

A proposed new psychological model for judgment and decision-making: Integrating the tri-partite model with hemispheric difference

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This paper considers the implications for leadership development of a proposed new psychological model based on the integration of two distinct fields of research in cognitive science and neuroscience, namely, judgment and decision-making in the heuristics and biases tradition, and in particular the dual-process theory of cognition and its development into a tri-partite model; and the differences between the distinct modes of attention supported by left and right cerebral hemispheres. It is suggested that decision-makers' performance in volatile or complex environments could be enhanced through the appropriate engagement of each among the expanded set of cognitive faculties identified in the model. Individual differences shown to correlate with leadership tend to divide into non-cognitive personality traits—primarily the Big Five but also further, narrower traits such as narcissism or Machiavellianism (Judge *et al.*, 2009; Judge *et al.*, 2002)—and cognitive ability, i.e. intelligence, primarily as measured by IQ tests (Hoffman *et al.*, 2011), all of which remain relatively stable during adulthood, limiting the scope for developmental intervention. In contrast, the proposed model includes aspects of cognition that are not abilities, measured as maximal performance, but rather dispositions to reflect and to use qualitatively distinct modes of attention—typical modes of thought, the habitual, coordinated engagement of which might enhance decision-making. The significance of these "cognitive traits" for leadership development is that such reflective and deliberate interventions into the decision-making process occur at a conscious level and therefore might be systematically invoked, either through self-coaching or in organisational processes.

The dual-process theory of cognition

The starting point for the proposed new psychological model is the dual-process theory of cognition (Evans, 2008, 2010; Kahneman and Frederick, 2002, 2005; Stanovich, 2011). Kahneman (2011) introduced the concepts of fast and slow thinking to a popular audience and used dual-process theory to frame the four-decades-long research programme into cognitive heuristics and biases that he co-founded (Tversky and Kahneman, 1974). The generic theory (there are many variants; see the reviews of Evans, 2008, 2010) distinguishes two kinds of thinking. Fast thinking (System 1/Type 1/heuristic processing) comprises a set of autonomous processes including the emotional regulation of behaviour, specific innate responses that were adaptations to the human evolutionary environment, implicit learning, and rules or decision-making principles reduced to automaticity through repetitive practice. Fast thinking requires little mental effort and acts as the default means of making judgments or decisions. Slow thinking (System 2/Type 2/analytic processing) is in contrast relatively slow and effortful. One of the key functions of slow thinking is occasionally to override fast thinking in contexts in which the latter would produce an irrational response.

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The relevance of dual-process theory, and the substantial evidence gathered in its support, for the development of judgment and decision-making in a leadership context is its warning of the fallibility of fast intuitive judgments, especially the tendency unconsciously to substitute an easily evaluated but less relevant characteristic for one that is harder to evaluate (Kahneman and Frederick, 2002). More generally, fast thinking is influenced by whichever concepts or experiences are most readily accessible in memory, i.e. by the most salient associations in the moment, rather than by those which are most relevant in the circumstances. In a study by Strack *et al.* (1988), subjects asked to hold a pencil between their teeth so as to force their mouths into a smile rated cartoons as funnier on average (a smile, even a forced one, being associated with amusement); holding the pencil between pursed lips so as to force a frown caused them to rate the same cartoons as less funny (frowning being associated with a lack of amusement). A simple, and unconscious, somatic association had a significant effect on the subjects' supposedly objective evaluations. In another experiment by Bateson *et al.* (2006), replacing a painting of a sunflower hanging on the wall behind a table of self-service refreshments with a painting of a pair of watching eyes caused subjects to leave larger sums in the payment box (being "watched", even by a painting, being associated with social pressure to be more generous), even though they were unable to recall the painting when interviewed subsequently. Such substitution, association and priming effects are compounded by introspective blindness to the biases influencing one's own decisions (West *et al.*, 2012; Pronin *et al.*, 2002).

In response to these challenges, Kahneman (2011, pp. 417-418) proposes the routine use of checklists (enforcing the steps in a proven model or technique, whether or not these come to mind in fast thinking) and exercises such as the "pre-mortem" proposed by Klein (2003): thinking deliberately about the ways in which a decision might fail and exploring the causal factors that lead to those failure modes in order to override confirmation bias, the tendency to appreciate evidence which supports one's position but to ignore or depreciate evidence which undermines it or supports a contrary position. Kahneman is pessimistic about the ability of any individual (himself included) to overcome his or her own biases, but more confident of the perception of bias in others and thus the potential for organisations to enforce the systematic scrutiny of individuals' judgments.

