amygdala and hippocampus during meditation, which would support the notion that mindfulness training is associated with a significant decrease in emotionally reactive behaviors that are incompatible with stability of concentration and self-regulation (Lutz *et al.,* 2008).

With particular application to leadership development practitioners, Modinos *et al.* (2010) looked to assess the relationship between individual differences in dispositional mindfulness and brain activity during the cognitive emotion control process, reappraisal. In a study of 18 participants (11 males, 7 females), who completed the Kentucky Inventory of Mindfulness Skills, a 39-item instrument for the measurement of mindfulness, participants were trained in reappraisal strategies and then subjected to a stimulus set consisting of 66 color pictures from the International Affective Picture System in an fMRI. Participants first viewed a photo and were then told to use a reappraisal strategy of their choosing. The results revealed that individual differences in the disposition to be mindful modulated brain activity in cortical regions involved in the cognitive control of emotion. Participants' ability to be open to and detach from current affective experience was associated with dorsomedial prefrontal cortex (DMPFC) activity during instructed reappraisal, which was in turn inversely correlated with the amygdala response to negative stimuli. The results suggest that individual differences in typical emotion regulation as indexed by mindfulness traits may influence these interactions. In other words, differences in self-regulation may explain differences in individual ability to regulate emotions. By undertaking mindfulness training, an individual will increase self-regulation in many areas in addition to emotion regulation (Bauer & Bameister, 2011).

Coaching and other interventions are commonly validated for their clinical rather than physiological or biological effects. As we witnessed at this year's Summit in Boston, the use of technology is beginning to become an accepted practice within intervention strategies. There is growing interest in the use of neuro- and bio-feedback technologies

to measure and assess physiological and biological responses to defined stimuli. Consistent with the research presented in this and prior sections, that data derived from such technologies allows us to objectively identify important individual differences. On the basis of our data-driven understanding of those differences, the intervention strategy can be more precisely focused with an expectation of more effective results. In a study of 13 participants (four males and nine females), Johnson *et al.* (2010) first used an fMRI to identify areas reactive to positive and negative emotional stimuli, and then fMRI-neurofeedback to train participants to up-regulate the target areas associated with processing negative stimuli. Their results showed that brain networks associated with specific emotions can be regulated by means of neuro-feedback.

Coaching and other interventions are commonly validated for their clinical rather than physiological or biological effects.

Although somewhat controversial at the moment, considerable headway is being made in the area of brain training. For example, Ros *et al.* (2010) demonstrated that half an hour of voluntary control of brain rhythms is sufficient to induce a lasting shift in cortical excitability and intracortical function. Owen *et al.* (2010) undertook a study in which 11,430 participants trained on-line several times each week on cognitive tasks designed to improve reasoning, memory, planning, and attention. Although improvements were observed in every one of the cognitive tasks trained, the research team found no evidence for transfer effects to untrained tasks, even when those tasks were cognitively closely related. In this *Journal*, O'Connor & Gordon demonstrate a statistical improvement in productivity as a consequence of systematic use of the My Brain Solutions system. In the interest of full disclosure, both CIMBA and NeuroLeadership Group use My Brain Solutions as an integral part of intervention strategies with very good results. Clearly, this is an important area for further research and development.

Although somewhat controversial at the moment, considerable headway is being made in the area of brain training.

The growing importance of culture

As we stated previously,the growing understanding of the general constructs of the brain and the particular functions of those constructs has given neuroscientists license to become more specific; and, in most cases, more precise in measuring and assessing individual differences in those various functions. While the most obvious individual difference is gender (all speakers, for example, at the Summits are encouraged to consider differences in gender [if they have not already] in the application of their research in anticipation of questions from our practitioners), more recent research has focused both on individual differences within more defined subcategories and differences between cultures (see Na *et al.,* 2010). At the Summit, Professor Yi-Ying Hong, provided a number of important insights on the importance of culture, particularly as it relates to the groundbreaking work on Cultural Intelligence (see article in this *Journal*), and further assisted us in focusing attention on the growing interest in this topic among both practitioners and research scientists.

Interestingly, neuroscience is increasingly addressing a basic issue fundamental to NeuroLeadership that will directly impact our growing concern about culture as well as several other areas: *how does the normal brain function?* As we have previously stated, much of past neuroscience research was essentially developmental in nature, embracing questions about the consequences of brain lesions and other brain maladies in searching for answers about basic brain functioning. In addition to requiring new research models that will necessarily incorporate broader cooperation among labs (Ralchle, 2009), neuroscience research on the workings of the normal brain will certainly benefit from inputs from scientists, researchers, and practitioners educated and experienced in fields other than the biological sciences (Evans, 2006; Paus, 2010). In addition, this interest in the functioning of the normal brain in specific functional

areas will certainly encourage neuroscientists to broaden their research base beyond the traditional American undergraduate student research subject (Henrich, Heine, and Norenzaya, 2010; Arnett, 2008) to encompass a broader, more experienced, culturally diverse subject pool. This renewed focus on real-world relevancy and application will, by necessity, obligate neuroscientists to integrate theory and methods from anthropology, cultural psychology, leadership, organizational behavior, and even neurogenetics. In fact, such is the nature and direction of the exciting new field, *cultural neuroscience* (Ames *et al.,* 2010; Kitayama *et al.,* 2011).

