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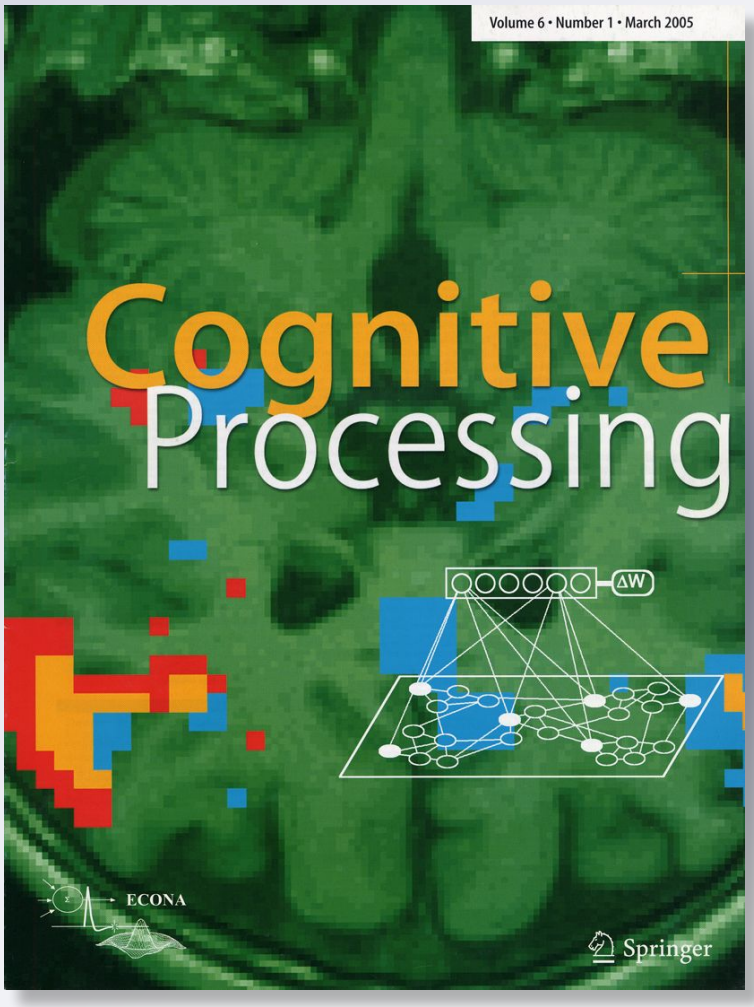


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RESEARCH REPORT

# Higher mind-brain development in successful leaders: testing a unified theory of performance

**Harald S. Harung · Frederick Travis**

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**Abstract** This study explored mind-brain characteristics of successful leaders as reflected in scores on the Brain Integration Scale, Gibbs's Socio-moral Reasoning questionnaire, and an inventory of peak experiences. These variables, which in previous studies distinguished world-class athletes and professional classical musicians from average-performing controls, were recorded in 20 Norwegian top-level managers and in 20 low-level managers—matched for age, gender, education, and type of organization (private or public). Top-level managers were characterized by higher Brain Integration Scale scores, higher levels of moral reasoning, and more frequent peak experiences. These multilevel measures could be useful tools in selection and recruiting of potential managers and in assessing leadership education and development programs. Future longitudinal research could further investigate the relationship between leadership success and these and other multilevel variables.

**Keywords** Top-level managers · Leadership · Brain integration · Moral reasoning · Peak experiences · Mind-brain development

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## Introduction

What is the mark of a successful leader? To succeed as a leader, managers in the private and public sector need to master a complex field. The many factors and models of effective leadership include the following: (1) establishing person–organization or person–supervisor value congruence (Hoffman et al. 2011), (2) transformational leadership that influence followers by heightening their self-awareness and influencing them to transcend lower-order needs and goals (Hoffman et al. 2011), (3) emphasizing honesty as the number one requirement of a leader (Kouzes and Posner 2009), (4) being forward-looking: envisioning exciting possibilities and enlisting others in a shared view of the future (Kouzes and Posner 2009), (5) creating job security and job variation among the associates (Humphrey et al. 2007), (6) shifting the leadership style from what was common in the industrial age to one that is appropriate for the knowledge era by focusing on enabling the learning, creative, and adaptive capacity of organizations as complex adaptive systems—Complexity Leadership Theory (Uhl-Bien et al. 2007), (7) empowering employees to act and motivate them to do so (Combs et al. 2006), (8) charismatic leadership: leaders' positive emotional expressions influence ratings of leader effectiveness and attraction to the leader (Bono and Ilies 2006), (9) creating shared purpose and meaning (Kriger and Seng 2005), and (10) leadership through ego-transcendence (Parameshwar 2005).

