NeuroLeadership and Integrative Neuroscience: “it’s about VALIDATION stupid!”

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The field of “NeuroLeadership” (Rock, 2006) has captured the attention of diverse stakeholders in the corporate sector, because if its potential materializes, it will result in significant cost reductions and enhanced productivity.

The overarching goal is to distil and apply what neuroscience is telling us about leadership, beyond common sense or pop psychology.

There are now many reports that extol the potential virtues of NeuroLeadership, for providing leaders and employees with brain insights to improve their performance. Essentially, the brain insights concern an understanding of self or dealing with others. The specific proposed benefits of NeuroLeadership include improvements in thinking; learning; making more effective decisions; overcoming negativity biases; finding more creative solutions; increasing the capacity for attention to key tasks and goals; dealing more effectively with stress; having a positive attitude, optimal motivation, engagement and outcome focus in the workplace.

These are lofty expectations. Can current neuroscience insights deliver these pragmatic outcomes?

Understandably, there is considerable skepticism about the ‘Neuro’ in NeuroLeadership, especially given it is still at an embryonic stage. Such skepticisms are not new. They are evident at the early stages of most emerging areas. The recurring criticisms from skeptics (who are often stakeholders with a vested interest in retaining their premier status in a related field), include claims that the data have been “overhyped”, “oversimplified”, “not new, just repackaged”, “over interpreted”, “oversold and under delivered”, “misused” and “with unproven benefits”.

The onus is on the field of NeuroLeadership to address this skepticism, and that can only be done with solid evidence. That is, the key predictions of the NeuroLeadership field require validation (or disconfirmation) in empirical studies with large cohorts, studied longitudinally.

Without validation, NeuroLeadership could be another passing fad. This would be rather ironic, given the brain’s role in information processing and behavior.

This paper serves to provide an overview of an exemplar “Integrative Neuroscience Validation Infrastructure for NeuroLeadership”. It consists of the first global standard for brain assessment that provides the framework for testing hypotheses concerning the specific aspects of behavioral change targeted within NeuroLeadership programs. A brief outline of potential hypotheses to be tested within the field of NeuroLeadership, is also suggested.

Integrative Neuroscience validation infrastructure for NeuroLeadership

This infrastructure has been created under the auspices of Brain Resource (www.brainresource.com), which has set up the first standardized international database on the human brain. This infrastructure was initially set up for “Personalized Medicine”, to identify the best gene-brain-cognition markers that predict individual treatment response (Gordon, 2007). An exclusive partnership between Brain Resource and Optum Health Solutions (United Behavioral Health) has resulted in an extension of this infrastructure, to include Optum’s USA corporate clients.

The standardized infrastructure emerged from several
decades of intensive scientific research, which now forms the basis of Brain Resource’s academic partner, BRAInnet (www.BRAInnet.net). BRAInnet is a network of over 150 scientists globally, that operates independently to draw on the standardized international database for research purposes, providing ongoing scientific insights.

This validation infrastructure consists of a series of interrelated platforms, from theory to assessment to application in the ‘real world’ (summarized in Figure 1). At the level of theory, it is based on an “Integrative Neuroscience” Model, which brings together the essential commonalities in brain theory across disciplines.

This theory underlies the choice of standardized assessments of brain function and behaviour.

With standardization, these sources of data can also been pooled, and have formed an international database on human brain and behavior, that is the first of its kind.

The summary below reflects the potential use of this infrastructure to deliver the efficiency benefits of standardized assessments, as well as examine the validation of predicted NeuroLeadership outcomes.

**Integrative Neuroscience model**

The brain is a highly interconnected system. Yet, most brain models still focus on the microscopic scale of genes, single neurons and specialized networks. However, despite the importance of this detailed information, there are real limits on the extent to which mechanisms operating at microscopic scale can be extrapolated into useful models of the whole brain, where phenomena result from the collective behavior of many highly connected interacting networks.