One of the leading voices against dual-process theory is Gigerenzer, who argues that both intuitive and deliberate thinking depend on rules; that a distinction can be drawn between heuristic or satisficing rules that define cues for a search process and criteria for stopping it and thus ignore part of the information, and on the other hand optimising rules that take all available information into account; that optimising rules require greater cognitive resources to implement but heuristic rules, while generally more efficient, also vary in their cognitive demands; that heuristic rules can be more accurate in certain environments, despite being more efficient; and that heuristic rules can be applied deliberately as well as intuitively; and therefore that the sharp distinction between the two kinds of thinking is misplaced (Kruglanski and Gigerenzer, 2011; Gigerenzer, 2009).

Heuristic rules that have been shown to characterise human judgment in certain circumstances include: simply choosing the alternative that is recognised over that which is not (Goldstein and Gigerenzer, 2002); seeking to apply the most valid (based on experience) search cue but falling back on decreasingly valid cues until one successfully discriminates between the alternatives (Gigerenzer and Goldstein, 1996); satisficing, i.e. choosing the first alternative which exceeds a "good enough" criterion (Simon, 1955); allocating resources equally between all available alternatives (DeMiguel *et al.*, 2009); and tit-for-tat, i.e. first

cooperating, then imitating the other person's last behaviour (Axelrod, 1984). While the point that heuristic rules can be both more efficient and more accurate than optimising rules in certain environments is well taken, the problem remains that no rule guarantees a good result in all environments and therefore, since there is no gut feeling that one's gut feeling is incorrect, there is no avoiding the need to consider whether to override one's fast intuitive judgment when encountering a new or volatile environment—a point that will be developed below. Thus the distinction between fast and slow thinking remains an important one.

The tri-partite model

Stanovich (2009, 2011) develops the dual-process theory into a tri-partite model, distinguishing fast thinking, slow thinking as serial (or algorithmic) processing—the power of imagination required to simulate a hypothetical situation and work through it step by step so as to explore the consequences—and, as a separate component, the reflective mind. The latter encompasses such cognitive dispositions as collecting information, seeking alternative perspectives and taking time to reflect before making a decision, and calibrating the degree of confidence in one's judgment to the weight of evidence available (Stanovich *et al.*, 2012). Slow thinking here is intelligence in the narrow sense of what IQ tests measure, in contrast with a broader concept of rationality—defined operationally by the tasks and effects studied in the heuristics and biases research programme—that also includes reflective thinking dispositions (Toplak *et al.*, 2014). Performance on many of the tasks in the heuristics and biases literature shows relatively modest correlation with IQ (Stanovich and West, 2008; Stanovich, 2009).

The tri-partite model has further relevance for the development of judgment and decision-making in a leadership context. First, it broadens the concern for cognitive performance beyond the traditional, narrowly defined intelligence of IQ:

"To think rationally means adopting appropriate goals, holding beliefs that are commensurate with available evidence, and taking the appropriate action given one's goals and beliefs. None of the currently used tests of intelligence assess any of these functions. The developmental trajectories of judgment and decision-making skills—the skills of rational thought—must be assessed in their own right" (Toplak *et al.*, 2013, p. 9).

Moreover, whereas IQ tests measure an ability—maximal performance on a given scale—reflective dispositions are typical, not maximal: taking time to reflect before making an important decision is good, but taking ever longer is not necessarily better (Stanovich *et al.*, 2011). In seeking to extend the concept of intelligence, the tri-partite model of cognition might fruitfully be compared with theories of emotional intelligence; popular among practitioners, it has been posited variously as an aspect of personality—trait emotional intelligence—and as emotional ability. Yet the MSCEIT, perhaps the leading emotional ability construct, was almost entirely predicted by IQ, the Big Five and gender (the multiple correlation was 0.81; Schulte *et al.*, 2004); and even prominent defenders of emotional intelligence acknowledge that "there is no one single study...that has established its construct validity unequivocally" (Antonakis *et al.*, 2009, p. 259). In contrast, reflective thinking dispositions have been shown to be relatively independent of IQ measures, and their predictive validity for judgment and decision-making established (Stanovich and West, 2008; Stanovich, 2009).