Is there a common, underlying factor? Kriger and Seng (2005) write about leadership in terms of three levels: having, doing, and being. Normally, attention is only at the expressed levels of behavior: (1) having the right skills, competencies, and resources appropriate to the task, and (2) doing appropriate activities at appropriate times for the situation. Yet, leadership is often a product of subtle,

invisible feelings, thoughts, and intuitions, and action is just the tip of the iceberg. Therefore, effective management may depend on mastering the third fundamental dimension that Kriger and Seng delineate—being. In this paper, we will explore the "being level" of effective leaders as reflected in their level of psychological and physiological development.

Previous research brings out the importance of psychophysiological development for performance in general and leadership in particular. For example, a meta-analysis of over 90 years of research has found that with respect to performance in general, general intelligence and integrity together give the best prediction, explaining 42% of performance levels (Robertson and Smith 2001). Rooke and Torbert's (2005) research on ego or self-development in 497 managers in different industries showed that about 80% of those who scored in an advanced growth range (post-conventional as explored later), which is normally reached by only about 10% of the adult population, were at senior management levels. Compared to adults with average intelligence, the brains of people with higher intelligence use up less sugar and transfer information faster and in a more dependable way (Smith and Smith 2005). Individual differences in the amount of regional gray matter volumes across the entire brain are related to the scores on cognitive tests of general intelligence (Colom et al. 2006).

A unified theory of performance (Harung et al. 1996) proposes that effectiveness in any domain is based on one's level of mind-brain development. Mind-brain development is a broad term, which includes known affects of natural maturation and ongoing experience on brain structure and functioning, and associated levels of psychological development, that is, cognitive, emotional, moral, and ego or self-development (Travis et al. 2011; Travis and Brown 2010).

The unified theory of performance builds on a hierarchical structure of the mind from gross to subtle. These levels include the following: senses, desires, the thinking mind, the deciding intellect (the level of general intelligence), the level of feelings and intuition, the individual ego that integrates personal experience, and the most fundamental level of silent, awake self-awareness or transcendental consciousness (Alexander et al. 1990; Parameshwar 2005; Kriger and Seng 2005). One's primary locus of awareness along this vertical mental structure would characterize one's current mind-brain developmental level, for instance at the rule-governed thinking level (mind) or the abstract reasoning level (intellect).

Development along this continuum involves the neural processes of increasing complexity and interconnections between association and sensory cortices, and the psychological processes of differentiating from the current level of processing and re-integrating at a more abstract, holistic, and inclusive level of processing (Alexander et al. 1990; Travis and Brown 2010). As leaders' mind-brain level deepens, they would be progressively less governed by outer circumstances and more governed by inner values, feelings, and thinking (Alexander et al. 1990). Their actions would be increasingly motivated by the desire to grow, rather than reacting to perceived deficiencies (Maslow 1968). Contact with deeper more fundamental mental levels results in growth of holistic thinking (Gustavsson 1992), resiliency in stressful situations and new abilities to resolve conflicts (Schmidt-Wilk 2000), and spontaneous growth of leadership behaviors (McCollum 1999).

## Markers of mind-brain development

### *Brain integration*

One marker of level of mind-brain development is level of brain integration. Higher brain integration provides a coherent framework for the brain to integrate localized processing modules into a larger picture (Palva et al. 2005). Brain integration has been operationalized by three measures derived from the brain waves (EEG or electroencephalography) that are recorded during challenging tasks (Travis et al. 2002):

1. *Higher broad band coherence in frontal executive areas of the brain*. The frontal executive areas direct the brain in a similar way that the chief executive officer (CEO) leads his or her organization. All other brain areas send information to the prefrontal cortex; this area integrates that information and then activates the rest of the brain in a coordinated way. With higher coherence, frontal areas unite perception, planning, strategizing, and behavior into a more successful performance.
2. *Higher alpha relative power*. Higher alpha relative power during tasks indicates that the person can remain at the balance point—being calm and alert at the same time. Greater inner balance allows the leader to be more adaptable to changes in his or her associates, customers, market, technology, and economy.
3. *Efficiency in brain functioning*. This is a measure of brain preparatory response during challenging tasks. Better match between task demands and brain activation translates into more efficient behavior. Brain areas involved in a task will be primed and activated only when needed and only for as long as needed. Conversely, brain areas not needed are not activated. In this way, resources are not wasted. Economy in thinking and acting is essential for an effective leader.