**Without validation, NeuroLeadership could be another passing fad.**

The fragmentation has begun to change in a very distinctive way. Multidisciplinary efforts have provided the impetus to break down the boundaries and encourage a more “Integrative Neuroscience” which serves to formulate and test working models of the whole brain, that bring together key organizing principles across scales of brain function (Gordon, 2000).

Despite huge deficits of knowledge, sufficient facts about the brain already exist, for an Integrative Neuroscience to begin to lift us clear of the jungle of detail, and shed light upon the workings of the brain as a system.

The brain model used as a frame of reference in the infrastructure is the INTEGRATE Model (Figure 2; Gordon et al., 2008; Williams et al., 2008; Williams & Gordon, 2007), which is based in Integrative Neuroscience and the evidence base it has established (e.g., Gordon, 2000; Gordon et al., 2005; Gordon et al., 2008). The model outlines the brain’s core motivations, key modes of function and diverse implications to many aspects of healthcare and productivity in the workplace.

The model is an integration of many models across disciplines and scale. There are five separations that the INTEGRATE Model brings together:

1. The separation of Emotion and Thinking.
2. The separation of Nonconscious and Conscious processing.
3. The separation of Cortical and subcortical activities.
4. The separation of Spatial and Temporal processes and networks.
5. The separation of Brain and Body interactions.

The key elements of the model that are most relevant to NeuroLeadership validation studies are summarized below.

The core motivation underlying all brain processing and behaviors is to “Minimize danger and maximise reward”. This motivation drives brain organization by determining what is significant at each point in time. For instance, at short time scales a sudden loud noise will signal danger and trigger our reflexive “fight or flight” reactions, whereas at longer time scales, the drive to find reward from meaning could shape our behaviors to find a new job.
Cognition encompasses all aspects of information processing. The INTEGRATE Model makes explicit the manner in which key processes of Emotion-Thinking-Self Regulation continuously interact, in a parallel processing continuum. A further emphasis in this model, is on the modes of parallel Nonconscious (Feedforward) and Conscious (Feedback) processes, that are continuously interacting from second to second across the life span. Modes of processing emphasize the type of processing, rather than the brain region. In the model, the brains specialized single neuron, networks and processes are all integral elements of the ongoing brain and body Excitation-Inhibition interactions.

**Emotions** are “action tendencies” that are triggered automatically and without awareness by signals of potential danger or reward. These emotional action tendencies rely on autonomic sensory-motor repertoires, low level sensory input (sensory store) which engages fast latency “feedforward” mode of brain and body activity. Rapid-acting neurotransmitters (GABA-Glutamater) are involved at this early time scale. At longer time scale (200–500ms) Thinking and Feeling emerge with Conscious awareness that relies on “feedback” from brain and body. Thinking supports the initiation of voluntary actions, selective attention and involves more detailed sensory processing with feedback from higher brain areas and from the body. Thinking typically occurs in combination with Feeling, which also relies on brain-body feedback. Brain chemicals that mediate Thinking and feeling include monoamines (dopamine, serotonin, noradrenaline and acetyl choline). At longer time scales of seconds, minutes and beyond, there is a capacity for self-generated as well as stimulus-related processing. Self-Regulation is aimed at achieving longer-term and more abstract goals related to Minimize Danger-Maximize Reward, and relies on planned behaviors, memory and ongoing cycles of feedforward-feedback brain-body interactions. Self Regulation is modulated by slower acting brain chemicals, such as hormones and neuropeptides. With ongoing outcomes from Emotion-Thinking-Self Regulation, both brain and behavior are constantly adapting, and this is reflected in brain ‘plasticity’ and the potential to generate new behavioral habits.
a second), “feedback” from brain and body supports the emergence of Conscious awareness and the capacity for **Thinking** and **Feeling**.