Secondly, Stanovich *et al.*, (2011) distinguish the different kinds of knowledge accessed in fast, slow and reflective thinking. Fast thinking depends on knowledge acquired both through

implicit learning and through deliberate repetition at the level of slow thinking. Klein (1998) found that fire-fighters' expert judgments were made autonomously, by way of fast thinking, on the basis of highly diagnostic cues that had been learned over extensive periods of slow thinking (see also Kahneman and Klein, 2009). In contrast, the knowledge accessed in slow thinking comprises cognitive strategies—mental models (including heuristics) or techniques that can be applied to simulate hypothetical situations or to guide behaviour—while the knowledge accessed in reflective thinking also comprises the individual's beliefs, goals and general knowledge. Thus the rationality of judgments and decisions under the tri-partite model may be adversely affected by the absence of relevant knowledge (e.g. cognitive strategies such as scientific method or probabilistic reasoning) or the presence of "knowledge" that misleads (e.g. superstitious beliefs) (Perkins, 1995). In comparison with a traditional personality-plus-intelligence leadership model such as that of Judge *et al.* (2009, p. 862), which involves beliefs and knowledge only to the extent of "core self-evaluations" (beliefs about one's own value, control and efficacy; p. 866), slow and reflective thinking depend on one's inventory of mental models as well as one's goals and general knowledge; this suggests the need for greater emphasis, in the context of leadership development, on the continual review and, where necessary, the updating of one's knowledge and beliefs.

Thirdly, having distinguished reflective thinking from slow thinking, Stanovich (2009) provides an explanation for why engaging the latter may not suffice to escape from the irrationality of fast intuitive judgments in contexts in which they are unreliable: the danger is that slow thinking may be framed by the unchallenged assumptions and associations that were most readily accessible in the fast thinking it was engaged to override (see also Evans, 2006; Kahneman, 2011). Even where a decision-maker has knowledge of proven models or techniques that may be applied through slow thinking to generate predictions about a given situation or to guide behaviour, there is no guarantee that the first cognitive strategy to come to mind—i.e. the frame or model that is most readily accessible in a given individual's memory and thus bequeathed by fast thinking to (unreflective) slow thinking, and that is subsequently applied through slow thinking—will be the most apt in the circumstances. Therefore even a decision-maker with high IQ and who has learned relevant models and techniques, if lacking certain reflective dispositions, may make poor decisions—led astray by irrelevant associations at an unconscious level.

Fourthly, any reliance on fast intuitive judgments is called into question outside specific domains of expertise, namely, environments which resemble the evolutionary environment in which certain innate responses were adaptive and selected for—not necessarily modern technological societies—or which are sufficiently stable and in which the individual has spent sufficient time in receipt of prompt feedback on the effect of any given action such that good (rational) responses have been learned to the point that they have become automatic. Therefore fast intuitive judgments are unreliable in new or volatile environments or those in which outcomes are ambiguous. Judge *et al.* (2009) make a parallel point concerning leadership traits: "the traits we, and our leaders, possess today may not be as well suited to contemporary society and its demands as to the demands of ancient social, economic, and anthropological organization. ... leadership conditions change quickly, and pose new and complex requirements on leaders that may be mismatched to our current 'stock' of traits" (p. 859).

Fifthly, in complex environments—i.e. non-linear environments in which even a full understanding of certain kinds of situation in isolation does not give a full understanding (or any understanding, necessarily) of those same kinds of situation in combination—models or

techniques proven to give good results in a familiar situation are not necessarily reliable when applied to that same situation in interaction with the wider environment. Thus in a complex environment, even where a given situation is recognised and a proven model is retrieved from memory and correctly applied through slow thinking (by an individual with sufficiently high IQ to use the model to reach a valid conclusion)—i.e. even where both fast and slow thinking have been carried out without obvious error by a sufficiently intelligent and well educated individual—there is no guarantee of a sound decision. Again, Judge *et al.* (2009) make a parallel point: "traits may not have linear effects—on fitness, or on leadership outcomes" (p. 860). Whilst the model presented in this paper is primarily cognitive given the concern with organisational decision-making, it is acknowledged that one future development might be its incorporation into a more comprehensive psychological model that includes established leadership traits.

