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Intuition: A fundamental bridging construct in the behavioural sciences

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The concept of intuition has, until recently, received scant scholarly attention within and beyond the psychological sciences, despite its potential to unify a number of lines of inquiry. Presently, the literature on intuition is conceptually underdeveloped and dispersed across a range of domains of application, from education, to management, to health. In this article, we clarify and distinguish intuition from related constructs, such as insight, and review a number of theoretical models that attempt to unify cognition and affect. Intuition's place within a broader conceptual framework that distinguishes between two fundamental types of human information processing is explored. We examine recent evidence from the field of social cognitive neuroscience that identifies the potential neural correlates of these separate systems and conclude by identifying a number of theoretical and methodological challenges associated with the valid and reliable assessment of intuition as a basis for future research in this burgeoning field of inquiry.

Historically, psychologists have been reluctant to acknowledge intuition as a viable construct, often consigning it to the 'fringes' of the field of psychology, within the realms of parapsychology, telepathy and premonition (see e.g. Claxton, 2000; Klein, 2003), and equating it to esoteric and 'New Age' thinking (Boucouvalas, 1997). Recently however, a number of scholarly developments have occurred which signal that intuition is a concept that has truly come of age. Psychologists have recognized its importance in a variety of cognitive processes, from the use of heuristics in decision making (Cappon, 1993; Kahneman & Tverskey, 1982; Klein, 1998, 2003) to creativity (Claxton, 1998) and learning (Burke & Sadler-Smith, 2006; Hogarth, 2001). Intuition lies at the heart of a number of dual-process theories of cognition (Epstein, 1991, 1994; Gilovich, Griffin, & Kahneman, 2002; Stanovich & West, 2000; Wilson, 2002; Wilson, Linsey, & Schooler, 2000) and personality and individual differences theories (Allinson & Hayes, 1996;

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Carraher, Carraher, & Schlieman, 1985; Langan-Fox & Shirley, 2003). It has also been implicated as a basis of expert-novice differences (Benner & Tanner, 1987; Dreyfus & Dreyfus, 1986) and has been recognized as a potentially powerful explanatory construct across a diversity of knowledge domains from medicine (Benner & Tanner, 1987; Rehm & Gadenne, 1990) to management (Agor, 1989; Dane & Pratt, 2007; Hodgkinson & Sparrow, 2002; Miller & Ireland, 2005; Parikh, 1994; Sadler-Smith, 2008; Sadler-Smith & Shefy, 2004; Sparrow, 1999). Moreover, recent work in the emerging field of social cognitive neuroscience has begun to reveal the neural substrates underpinning its use in social cognition (Lieberman, 2000; Lieberman, Jarcho, & Satpute, 2004).

In the light of these developments, we maintain that intuition has the potential to unify lines of inquiry spanning cognitive, developmental, social, educational, health and organizational psychology. However, despite the accumulating evidence, intuition continues to be somewhat overlooked or discounted within the mainstream of the discipline as a whole. The purpose of this article, therefore, is to critically evaluate the current state of scientific knowledge with regard to intuitive processing, with a view to refining the way in which the construct might be operationalized in future work.

Defining intuition

The etymological roots of the term 'intuition' stem from the Latin word *in-tuir*, which can be translated as 'looking, regarding or knowing from within'. The literature is populated with a wide array of concepts that are related to intuition but which are sometimes not well-delineated from it; these include creative cognition (Finke, Ward, & Smith, 1992) and creativity (Sternberg & Lubart, 1996), tacit knowledge (Polanyi, 1964), implicit learning and implicit memory (Reber, 1989; Roediger, 1990; Seger, 1994) and insight (Bowden, 1997) (see Table 1). Conceptually, intuition does have features in common with these and with related constructs, but there are also important differences. For instance, insight involves incubation (Mayer, 1996; Wagner, Gais, Haider, Verieger, & Born, 2004), a long gestation period following an impasse in problem solving (Bowden, Jung-Beeman, Fleck, & Kounios, 2005; Harper, 1989) and a final insightful experience (an 'aha' or 'Eureka' moment) (Knoblich, Ohlsson, & Raney, 2001; Schooler, Ohlsson, & Brooks, 1993) in which there is distinctive and sudden understanding of a problem, or of a strategy that aids the solving of the problem (Mayer, 1996). In contrast, intuition occurs almost instantaneously, is affectively charged but does not have any accompanying verbalization or conscious awareness of the problem-solving process (Hogarth, 2001) and may precede insight (see Volz & von Cramon, 2006). With regard to the implicit/explicit learning and knowledge distinction outlined in Table 1, Dienes and Berry (1997) reviewed a considerable volume of literature and concluded that there was evidence to substantiate this basic dichotomy (see also Dienes & Perner, 1999). Implicit learning and implicit knowledge contribute to the knowledge structures upon which individuals draw when making intuitive judgments. However, although they may underpin the non-conscious cognitive, affective and somatic processes that lead to an intuitive judgment, they are not equivalent to intuitions.