**Thinking** is when you can identify information to yourself in words or images. **Feeling** is when you can identify to yourself the Emotion you are experiencing. Thinking and Feeling allow you to selectively attend to information, extract its context, make voluntary decisions and responses, and link these to what you know and remember. They occur to minimize danger-maximize reward. Thinking and Feeling rely on Conscious awareness, and a “feedback” mode of brain-body activity. For example, with feedback and awareness, you can identify the loud noise (car backfiring), your Emotion (fear) and their context (cars backfiring are not harmful and you don’t need to be afraid) – and choose to inhibit your fear-related action tendencies.

**Self regulation** is the shaping, planning and monitoring of behaviors over time, to Minimize Danger-Maximize Reward. It encompasses Emotion regulation. For example, if you find that you have excessive fear reactions to signals in your environment, you can train your breathing so that you can better inhibit these reactions and ensure they do not interfere with your reward-related behaviors.

With ongoing outcomes from Emotion-Thinking-Self Regulation, both brain and behavior are constantly adapting, and this is reflected in your brain’s “plasticity”.

**Standardization of assessments**

Brain Resource’s standardized methodology brings together complementary information to capture the essence of the brain’s inordinate complexity.

Measures that are normally assessed in isolation are brought together, including Cognition (Thinking-Feeling-Self Regulation), Personal Experience, Brain function (EEG, ERP, fMRI) and structure (MRI) and Genomics (Figure 3).

Standardization allows pooling of the data and the consequent statistical power that is more likely to lead to robust testing of NeuroLeadership predictions.

For the first phase of NeuroLeadership validation, measures of Emotion, Thinking and Self Regulation measures can be delivered via web-based assessments. These web-based assessments also incorporate functional outcome measures of workplace attitude and performance. These web-based assessments and the scores that they generate, are briefly outlined below.

**Cognition encompasses all aspects of information processing.**

**Emotion-thinking-self regulation**

Cognition includes all aspects of information processing. The web-based standardized assessment focuses on Emotion, Thinking and Self Regulation.

**Emotion**

- **Emotion recognition**: Conscious identification of facial emotions. Variations in the time and accuracy with which emotions are identified indicate specific changes in core emotional function.
- **Emotion Bias**: Nonconscious emotional biases to fear, sad, disgust, surprise, happy and neutral emotions.

**Thinking**

- **Memory**: Aspects of memory that require learning of new information, holding information “online” (like a telephone number) and recalling it later.
- **Sustained Attention**: Focusing on the main task and resisting distractions over time.
- **Impulsivity**: Balance between automatic responses and suppressing these responses as the task situation changes.
- **Executive function**: Planning, monitoring and using feedback to adjust and organize behavior to meet goals.

**Self regulation**

- **Negativity bias**: The tendency to see yourself and your world as negative. It is associated with sensitivity to stress and emotional stability.
- **Positivity bias**: The tendency to see the opportunity and solutions, rather than the problems in yourself and your external situations.
• **Social skills:** Capacity for social relationship building relies on the ability to understand other people’s emotions and intentions.

• **Emotional Intelligence (EI):** Defined by Salovey and Mayer [1990] as the “ability to monitor one’s own and others feelings and emotions, to discriminate amongst them and use them to guide one’s thinking and actions”. Brain Resource’s validated EI assessment has three scores that assess empathy/intuition, social skills and self esteem (Kemp et al., 2005).

• **Emotional resilience:** Capacity for coping with life and feeling confident in yourself and your opinions, especially during times of negativity and volatility.

**Additional workplace-related assessments**

**Likelihood of a stress-related problem**
Screening scores of stress, anxiety and depression are also acquired (Lovibond & Lovibond, 1995).

**Functional outcome measures**

**Health and work performance questionnaire (HPQ)**
The HPQ is a widely validated assessment of absenteeism, presenteeism and productivity levels of members within an organization (Kessler et al 2003).