Higher levels of brain integration are associated with higher activity in the frontal-parietal default mode network

of the brain (Travis et al. 2009), which also is reported to underlie general intelligence (Glascher et al. 2010). The prefrontal cortex is the seat of cognitive functions, which integrates the concrete present with past memories, emotions, values, and goals, and determines our next step (Gilkey and Kilts 2007). Under excessive stress, the functional of the prefrontal cortex shuts down (Sullivan and Gratton 2002), and cognitive functioning of leaders deteriorates (Thompson 2010). Faced with high levels of stress, executives may overreact to life-experiences, become more irritable, and lack the capacity to recognize problems or exploit possibilities (Biberman et al. 2011). Based on interviews and several standard psychological tests, Travis et al. (2004) found that higher levels of brain integration correlate positively with higher emotional stability, higher moral reasoning, and more openness to experience; and correlates negatively with anxiety. It is therefore likely that mature development provides the manager with more calmness and alertness, even during turbulent situations.

### *Moral reasoning*

Another marker of level of mind-brain development is level of moral reasoning. Higher moral reasoning implies doing the right thing and requires a larger context for making sound decisions—for instance the impact of actions on others, society, and environment, rather than merely on one's own individual needs. Higher moral reasoning is associated with higher levels of cognitive and ego or self-development (Gibbs et al. 1990), and with higher levels of brain integration (Travis et al. 2004). Research in neuroethics indicates that moral reasoning also has an affective component (Salvador and Folger 2009).

Moral behavior has received increasing attention in recent years as is evident from numerous media disclosures and by numerous papers (e.g., Giacalone and Jurkiewicz 2003; see also below). Surveys reveal that 80% of Americans do not trust corporate executives and—worse—that roughly half of all managers do not trust their own leaders (Hurley 2006). Fortunately, value congruence, or the extent to which an individual's values are consistent with those revealed in his or her organization, has significant positive effects on a variety of outcomes (Hoffman and Woehr 2006). Value congruence involves moral, loyalty, self-concept, and value-laden goals (van Knippenberg et al. 2004; Hoffman et al. 2011). Damon (2004) interviewed 48 executives who had achieved great success by adhering to moral conviction. He writes that "Morality is a positive force in human life, not just a set of stifling constraints" (p. 14). Damon found many other examples of positive morality and high performance: choices shaped by idealism and noble purpose in childhood and adolescence (Damon 1999; Damon et al. 2002).

With psychological development, there is an enhancement of a person's capacity to make meaning of experience, to perform consciously, and to handle complexity. This growing ability can be illustrated by contrasting the personal characteristics of conventional development (about 80% of today's adult population) with the more mature post-conventional development (about 10%[1]): from narrow craft perspective to more holistic comprehension, from short-term to long-term, from reactive to proactive and preventive, from resistance to innovation, from mistrust to trust, from moral based on following others or norms to internalizing what is right and wrong, from win–lose to win–win interpersonal strategies, and from extrinsic motivation (winning, money, power, fame) to intrinsic motivation (self-improvement and searching for meaning or peak experiences; Loevinger 1976; Cook-Greuter 1999, 2000; Rooke and Torbert 2005).

For a post-conventional person, the corresponding reality is primary and the conventional, secondary. The conventional person, however, tends to be restricted to the conventional perspective. It is evident that a post-conventional psychology is more comprehensive and progressive, and therefore would be a distinctive advantage for mastering management. Rooke and Torbert (2005) write about seven stages of ego or self-development—based on Loevinger's (1976) stage model of development—and how transformation to a higher stage progressively leads to enhanced capacity to lead.

### *Peak experiences*

A third marker of level of mind-brain development is frequency of peak experiences. Peak experiences are experiences of ego-transcendence, glimpses of transcendental consciousness lying beyond ordinary daily experience (Wuthnow 1978; Alexander et al. 1990). Parameshwar (2005) investigated how ten internationally renowned human rights leaders—such as Mahatma Gandhi and Mother Theresa—through ego-transcendence pioneered social innovations in spite of challenging circumstances. Her paper presents an integrative conceptual framework of exceptional leadership based on ego-transcendence and a higher purpose, and defines transcendence in terms of "… at the farthest spectrum of consciousness, the individual 'I' is fully transcended and the pure consciousness… is all that remain" (p. 713). Maslow (1968) also defined peak experiences in terms of transcendence.

Peak experiences during rest can be experienced as a state of quiet wakefulness, which brings a sense of inner well-being and freedom from changing circumstances.

[1] The remaining 10% of adults are pre-conventional, a developmental range normally found in children.

Transcending may be related to superior executive performance in that it provides the executive with a fresher, less troubled, and more steady state of mind from which to make decisions and influence others (Biberman et al. 2011).

Peak experiences during activity bring with them such qualities as inner silence and deep relaxation amidst dynamic activity, ease of functioning and effortless action, playfulness, inner happiness, broad awareness combined with sharp focus, frequent luck or fortunate coincidences, loss of fear, awe and wonder, time and space disorientation, very rich perception, and reliable intuition (Ravizza 1977; Wuthnow 1978; Mason et al. 1997). Such moments are often related to optimal performance (Maslow 1968; Harung in press).