Clearly, reflective thinking necessarily plays an important role in judgment and decision-making, especially in new, volatile or complex environments. The tri-partite model suggests several points at which reflective thinking is required: first, the prompt to engage slow thinking to override fast thinking and not to rely on the default judgment of the latter; secondly, the prompt to consider an alternative to the frame most strongly associated with the situation in fast thinking and thus inherited as the starting point for slow thinking; thirdly, more generally, the drive to acquire knowledge of relevant frames and to unlearn those which inhibit rational thought, such as superstitious beliefs. The significance for leadership development, in the context of this paper, is that these reflective interventions into the decision-making process occur at a conscious level. Therefore it may be possible deliberately to prompt such thinking, either by self-coaching or a personal decision-making checklist or, following Kahneman's advice, in an organisational process that involves external scrutiny of individuals' decision-making. In contrast, developmental intervention to increase adult IQ is limited to working memory training leading to modest improvements in fluid intelligence of the matrix reasoning sort (Nisbett *et al.*, 2012, p. 139).

Perhaps the closest comparator to this proposed reflective-level intervention that is currently used in the development of individual decision-making is the teaching of critical thinking skills. However, West *et al.* (2008) suggest that while there is overlap between critical thinking skills and rational thinking, the latter is broader: selected heuristics and biases (i.e. rationality) tasks measure aspects of the theoretical construct of critical thinking that traditional tests such as the Watson-Glaser Critical Thinking Assessment (Watson and Glaser, 1980) do not; and reflective thinking dispositions are an independent predictor (after controlling for cognitive ability, i.e. IQ) of both the ability to avoid bias in reasoning caused by prior belief, a classic critical thinking skill, and these additional aspects of critical thinking. Thus the development of rational thinking through reflective-level interventions may offer greater scope for improvement in decision-making than traditional critical thinking skills.

The left and right cerebral hemispheres

This paper seeks to bring a new perspective to the challenges enumerated above, and to build on the above proposal deliberately to prompt reflective thinking, by integrating the tri-partite model with a distinct body of research from the field of cognitive neuroscience: hemispheric difference. McGilchrist (2010) presents a concise summary of decades of research into the distinct modes of attention of left and right cerebral hemispheres, the division of which he describes as "offering the reciprocal possibilities of breadth and flexibility in apprehending

the unpredictable and (as yet) unknown, versus the focus and precision required to grasp and use what is familiar and has already been prioritized as of interest" (p. 324).

In summary, the left hemisphere's narrow, focused attention prioritises what is expected and works within a closed, fully "known" model, ignoring what does not fit (Podell *et al.*, 1995; Phelps and Gazzaniga, 1992; Brownell *et al.*, 1986; Molloy *et al.*, 1990). It focuses on parts and attends to detail (Cutting, 1997; Bradshaw and Nettleton, 1983) but works with abstract categories, ignoring context or individual differences (Cutting, 1997; Marsolek, 1995; Brown and Kosslyn, 1993). It appreciates mechanical, causal processes and non-living structures, specialising in the use of tools and techniques in order to manipulate the environment (Gainotti, 2002; Martin *et al.*, 1996; Perani *et al.*, 1995).

In contrast, the right hemisphere's broad, flexible attention is open to what is new or unexpected; it is tolerant of ambiguity or uncertainty and able to act as a devil's advocate (Rogers, 2000; Goldberg *et al.*, 1994; Berns *et al.*, 1997; Sperry, 1985; Ramachandran, 1994). Broad attention and greater working memory (Tucker and Williamson, 1984; Kirsner, 1980) allow the right hemisphere to appreciate wholes, taking in the full context (Federmeier and Kutas, 1999; Heilman *et al.*, 1975); to appreciate broad or complex patterns, integrating the different senses (Navon, 1977; Fink *et al.*, 1999; Chapanis, 1977); to understand implicit meaning and metaphor (Bottini *et al.*, 1994; Pobric *et al.*, 2008); and to seek alternative perspectives and so to shift between and to compare different frames (Coulson, 2001; Ramachandran, 1994). It recognises particular things or persons as individual and unique (Landis *et al.*, 1986). It is embodied and appreciates living things (Wallace and Canter, 1985), specialising at expressing and receiving social emotions (Decety and Chaminade, 2003). Given the left hemisphere's narrow focus and tendency to ignore whatever does not accord with its current model, the right hemisphere plays a crucial role in directing and redirecting the attention of the left hemisphere in order to take advantage of its attention to detail in environments that require shifting focus.