**Workplace evaluation (WE) 360**
WE 360 [Hermens, 2001] assesses employee’s self evaluation compared with other appropriate staff’s ratings of them, in 4 key dimensions of performance (Figure 5):

- **Relationship Management:** ability to deal effectively with customers.
- **Technical Competence:** ability to use organizational tools and systems.
- **Value Focus:** personal approach to bottom line issues.
- **Emotional Awareness:** willingness to accept and undergo change.

**Standardization is critical**
All assessment hardware, software, activation tasks, scoring and analyses are undertaken in an identical fashion. The virtues of Standardized Assessments have been replicated in many fields. For example in medicine, standardizing assessments has been found to increase accuracy and reliability by on average 15% (Kawomoto et al 2005; Reilly et al 2002). This is due to diminishing the random errors.

The Brain Resource International Database has thousands of subject’s scores on the key assessments. Many of the subjects also have information on their Brain measures (including functional magnetic resonance imaging, fMRI; event-related potentials, ERP, electroencephalogram, EEG, acquired during a range of standardized activation tasks).

This allows the interrelationships to be examined, between the web-based assessments and what they reflect in terms of actual brain function (in other words their “Construct Validity”). Equally importantly, this Integrative Neuroscience approach, allows interpretation of the web assessments to be maximized, in being able to extend what these measures mean in terms of functional outcomes, such as workplace performance and behavior (“Predictive Validity”).

All subjects in the database also have their Personality Trait scores [Extroversion-Introversion, Neuroticism, Openness, Agreeableness, Conscientiousness] assessed using the NEO FFI [Cost & McCrae, 1997]. Interrelationships...
between Emotional Intelligence scores (summarized above), Personality Traits, Cognition, Brain and Genetics are similarly examined, with respect to their real world utility in workplace performance.

**International database**

All these measures are taken in each individual. Standardization allows pooling of subject numbers (in a de-identified manner; no names of people, only ID codes enter the database).

Companies have total control over the use of their own data and make all decisions about if and when their data should be examined independently.

In parallel, Brain Resource undertakes its own research, acquiring its own data internationally, which goes into the database.

**Independent scientific validation**

Scientific integrity of the NeuroLeadership findings will be researched by an independent scientific network: the Brain Research and Integrative Neuroscience Network (BRAINnet; http://www.BRAINnet.net).

It is the first e-science infrastructure for large-scale sharing of human neuroscience data & testing hypotheses generated from integration of theory (Figure 6).

BRAINnet was formed as an independent collaborative to coordinate scientific use of the Brain Resource International Database. The milestone of 150 peer-reviewed publications was reached in 2007 (total 187). On average, 1 publication was published per week over the past year. There are over 180 scientific members, from the USA, Europe and Australia.

The goal is to now extend BRAINnet as a platform for facilitating efforts in applied areas. For instance, to bring together applied researchers from complementary disciplines into a NeuroLeadership international research consortium, aimed at testing programs and hypotheses using this standardized assessment methodology, with the Integrative Neuroscience database as the frame of reference.

**The Integrative Neuroscience NeuroLeadership infrastructure allows for testing programs, selective hypotheses and is also an iterative learning system**

This infrastructure may be employed to test a series of NeuroLeadership objectives in a programmatic manner. One set of objectives using the integrative model and standardized assessments, is proposed below.

1. To establish the “construct validity” of the key concepts in NeuroLeadership. For instance, do those individuals classified as ‘effective leaders’ perform better on measures of stress resilience, positivity versus negativity bias and attention to key tasks (captured by the continuum of objective Emotion, Thinking and Self Regulation measures), than those classified as ‘poorer leaders’. From there, one might test whether these measures relate to underlying brain differences.

2. To establish the “predictive validity” of the key concepts: Do the objective measures associated with leadership and styles of leadership (for example, hierarchical control versus shared leadership models) predict functional outcomes, such as workplace performance?