More frequent peak experiences have been reported by business leaders compared to non-leading controls (Thornton et al. 1999), and by high performers in a variety of professions (e.g., leaders in business, public administration, and education) compared to controls (Harung et al. 1996). Wuthnow (1978) found that those reporting several deep and lasting peak experiences (peakers) tended to find their lives more meaningful, to feel more assured of themselves, to be less concerned with social status and more concerned with helping others as compared to those not reporting any deep and lasting peak experience (non-peakers). Panzarella (1980) writes that peak experiences may leave permanent "total" effects involving more positive self-feelings as well as improved relationships with others and a boost of optimism.

### Research on world-class performers

Research on world-class athletes supports the relation of higher mind-brain development with greater effectiveness (Harung et al. 2011). If higher mind-brain development is associated with greater expression of inner resources, then people who are more successful would have higher levels of mind-brain development. The 33 world-class Norwegian athletes in this study finished among the top ten in Olympic Games, World Championships, or similar competitions for at least three seasons. The comparison athletes—who were matched for age, gender, and type of sport—trained and competed regularly, but did not normally place among the top 50% in Norwegian championships. Compared to comparison athletes, world-class athletes reported (1) higher levels of ego or self-development, (2) higher levels of moral reasoning, (3) faster habituation to loud tones (an objective measure of the ability to ignore distractions), and (4) higher levels of brain integration.

Another study found higher overall mind-brain development in professional compared to amateur classical musicians in Norway and Sweden on these markers. The professional musicians also scored significantly higher on cognitive measures, which helped them to excel in music, that is, faster resolution of perceptual conflict and higher vigilance levels, and a tendency for faster speed of cortical processing (Travis et al. 2011).

The current study compared levels of mind-brain development of managers at the top of their organization to those with low levels of organizational responsibility. We hypothesized that if managerial effectiveness is strongly influenced by level of mind-brain development, then top-level managers in comparison with low-level managers should exhibit (1) higher levels of brain integration, (2) higher levels of moral reasoning, and (3) more frequent self-report of peak experiences.

## Methods

### Subjects

In business and industry, the attainment of power and fame and the accumulation of extensive wealth may not necessarily have its basis in a genuine leadership. On the contrary, there are many examples of rich and powerful businesspeople who display questionable morals, or who have accrued their wealth based on fear-based management and the manipulation of other people (Giacalone and Jurkiewicz 2003; World Economic Forum 2005). On this basis, we decided not to use a quantitative selection approach based on growth in for example profit or sales of the organization. Rather, we decided to use a qualitative selection approach based on the following criteria for the top-level managers: (1) successful leadership over 10 years or longer, (2) acting as a good example for others, and (3) broader perspective than just earning money, that is, exemplifying corporate social responsibility.

We consulted with Tor Dahl, who for more than 35 years was CEO of Manpower (a major staffing and selection company) in Norway, the Nordic countries, and Europe. Mr. Dahl had for many years been taking a keen interest in Norwegian leadership in practice, and his company had served the majority of the organizations whose leaders are involved in this study. Since Norway is a small country, it was relatively easy for Mr. Dahl to maintain an overview. Thirty-eight top-level Norwegian managers were identified and contacted, and 20 agreed to take part in the study. They had held their positions for an average of about 18 years. Sixteen were from the private sector and four from the public sector. Among the sixteen managers in the private sector, nine (56%) were successful entrepreneurs, and seven (44%) companies were

listed (six on the Oslo Stock Exchange and one on NYSE).

Next, controls were selected who were matched for age (top-level managers: 56.6 ± 2.3 years, comparison group: 56.1 ± 1.6 years), gender (4 female and 16 males), level of education, and type of organization (private or public), but had limited organizational responsibility. The majority of the controls were low-level managers (e.g., project manager, senior engineer, and product manager) and the others were skilled knowledge workers (e.g., associate professor, senior consultant, and programmer).

## Procedure

The subjects underwent 1½ h of testing. First, they completed a consent form. Next, they filled out two psychological tests while EEG sensors were applied to their scalp to measure brain wave activity. Following application of sensors, the subjects were given two computerized tasks while their physiological data were recorded.

## EEG protocol

EEG was recorded with the BIOSEMI ActiveTwo System from 32 locations in the 10–10 system over the scalp. Signals from the left and right ears were also recorded for later re-referencing as a linked-ears reference. All signals were digitized on line at 256 points/s, with no high or low frequency filters, and stored for later analyses using Brain Vision Analyser. EEG was recorded during two computer tasks.