The left and right cerebral hemispheres are connected by the corpus callosum, the function of which is communication between the hemispheres but also inhibition of one hemisphere by the other so that specialised functions may be carried out undisturbed. There is an asymmetry in the transfer of information between the hemispheres such that in normal subjects information is transferred from the left hemisphere to the right more slowly than from the right to the left, even where the nature of the task better suits the right hemisphere (Larson and Brown, 1997). There is also an asymmetry in the inhibition of one hemisphere by the other such that the suppressive effect of the left hemisphere on the right is greater than that of the right on the left (McGilchrist, 2010; Oliveri *et al.*, 1999; Kinsbourne, 1992). However, McGilchrist (2010) describes the inhibitory nature of the corpus callosum as "adaptive and creative, rather than restrictive" (p. 327); he also notes the conclusion of Banich (2003, p. 270): "Interhemispheric interaction has important emergent functions—functions that cannot be derived from the simple sum of its parts."

Integrating the tri-partite model and hemispheric difference

The tri-partite model distinguishes three kinds of thinking: autonomous thinking that results in fast intuitive judgments but subject to numerous biases; slower, more effortful thinking that supports the deliberate application of mental models or techniques or the simulation of hypothetical situations but that is prone to accept unchallenged the frame or model that was most strongly associated with the situation in fast thinking; and reflective thinking that

prompts the need for deliberation but that also questions assumptions, seeks alternative perspectives, and considers the alignment between potential actions and overall goals. The cerebral hemispheres support two distinct modes of attention: the narrow, focused attention of the left hemisphere that brings clarity and power by filtering out everything that does not fit a given model and by supporting detailed analysis of the parts and the causal relations between them; and the broad, vigilant, embodied attention of the right hemisphere that remains alert to what is new or unexpected and tolerant of ambiguity, that tends to question the received view and to seek and compare alternative perspectives, that supports a holistic appreciation including non-literal, non-verbal aspects of a situation, and that accesses and integrates the senses including one's own somatic and emotional states and perceptions of others' emotions and intentions.

The significance of the tri-partite model for leadership development identified above was that the reflective thinking dispositions to deliberate, to seek an alternative perspective and to update one's knowledge (both by learning new models or beliefs and, where necessary, by unlearning incorrect beliefs) could be encouraged in an organisational context through the implementation of a decision-making process that incorporated such steps. The central claim of this paper is that by integrating hemispheric difference with the tri-partite model, a richer structure for such a decision-making process may be developed.

A proposed new psychological model

Fast thinking is supported by a set of neurological systems involving various parts of the brain including those in both left and right cerebral hemispheres. The integration of hemispheric difference does not change the view of fast thinking.

Slow thinking in the tri-partite model—i.e. the deliberate application of a particular technique or model, or hypothetical, consequential reasoning—resembles the mode of attention of the left hemisphere: one focal model; serially working through a simulated representation of the world, part by part. This paper proposes that slow thinking—slow, effortful engagement with a situation—is also supported by cognitive attributes that are characteristic of the right hemisphere: reasoning that is holistic or analogical rather than serial and literal. This paper will not explore analogical reasoning in detail but one key claim is that the making of an analogy between a (source) conceptual category in memory and the (target) situation faced by an individual—i.e. the recognition of some similarity between the structure of a familiar concept and that of a newly encountered situation—enables inferences about the former to be made of the latter (Hofstadter, 1985; Hofstadter and Sander, 2013; Lakoff, 1993; Lakoff and Johnson, 1999; Tversky, 1977). "Metaphoric language is the manifestation of conceptual structure organised by a cross-domain mapping: a systematic set of correspondences between the source and target that result from mapping frames or cognitive models across domains" (Coulson, 2001, p. 162). Where the conceptual stretch to bring the target situation within the source category is great, the application of that conceptual category may be deemed metaphorical rather than literal; but practical inferences may be drawn nonetheless. By providing a means rapidly and creatively to apply new conceptual frameworks to unfamiliar situations (i.e. to generate new hypotheses), if supported by key cognitive strategies such as scientific method, such a process addresses the potential failure modes identified above for both the tri-partite model and leadership trait theory in volatile or complex environments.

It follows that slow thinking can also be intuitive. In the cognitive science literature, "intuitive" tends to imply "fast"; this paper draws a distinction between fast intuitive

judgments that are the result of fast thinking and slow intuitive associations and analogies—and the practical inferences that are the result of analogical reasoning—supported by slow thinking in the right hemisphere. One may question whether an individual's attempt to find relevant associations between concepts or experiences stored in memory and aspects of a given situation is effortful and thus correctly deemed slow thinking: there is no deliberate means to force an association into consciousness; and when such an association does enter consciousness, it is not necessarily preceded by the sensation of having expended effort and indeed attention may have been focused elsewhere. However, conscious or not, cognitive resources are engaged over an extended period of time in finding such associations, and the result is a relevant frame, concept or experience that was not most readily accessible in fast thinking and that, without further cognition, would not have become available to the individual.