3. To establish the “efficacy” of NeuroLeadership programs. Do these programs lead to significant improvements in functional outcomes, and are these improvements related to the constructs established in 1 and 2. If they do, these measures can be used as markers to assess and predict NeuroLeadership.

4. Replication of the results in 1 to 3 across companies using the standardized assessments in independent samples, would also be important in determining their robustness. Statistically significant changes using the Standardized Assessments would provide a “Proof of Efficacy” for any NeuroLeadership intervention.

The design of a validation study would then need to consider “effectiveness” or conventional randomized controlled trial designs. Effectiveness designs are based on the presumption that the most ecologically valid protocol is one that mirrors normal practice as much as possible. The conventional view remains that unambiguous validation of a training program, would require a double blind placebo controlled study with sufficient subject numbers to ensure high statistical power.
Standardization allows multiple researchers to undertake the identical research in different companies simultaneously, thereby expediting the speed of replication.

Experience from current international studies in Integrative Neuroscience and healthcare using this infrastructure, has shown that it is prudent to initially focus on relatively straightforward hypotheses, before testing questions with multiple interactions and subtle underlying mechanisms. With respect to the proposed NeuroLeadership predictions relevant to objectives 1 to 4 (summarized above), a number of exemplars (A–E) are proposed below.

A. Standardized assessments to determine the efficacy of NeuroLeadership programs.

NeuroLeadership programs such as David Rock’s “Quiet Leadership” Program (to help people think better – don’t tell them what to do; Rock, 2006), John Medina’s “Brain Rules” (Medina, 2008) and others, are readily examined to determine the extent of benefit.

From there, more detailed predictions might concern which forms of NeuroLeadership program does the brain respond to best versus those that the brain ‘resists’.

Evidence from these types of studies would help shape NeuroLeadership programs and provide a base for assessing their impact/cost-benefit.

They are often used with significant “subjective inference” about “personal capacity” to select and stream people for specific executive and non-executive positions. There is not to my knowledge, any database of longitudinal results using mainstream psychometric assessments in corporates, that has unambiguous replicated “personalized” validation and predictive validity, with respect to individual leaders or employees.

B. Assessing the relative interactions among key elements in NeuroLeadership programs.

Can a small activity sometimes make a big difference and vice versa?

A rather telling example of this point is provided (in a personal communication, 2008) by Dr. Eugene Baker (VP Employee Assistance Programs at Optum Health Solutions):

“There are some interventions in which the learning curve accelerates early and tapers off, while there are other situations in which learning is slow at first and plateaus later. Some interventions achieve the results from only a small portion of the program. For example, speed reading programs often successfully teach people to move along a pointer as they read and then charge for techniques that have relatively less marginal utility. The assessment framework could help personalize learning profiles and identify the key ingredients in interventions.”

C. Examining the best pathway for behavioral change.

The brain’s “plasticity” (Kilgard & Merzenich, 1998) and the importance of diminishing chronic stress to enhance Wellbeing (Seligman, 2007), has generated considerable optimism across all areas of behavioral change (including in the NeuroLeadership literature), of the capacity for people to change.

Yet, in reality, change is hard. It remains unknown whether some programs will be more effective than others in making change possible.

The principle of change pathways is “if you can’t measure it, you can’t manage it” (Mimma Mason; personal communication, 2008). Meaningful long term change requires objective measurement of WHAT to change.

Mastery of HOW to change begins with overcoming “motivational ambivalence” [Miller & Rollnick, 2002]. Dr. Roy Sugarman (personal communication, 2008), summarizes the essence of this step as follows: “no one fully believes or acts upon anything unless it comes out of their own mouth”. Once the motivation is “owned”, the implementation of the change pathway could include; “small steps” of positive reinforcement and the “Gordon 1,000 rule” to practice, visualize or simulate the change more than 1,000 times until it becomes an automatic Nonconscious habit. Monitoring the EXTENT of change (using the standardized assessments), ensures that personalized change is happening to a meaningful extent.
The ‘Gordon 1000 rule’ comes out of decades of independent science using the integrative infrastructure, for which the evidence points to the large amount of practice that is needed to achieve genuine change. However, on the other hand, the Emotional, Thinking and Self Regulation measures show that periods of high emotional arousal can more rapidly facilitate change.