The first task contained 16 paired simple reaction-time trials that lasted for 2-min. Each trial included a warning asterisk (150 ms duration, 1 cm in height) in the center of a computer screen, followed 1.5 s later by a continuous computer-generated tone (1,200 Hz, 85 dB). Subjects were asked to press the button in their right hand as soon as they heard the tone.

The second task contained 24 paired choice reaction-time trials that lasted for 3-min. Each trial included a one- or two-digit number (150 ms duration, 1 cm in height), a 1.5-s blank screen, and then another one- or two-digit number (150 ms duration, 1 cm in height), and were asked to press a left- or right-hand button to indicate which number was larger in value.

We calculated the difference in level of brain preparatory response, called the Contingent Negative Variation (CNV), for accurate responses in the simple and choice reaction-time tasks. We do not compare accuracy because it is usually very high on these tasks—95% or higher. The difference in CNV on these two tests is one component of the Brain Integration Scale. The other two components in the Scale are power (wave amplitude squared) and coherence (alignment of waves from different parts of the brain) during the choice reaction-time test. We calculated power and coherence during the choice reaction-time test, because it is more demanding and so brain patterns should be more sensitive to changes in overall brain functioning.

## Psychological test instruments

### *Moral reasoning*

Gibbs's Socio-moral Reflection questionnaire presents moral statements and asks subjects to describe *why* a moral act may be important to them (Gibbs et al. 1990). For instance: "Keeping promises is important because …," or "Helping one's friend is important because …." Gibbs has written an extensive reference manual to aid in categorizing responses into moral maturity levels (Gibbs et al. 1992). Gibbs's Social Reflection questionnaire has high test–retest reliability ($r = 0.88$), and high Cronbach alpha coefficients ($r = 0.92$). Scores on this instrument highly correlate with scores on Kohlberg's Moral Judgment Interview ($r = 0.70$) (Gibbs et al. 1992), a widely used test of moral reasoning.

Gibbs specifies four stages of moral reasoning: (1) unilateral and physicalistic rules—concerned with the body alone—determine behavior; (2) exchanging and instrumental consideration of consequences determines actions; (3) mutual and pro-social concerns for the integrity of the individual determine actions. (4) systemic and standard concern for the larger societal consequences and benefits determines actions. More abstract levels of moral reasoning emerge developmentally and parallel growth in cognitive development and in self-development (Gibbs et al. 1992). A Norwegian version of the questionnaire translated by the first author was used in this study.

### *Survey of Peak Experiences*

This questionnaire has been refined over 25 years based on glimpses of peak experiences in criterion-rich subject populations (Harung et al. 1996). The instrument consists of four questions derived from traditions that reflect both Eastern and Western thought. The first author translated this instrument into Norwegian for use in this study. These questions are as follows:

1. *Peak experiences during waking activity*. "Have you experienced that while performing activity there was an even state of silence within you, underlying and coexisting with activity, yet untouched by activity? This could be experienced as detached witnessing even while acting with intense focus."

2. *Peak experiences during eyes closed rest*. "During practice of relaxation, meditation, prayer, or any other technique—or when you have relaxed or had a quiet moment—have you then experienced a completely peaceful state; a state when the mind is very awake, but quiet; a state when consciousness seems to be expanded beyond the limitations of thought, beyond the limitations of time and space?"
3. *Peak experiences during sleep*. "During deep sleep, have you ever experienced a quiet, peaceful, inner wakefulness? You woke up fresh and rested, but with a sense that you had maintained a continuity of silent self-awareness during sleep?"
4. *Luck or fortunate coincidences*. "Have you experienced that your desires are fulfilled in a way that seems to be caused by coincidence or luck? You may have experienced that the circumstances arrange themselves to fulfill your desires without your direct action."

For each question, the subject indicated frequency of the experience—ranging from "never to my knowledge" (0) to "all the time" (11). In addition, the subjects were asked to write down sample descriptions of such glimpses, using their own words.

### Data analysis: EEG

#### *Coherence and power*

Coherence and power were calculated from the EEG recorded during accurate responses in the second choice reaction-time computer task. The second task heavily loads perceptual, cognitive, and response systems and so should accentuate any group differences. Mathematically, coherence reflects the similarity of electrical activity from different parts of the brain. Functionally, coherence reflects whether two parts of the brain are working together on the task (Thatcher et al. 1986).

The artifact-free data were digitally filtered with a 2–45 Hz band pass filter, and fast Fourier transformed in 2-s epochs, using a Hanning window with a 20% onset and offset. Coherence was calculated in 0.5 Hz bins. Frontal coherence (F3–F4) was averaged from 8 to 45 Hz. EEG power ($uV^2$/Hz) was calculated for the 32 recording sites. Relative alpha power (8–12 Hz) was averaged at frontal and central sites.