Furthermore, it is proposed that the somatic and affective states that act as unconscious filters in fast thinking by increasing the accessibility of frames associated with previous situations in which the individual experienced similar feelings can also be employed deliberately in slow thinking to aid retrieval of relevant knowledge or experiences—in effect, self-priming. This second proposed aspect of slow thinking supported by the right hemisphere requires evidential support from future research but in the anecdotal experience of this author, clients in a coaching context who are invited first to express the feeling or sensation associated with a given situation, then to attend closely to that embodied feeling and finally to recall any previous occasion on which a similar feeling was experienced frequently do then recall relevant previous experiences or perspectives, and indeed often express surprise that they had not previously appreciated the connection. While there is no guarantee that these further, slowly retrieved frames will be any more relevant to a sound decision-making process than the first, most readily accessible frame that resulted from fast thinking, they will be relevant to the individual's understanding of his or her own previous behaviour and fast intuitive judgments. Therefore, at very least, this process may support improved self-knowledge and personal development. Moreover, it may enhance one's access in a given situation to the inventory of mental models and other relevant knowledge on which slow and reflective thinking depend. A first step in future research would be to investigate the self-reported utility of such a process; another would be to record the number or quality of concepts or experiences recalled by subjects following such a process in comparison with a control group.

A third aspect of slow thinking supported by the right hemisphere is the comparison of different, even mutually inconsistent perspectives. While the left hemisphere applies one frame and filters out all that does not fit, the right hemisphere in contrast can hold alternative perspectives in mind and thus compare them. Being tolerant of ambiguity, the right hemisphere can also hold in mind inchoate fragments of an understanding about a situation, before they have crystallised into a coherent frame. Such thinking is required in complex and volatile environments in which neither fast intuitive judgment nor the application of a previously proven model will prove generally reliable and any one frame or model may provide only a partial understanding.

A fourth aspect of slow thinking supported by the right hemisphere is a deeper appreciation of the perspectives of other individuals, which depends in part on cognitive and affective empathy and thus the perception of social emotions in which the right hemisphere specialises. Here too it will be necessary to hold in mind other individuals' mutually inconsistent or fragmentary perspectives. Without such an appreciation, any hypothetical, consequential reasoning about situations involving other individuals is unlikely accurately to represent the

reality.