Comparative studies both between programs and individuals could tease out “personalized” capacities and best pathways for change.

D. Testing specific aspects of performance in leaders and employees.

There are many possible testable performance variables from the model. One example, that cuts across all aspects of information processing, is decision making.

The relevance to NeuroLeadership, is that there is converging evidence, that most leaders and employees are unaware that their decision making is likely to be significantly flawed by systematic biases.

Decision making involves every time frame along the continuum of the INTEGRATE Model. It is simply the way in which processing options or reactions become iteratively narrowed down over time.

All decision making is affected by the same core motivational drive to minimize danger and maximize reward. All biases are part of the same process.

For example, a “Confirmation Bias”, is simply a Nonconscious threat contradicts a person’s prediction that the world is safe or consistent. On the other hand, an “Exposure Effect Bias” (that people like things that are more familiar), is a form of safety (reward), and that is a reason that people Nonconsciously like what they are used to. Newness can be threatening.

Decision making exemplifies an area that requires integration of the growing multidisciplinary literature, that extends from biological models (Ernst and Paul, 2005; Doya, 2008; Bechara, Damasio & Damasio, 2000; Lee, 2008), to mathematical decision theory (Goodwyn & Wright, 2004), to the use of “heuristics” (Tversky & Kahneman, 1974; Kahneman, 2003).

Validation of the best interventions to enhance decision making in leaders and employees, would provide a significant NeuroLeadership benefit.

These models and insights can be reconciled as “intuitive versus rational” decision making in the INTEGRATE Model and tested using the standardized assessments, including the Conscious “Thinking” executive functions and planning scores from the “Maze” assessment, and Nonconscious Bias indices (as described previously and in E below).

E. Ultimately, emotions that operate Nonconsciously are key to understanding and predicting NeuroLeadership qualities.

The INTEGRATE Model highlights the importance of Nonconscious emotion processing and its effects on behaviour. Details about the recent objective measures of Nonconscious processing is beyond the scope of this paper, but can be found in a number of our publications (Williams et al., 2004; Liddell et al., 2005; Williams et al., 2006a, b; Williams et al., 2007; Williams et al., in press).

One example of a Nonconscious measure from the Integrative Neuroscience infrastructure is of ‘Emotional Bias’, which captures the degree to which an individual automatically focuses on negative and threat-related emotions, versus positive ones.

A greater automatic bias towards the negative is difficult to control, and has been associated with higher anxiety, suboptimal decision making and what drives the “pushback” issues in leader-employee dynamics.

This area of research shows promise for elucidating the underlying mechanisms of leadership, which to date has been under-explored.

Studies of relative change also highlight the importance of “Personalized” insights into what styles of NeuroLeadership are best suited to what program. Studies that compare programs should allow for tailoring each program to the individual’s concerned, as well as to the needs of each corporation.

The onus is on NeuroLeadership researchers and practitioners to embrace this harsh reality.

The NeuroLeadership infrastructure acts as a strategic
decision-making database, to select which validated programs provide the most cost-benefit. It also has the capacity to learn on the basis of the evidence, so the cumulative insights and outcomes could help NeuroLeadership scientists to iteratively extend the model and generate new hypotheses and programs.

Conclusion

In this paper, I have attempted to provide some context of the complexities that demand a rigorous approach to validating findings from the emerging field of NeuroLeadership.

I have also attempted to summarize an exemplar standardized infrastructure that might be employed to validate NeuroLeadership programs and hypotheses.

Data will be the only final arbiter for the VALIDATION of which programs and key elements of NeuroLeadership really work, in a cost-effective manner.

References