#### *Brain preparatory response*

The data during accurate responses during the paired-simple and choice reaction-time tasks were visually scanned, and any epochs with movement of body, electrode, or eye artifacts were manually marked and not included in the spectral analyses. The artifact-free data were digitally filtered with a 0.01–6 Hz band pass filter, segmented in 2 s segments—200 ms before the first stimulus, 1,500 ms after the first stimulus, onset of the second stimulus, and 300 ms after the onset of the second stimulus and during response selection. The average amplitude in the 200 ms window before the second stimulus was calculated during the simple and choice trials. Simple-choice difference scores were calculated ($\text{Amplitude}_{\text{simple}} - \text{Amplitude}_{\text{choice}}$) to assess the impact of the additional cognitive load of the choice trials independent of possible group differences in the simple trials.

### Brain Integration Scale calculation

Frontal coherence, relative alpha power, and the simple-choice difference scores were added to the normative database, converted to z-scores, and summed to yield a single value for each person tested (see Travis et al. 2002).

### Data analysis: psychological tests

The Survey of Peak Experiences questionnaires were scored using standard templates. Gibbs's Social Reflection questionnaires were sent to certified scorers. The scorers for this instrument met the requirements for reliability in scoring, set forth in Appendix B and C in Gibbs manual (Gibbs et al. 1992).

### Statistical analyses

A MANOVA was conducted on the six variates—the four variables from the Survey of Peak Experiences, the score on the Gibbs's Social Reflection questionnaire, and the Brain Integration Scale score. Partial eta squared ($\eta^2$), the power statistic reported for $F$ tests by SPSS, is reported for all analyses. Partial eta squared is the variance accounted for—similar to $r^2$. An exploratory correlation analysis was also conducted to probe relations between moral reasoning, the components of the Survey of Peak Experiences, and the components of the Brain Integration Scale.

## Results

The MANOVA of the six variables revealed a significant main effect for group (Wilk's Lambda $F(6,33) = 2.74$, $P = 0.029$). Table 1 presents the means, standard deviations, $F$ statistics, $P$ values, and partial eta squared ($\eta^2$) for individual ANOVAs of group differences for the six variables. As seen in this table, the top-level managers had a trend for greater luck, and significantly more frequent peak

**Table 1** Means (SD), $F$ statistics, $P$ values, and partial eta squared ($\eta^2$) from individual ANOVAs of group differences on the six variables

| Variable | Top-level managers | Comparison | $F(1,38)$ | $P$ value | Partial eta squared ($\eta^2$) |
|---|---|---|---|---|---|
| Survey of Peak Experiences | | | | | |
| 1. During activity | 4.3 (3.2) | 3.3 (3.0) | 1.08 | NS | 0.03 |
| 2. Luck | 4.3 (2.0) | 2.8 (3.1) | 3.21 | 0.080 | 0.08 |
| 3. During rest | 4.3 (3.0) | 2.4 (2.5) | 4.75 | 0.035 | 0.11 |
| 4. During sleep | 1.9 (2.0) | 1.2 (2.5) | <1.0 | NS | 0.02 |
| Gibbs's socio-moral reflection | 3.40 (0.10) | 3.26 (0.25) | 5.30 | 0.027 | 0.12 |
| Brain Integration Scale | 2.48 (0.68) | 1.54 (1.33) | 7.91 | 0.008 | 0.17 |

experiences during rest, higher Brain Integration Scale scores, and higher scores on the Gibbs's Social Reflection questionnaire, compared to the comparison group.

Table 2 presents the Pearson correlation matrix of the Brain Integration Scale scores, the three components of the Brain Integration Scale, the Moral Reasoning score, and the four variables in the Survey of Peak Experiences. Significant correlations (two-tailed) are bolded for easy identification.

The Brain Integration Scale significantly correlated with its three components, with higher luck, and with higher moral reasoning. Among the three components of the Brain Integration Scale, higher alpha coherence correlated with the same measures as the Brain Integration Scale; brain preparatory response only inversely correlated with moral reasoning (this is a positive relation); and relative power only correlated with more frequent peak experiences with eyes closed. Moral reasoning also correlated with higher incidences of luck, along with the Brain Integration Scale. Within peak experiences, frequency of peak experiences with eyes closed and eyes open were correlated.

## Discussion

The data supported the hypotheses. The top-level managers, compared to controls, had significantly higher Brain Integration Scale scores (Hypothesis 1), higher scores on Gibbs's Socio-moral Reflection questionnaire (Hypothesis 2), and more frequent peak experiences during rest (Hypothesis 3). There was a trend for more incidences of luck in the top-level managers. Significant correlations were also seen between the Brain Integration Scale and components of the scale with the other measures.