As an emerging research discipline, cultural neuroscience has evolved from the seemingly dissimilar disciplines of cultural psychology and neuroscience...

As an emerging research discipline, cultural neuroscience has evolved from the seemingly dissimilar disciplines of cultural psychology and neuroscience (Ames *et al.,* 2010). The primary research objective of cultural neuroscience is to investigate cultural variation in psychological and neural processes as a means for explaining the bi-directional relationship of these processes and their properties. Research is motivated by a number of interesting and relevant questions regarding human nature, including most generally: how do cultural traits (e.g., values, beliefs, customs, traditions) shape neural processes and behavior? And, how do these neural processes facilitate the emergence and transmission of those traits? (Chiao *et al.,* 2010). The emergence of cultural neuroscience was stimulated by a number of scholars who, over the last two decades, have argued persuasively that psychological processes are malleably shaped to a degree far greater than previously considered possible by exposure to, and active engagement in, socio-cultural environments (see, e.g., Heine, 2008).

As an illustration of cultural psychology research, the Boston Summit introduced us to Dr. Sheena Iyengar , S.T. Lee Professor of Business at Columbia University and author of the book, *The Art of Choosing*, who discussed a culture-based experiment she had conducted in San Francisco. The participants were a mix of children divided into two groups, one comprised of children of Japanese or Chinese immigrants who spoke their parents' native language at home (referred to as the 'Asian' group) and the other of American elementary students (the 'Anglo American' group). Three experiments were conducted, with each experiment being conducted by one subgroup from both the Anglo American group and the Asian group. The teacher began by showing each child six piles of word puzzles and six marking pens. Each pile contained one category of anagram – words about animals, food, the city of San Francisco, and other topics. Each marker was of a different color. Two of the subgroups – again, one from each of the two main groups – were told to choose whichever category and marker they preferred. Another two subgroups were told specifically by the teacher which category and which marker they were to use. With the final two subgroups, the teacher pretended to relay specific instructions from the child's mother as to which category and which marker they were to use. The two ethnic groups reacted dramatically differently. The Anglo American children solved the most anagrams and played the longest when they picked their own markers and puzzles; the Asian children did best when they thought they were following their mothers' wishes.

The emergence of cultural neuroscience was stimulated by a number of scholars...

Cultural neuroscience goes one step further and looks for important differences in neural processes in explaining differences between the two cultures. For example, in Collaboration we discussed the importance of social awareness in making accurate assessments of others' internal mental states, beliefs, desires, and intentions. Adams *et al.* (2009) provides the first behavioral and neural evidence for an 'intra-cultural advantage' in mental state decoding in a study of native Japanese and white American participants. By intra-cultural advantage the authors

are referring to the fact that we tend to be able to more readily decode the mental states of others in social groups closest to us; thus, relative to those outside the group, we would have an intra-cultural advantage. Relying on accepted past research demonstrating that much of social awareness information (labeled "mental state reasoning" by the authors) is derived from the eyes, both groups were shown photographs of Caucasians and Asians depicting just the eye region. After first examining decoding behavior to confirm the expected intra-cultural advantage, the research team then examined the neural correlates of this intra-cultural advantage using fMRI. The brain-imaging data revealed greater bilateral posterior superior temporal sulci recruitment during same (e.g., Americans decoding Americans) versus other (e.g., Japanese decoding Americans) culture mental state decoding in both cultural groups. The findings offer support for both cultural consistency in the neural processes providing mental state reasoning and its differential recruitment based on cultural group membership.

Conclusion

While significant and impressive progress has been made this year in NeuroLeadership, it is becoming increasingly evident that social psychologists, neuroscientists, OB and leadership theorists, and leadership practitioners need to be working together more closely to build theories and conduct sophisticated empirical studies to continue growing in their respective fields where they interrelate. Cooperation and collaboration are particularly needed in the areas of emotion, emotion regulation, and culture where overlap is most pronounced and the need for practitioner tools the most significant. A functional co-mingling of concepts ranging from definitions to functioning models amongst these disciplines would serve to focus the usefulness of those tools and have the beneficial effect of accelerating 'time-to-market'.

"Now may be a good time to take a neuroscientist to lunch."

The most interesting and exciting trend over the past two years has been the increased emphasis on looking to understand the functioning of the normal brain. In light of this trend, perhaps the best advice we can give is the same we offered in our initial review: "Now may be a good time to take a neuroscientist to lunch."

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