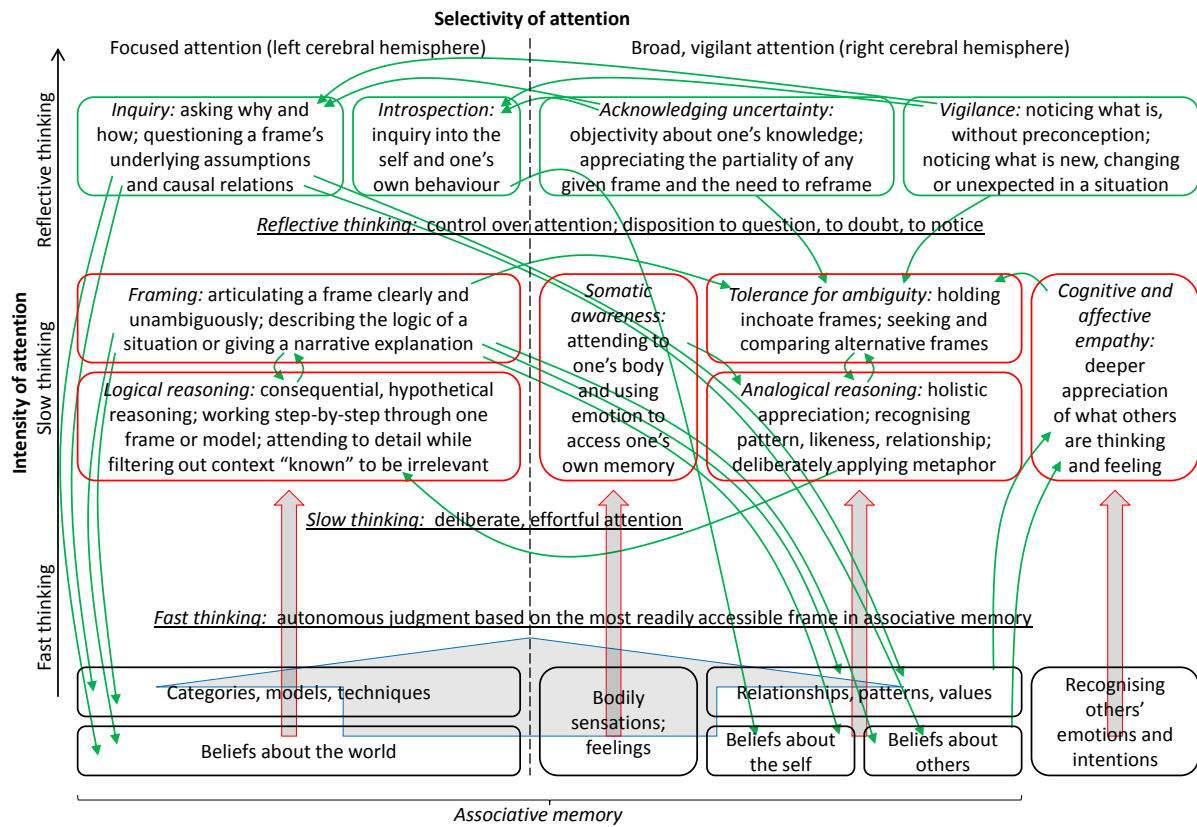
With regard to reflective thinking in the tri-partite model, the prompts to seek an alternative perspective and to question and update one's own knowledge clearly depend on aspects of right hemisphere attention: the vigilance to what is new or unexpected; the appreciation of uncertainty and the limits to knowledge and the tendency to play the role of devil's advocate. However, the act of inquiry into one's current beliefs or the assumptions underlying a given frame requires a focus on detail and an examination of the causal relations between the parts that is characteristic of the left hemisphere. Yet rational decision-making demands alignment of present action with overall goals, and an overly narrow focus risks missing the wood for the trees—suggesting the need for the broader, holistic appreciation of the right hemisphere.

In short, to be effective, reflective thinking requires coordination between the two hemispheres. A full appreciation of a given situation and a sound decision-making process are emergent properties of thinking using the whole brain and cannot be explained solely in terms of the separate parts. However, communication between the hemispheres and inhibition of one hemisphere by the other is asymmetrical—the left hemisphere being both slower to communicate information to the right and having greater suppressive effect on the right. McGilchrist (2009) presents his concern at the risk of dominance of the narrow, unambiguous world view of the left hemisphere at the expense of the broader, open way of attending to the world supported by the right hemisphere. One aim in proposing this new model is to provide theoretical support to those practices which broaden decision-making beyond the narrow, rational-analytic mode and which allow an escape from the closed certainty and false precision of the left hemisphere.

In summary, the proposed new model identifies an expanded set of cognitive faculties relevant to judgment and decision-making. At the reflective level, these comprise: vigilance to information that is new or contrary to one's current perspective; appreciation of uncertainty and the partiality of one's knowledge and a consequent willingness to challenge currently held beliefs as well as to acquire new beliefs and perspectives (characteristic of the mode of attention supported by the right hemisphere); and inquiry into assumptions and a demand for explanation as part of a detailed analysis of any given frame or model (characteristic of the left hemisphere). At the level of slow thinking, these comprise: sustained focus and attention to detail in working through any hypothetical situation or in applying any technique or model; and clarity in articulating the logic of a frame (left hemisphere); but also holistic appreciation of the situation; tolerance for ambiguity in holding and comparing alternative and perhaps mutually inconsistent perspectives, and the patience to allow an inchoate new frame to emerge; openness to finding new associations or analogies with concepts or experiences in memory, including by way of somatic or affective association and by the application of "metaphorical" conceptual categories; and attending to others' perspectives, both as a source of alternative frames and as a means to understand others and to communicate effectively (right hemisphere).

The new model supports the development of new decision-making processes based on the sequencing of and flow between these distinct aspects of cognition and, in particular, interventions at the reflective level and the transition between the modes of attention supported by left and right cerebral hemispheres. In contrast with theories of emotional intelligence, which introduce either personality traits or abilities related in various ways to emotion, but which ultimately accept the distinction between non-cognitive traits and cognitive (or extra-cognitive) abilities, this paper proposes an expanded set of cognitive

faculties that are neither clearly personality traits (yet are dispositional) nor strictly abilities (yet contribute to high-level cognitive performance), and certain of which (at the level of slow thinking in the right hemisphere) stand at the interface between the cognitive and the somatic and affective, and between the cognitive and the social-emotional.