### Practical implications of the findings

These data add an objective, neurophysiologic prospective to the discussion of more effective versus less effective managers. While different management styles may be beneficial in different situations, higher levels of brain integration could provide a common basis for more integrated and effective perception, planning, and action. To be successful, managers need to maintain the big picture while

**Table 2** Pearson correlation matrix of the Brain Integration Scale scores, the three components of the Brain Integration Scale, Moral Reasoning score, and the four variables in the survey of peak experiences

| | Brain Integration Scale | Alpha coherence | Brain preparatory response[a] | Relative power | Moral reasoning | Peak experience: eyes open | Luck | Peak experience: eyes closed |
|---|---|---|---|---|---|---|---|---|
| Alpha coherence | **0.676**** | | | | | | | |
| Brain preparatory response[a] | **−0.302*** | **−0.0365*** | | | | | | |
| Relative power | **0.497**** | **0.306*** | −0.164 | | | | | |
| Moral reasoning | **0.397**** | **0.451**** | **−0.312*** | 0.150 | | | | |
| Peak experience: eyes open | 0.130 | 0.034 | 0.228 | 0.127 | 0.160 | | | |
| Luck | **0.308*** | **0.303*** | 0.145 | 0.102 | **0.321*** | 0.298 | | |
| Peak experience: eyes closed | 0.133 | 0.030 | 0.145 | **0.375*** | 0.110 | **0.440**** | 0.267 | |
| Peak experience: sleep | 0.024 | −0.026 | −0.243 | 0.023 | 0.163 | 0.274 | 0.151 | 0.155 |

Significant correlations (two-tailed) are bolded for easy identification

** Correlation is significant at the 0.01 level (2-tailed); * correlation is significant at the 0.05 level (2-tailed)

[a] When Brain Preparatory Response is negative, it indicates a better match of brain preparatory response and task demands. So "negative value" is considered better

they focus on details; they need to be multidimensional in their vision while they are one-dimensional in action; they need to maintain strategic insight while they adopt a tactical view.

Greater brain integration may serve as the global context to better integrate localized experiences. Enhancing mind-brain development could thus activate more comprehensive perspectives and strategies, enabling managers and associates to see beyond immediate circumstances and deal with larger principles and forces at work in the market place and in society. This expanded perspective could guide cognitive, behavioral, and organizational strategies and execution for greater success in business.

## Differences in frequency of peak experiences

Top-level managers, compared to comparison subjects, had significantly more frequent peak experiences during rest and a trend for more instances of luck. There were no differences on these measures in the previous research with athletes (Harung et al. 2011). This could reflect the different areas of business and sports. Sport has clearly articulated rules of conduct, well defined objectives, and times and venues for competition that are settled long in advance. In contrast, business occurs within an ill-defined socio-economic, technological, competitive, and governmental environment that is characterized by high complexity, constant change, and globalization.

Therefore, effective decisions may require a much broader perspective in management than in sports. While major athletic competitions are short, relatively few, and very intense, managers need to perform at the top several hours every working day for many years. As a consequence, to succeed managers may need to rely more on intuition or hunches in making decisions, and to profit from good luck (Mintzberg 1976). Parnell and Dent (2009) observed that the higher the manager is in the organization, the more likely he or she is to perceive luck as affecting outcome.

## Unified theory of performance applied to leadership

Figure 1 illustrates how the unified theory of performance has two main components that influence leadership performance: (1) the level of mind-brain development of the leader, and (2) the larger context of the pervasive collective consciousness in which she or he operates (Gustavsson 1992; Harung 1999; Harung et al. 1999). The degree of development of collective consciousness is determined by the average level of development of all the members of the organization, including the leader. Collective development is not part of this study, but we mention it here for the sake of completeness.

Since the individual functions as a whole, we would expect that the three markers of mind-brain development have a reciprocal influence on each other. This reciprocal relationship, which is illustrated by the horizontal arrows in the figure pointing both ways, is backed by the higher correlation among mind-brain variables in this study (see Table 2) and by findings in other research. For example, higher intelligence is associated with faster and more dependable transfer of information in the brain (Smith and Smith 2005). Panzarella (1980) studied musicians and visual artists reporting peak experiences and found that "the range of effective peak experiences triggered for the individual was significantly correlated with the measure of self-actualization" (p. 84; self-actualization is the endpoint of psychological development in Western psychology).

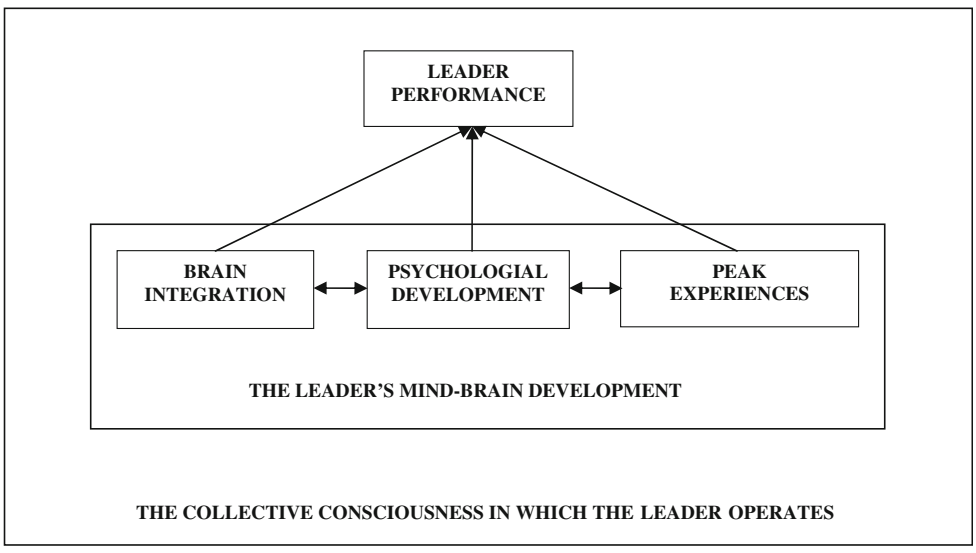


**Fig. 1** Unified theory of performance applied to leadership

Similarly, Maslow (1968) found that the closer a person came to self-actualization, the more peak experiences he or she reported.

What are the causal factors of level of performance? Does successful management lead to peak experiences, higher moral reasoning, and higher brain integration? Or do development of these measures support higher performance in management and other areas? The current design, being cross-sectional, cannot answer this question. However, meta-analyses spanning over 90 years of research at work show that age and work experience have negligible influence on level of performance (Schmidt and Hunter 1998). In the present study, the leaders and controls were matched for age and still showed significant differences in mind-brain development, as well as in level of success in management. As seen, aspects of mind-brain development are predictive of level of performance and leadership (e.g., Robertson and Smith 2001; Rooke and Torbert 2005). Thus, these data indicate that mind-brain development is causal to success. Future research can investigate causal effects of mind-brain development on level of achievement.

### Limitations of the study

This is a preliminary study that explored the relation of mind-brain development—as operationalized by measures of brain integration, moral reasoning, and peak experiences—with managerial success. One limitation of this study was that the selection criteria were qualitative rather than quantitative. An experienced CEO such as Tor Dahl could identify top managers from his extensive leadership experience, but this selection procedure makes it difficult to replicate the study. Another limitation was the control group, which included both low-level managers and skilled knowledge workers. A more rigorous design could identify, as controls, managers of companies that were exhibiting limited growth and compare them to managers of companies that were exhibiting substantial growth. A third limitation is that the study was cross-sectional. We do not know whether (1) the top-level managers started with higher levels of mind-brain development early in their career, and this trait supported their success, or (2) the top-level managers started with lower levels of mind-brain development, which grew as they became more successful.

### Future research

Future research could replicate and extend the present study, involve more subjects, and address the above limitations. The level of mind-brain development can be compared in managers that score high on performance assessment (e.g., Bailey and Austin 2006) and mangers that score on a substantially lower level (controls). Managers can also be selected based on the performance of their organization over several years in terms of for example growth in sales, profit, customer satisfaction, or number of employees. The top-level managers and controls could then be differentiated on these quantitative variables.

Future research could also investigate the predictive power of mind-brain development in a longitudinal study where junior managers (1) were assessed for levels of mind-brain development and (2) then followed for 3–5 years. Those with higher mind-brain development at the initial measurement would be hypothesized to advance faster in their career and to exhibit greater success. The research could also measure other psychological variables, such as general intelligence and behavior-related performance tests (Robertson and Smith 2001). Finally, one could study whether and how the average mind-brain development in an organization influences its performance and that of its leader.

## Conclusion

This study has investigated a unified theory of performance, which states that higher mind-brain development forms the basis for higher performance and more effective leadership in any profession or vocation. The findings from this and other world-class performance studies suggest that multilevel variables—levels of brain integration, moral reasoning, and frequency of peak experiences—can help define more effective leaders and higher performers in general. These measures may thus be useful in the selection, recruiting, and promotion of potential leaders and associates, and in providing a more accurate assessment of the outcome of education and training programs.

The findings also suggest that managerial training programs should explore how different interventions might enhance mind-brain development. If mind-brain development can be systematically enhanced over the life span, then leadership could be continuously improved as well.

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