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Figure 1: A proposed new psychological model for judgment and decision-making, with illustration of the sequencing of prompts for left- and right-hemisphere aspects of cognition

Implications for leadership development

The proposed model suggests two themes for future research. The first follows Kahneman (2011) in identifying prompts for the engagement of these different cognitive faculties that can be incorporated into decision-making processes in an organisational context. *Figure 1* illustrates a rudimentary decision-making methodology developed by the author for use in coaching and in group decision-making, comprising a dialogue-based process which traces through these distinct aspects, at each stage drawing from a set of questions and exercises which prompt that particular aspect of cognition (e.g. vigilance to what is new or unexpected may be prompted by asking: "What surprises you about this situation?"). In addition to prompting reflective thinking to avoid the various failure modes discussed above, this methodology aims to encourage greater self-awareness using both deliberately objective inquiry into one's own intentions and behaviour, and deeply subjective access to one's own relevant knowledge and experience through somatic and affective association; and to introduce techniques for generating alternative perspectives, both by systematically identifying and modifying the assumptions and relationships comprising a given frame, and by engaging analogical (or metaphorical) reasoning to import familiar inferential structure

into unfamiliar situations.



One broad empirical claim to be tested by future research is that organisational decision-making processes that trace through more of the aspects of cognition identified in the model will tend to outperform those which rely on fewer aspects. More fine-grained claims could be formulated and tested with respect to the efficacy of processes which accord with certain dynamical instances of the model—certain sequences of transitions between different aspects, or paths through the model—in specific contexts; for instance, the efficacy, in the context of an innovation process, of the sequence: vigilance (noticing the situation but not yet defining the problem), tolerance for ambiguity (holding in mind this inchoate appreciation and seeking a new frame), analogical reasoning (deliberately stretching a metaphor to describe the situation), logical reasoning (working through the consequences of this new frame), framing (only now defining the problem within the new frame) and once again tolerance for ambiguity (comparing new and old frames).

A second theme for future research is theoretical: whether the conceptual framework proposed in this paper can bring insight to existing work in the field of leadership development, especially decision-making in a group context in complex or volatile environments that necessitate the generation of new frames and the holding of multiple perspectives. In their review of the literature on shared (or otherwise "plural") leadership, Denis *et al.* (2012), when considering potential future theoretical research on shared leadership in teams, call for "further exploration to understand how deep cognitive structures influence the development of shared leadership", suggesting that "In contexts characterized by complex and interdependent tasks and a high degree of ambiguity, cognitive processes may make the difference in determining the potential of shared leadership to improve performance" (p. 230). This paper proposes just such a model of aspects of cognition and supervening dynamic cognitive structures that might be incorporated into organisational processes to improve performance.

As a further example, Carroll and Simpson (2012), writing within the relational leadership paradigm (Uhl-Bien, 2006; Lichtenstein *et al.*, 2006; Hosking, 2007), describe reframing processes in a leadership context and identify three "framing movements" in dialogue: "kindling", the conjunction of a familiar context with a new concept, leading to the construction of a new, shared frame; "stretching", in which consequential, hypothetical reasoning within the frame leads to its extension and development; and "spanning", the simultaneous holding of two distinct frames in order to construct a "larger and more complex vehicle for meaning-making" (p. 1300). Without developing these in any detail, there are *prima facie* correspondences between these framing movements and distinct aspects of cognition identified in this paper: kindling and analogical reasoning (importing inferential structure from one domain to another); stretching and logical reasoning; and spanning and tolerance for ambiguity (in the holding of multiple frames). Future research might consider what further framing movements could be supported by other elements of the model, either separately or in sequence; and whether a group dialogue-based methodology that prompts the engagement of these different aspects of cognition, such as that proposed in this paper, can support the framing movements that Carroll and Simpson suggest are "required to build the social capital, relationality and shared meaning-making that enables groups to think, act and work together in leadership" (2012, p. 1302).

In conclusion, this paper suggests that decision-makers' performance in volatile or complex environments could be enhanced through the appropriate engagement of each aspect of

cognition identified in a proposed new psychological model that develops the tri-partite model by integrating hemispheric difference. A decision-making methodology incorporating prompts to engage each aspect could be adopted by individuals or embedded in organisational processes, providing a new basis for leadership development in such challenging environments.

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