As to the meaning of intuition, until recently consensus eluded scholars, to the extent that Bastick (1982) claimed that the numerous and varied properties of the concept precluded the possibility of a unitary definition. We disagree with this viewpoint, which unhelpfully leads researchers into an analytical and theoretical *cul-de-sac* in what is undoubtedly an important area of human cognition and behaviour. Fortunately, the recent conceptual and theoretical developments alluded to above have

Table 1. Intuition and related constructs

Construct	Definition	Source(s)	Relationship to intuition
Tacit knowledge	Polanyi (1964) argued that a tacit knowledge exists, the content of which is not part of one's normal consciousness, nor open to introspection	Reber (1993)	Intuition draws upon experience and expertise and previous 'analyses frozen into habit' (Simon, 1987). Intuition is an aspect of expertise or tacit knowledge which is drawn upon with varying degrees of automaticity depending upon the interaction of the individual and the context
Implicit vs. explicit learning and knowledge	Unconscious process in gaining abstract or 'tacit' knowledge vs. conscious process in gaining concrete or explicit knowledge	Dienes and Berry (1997) and Reber (1989)	Intuitive knowledge may be the end product of implicit learning experience which is stored below the level of conscious awareness
Instinct	Fast, reflexive responses that enable organisms to react to a threat and enhance its possibilities of survival	Carlson (2004)	Both instinct and intuition may lead to somatic responses to a stimulus; unlike intuition, instinctive reactions are not guided by deep knowledge structures and prior learning and expertise (they are not 'analyses frozen into habit')
Insight	Sudden realizations ('a eureka' experience) usually after a period of immersion in a problem and in which an impasse has been reached in its solution (a period of incubation)	Mayer (1996) and Nisbett and Wilson (1977)	Insight is a sudden moment of enhanced awareness in which a problem solver attains a conscious and clear understanding of the solution to a perplexing problem. Intuiting on the other hand does not involve conscious and deliberative 'rational processing', and intuition is accompanied by a somatic awareness which influences decision choices but the subject may be not consciously aware of the source
Creativity	Preconscious activity which guides or alerts an individual to highly novel, creative, and unusual ideas and outcomes	Finke *et al.* (1992)	Intuition may be involved in the early stages of the creative process by providing somatic signals for or against a course of action

provided the basis for a broadly consensual definition of intuition to emerge. Table 2 summarizes a range of definitions that share a number of characteristic features, not least the importance attached to the role of the unconscious in information processing. It is highly noteworthy, however, that although an historic link can be drawn between intuition and the work of Jung (1933), there is a notable absence of modern authors who define the concept in Jungian psychoanalytic terms.

Intuiting is a complex set of inter-related cognitive, affective and somatic processes, in which there is no apparent intrusion of deliberate, rational thought. Moreover, the outcome of this process (an intuition) can be difficult to articulate. The outcomes of intuition can be experienced as an holistic 'hunch' or 'gut feel', a sense of calling or overpowering certainty, and an awareness of a knowledge that is on the threshold of conscious perception (Bechara & Damasio, 2005; Damasio,1994). In their recent comprehensive review of the intuition literature within the field of management, Dane and Pratt (2007: 40) defined intuitions as 'affectively-charged judgments that arise through rapid, non-conscious, and holistic associations'. This particular definition seems to capture the essence of intuitive processing, as contained in the work of the various authors summarized in Table 2. Accordingly, it is the definition of choice that will be adopted in the remainder of this article.

Intuitive abilities, styles and strategies

Researchers have conceptualized intuition in a number of different ways: as a cognitive ability (Sternberg, 1997); an enduring cognitive style or trait (Allinson & Hayes, 1996) and as a cognitive strategy (Hogarth, 2001; Klein, 2003). Abilities refer to the general attributes and competencies an individual brings to the performance of a task and are closely aligned to aptitude (Langan-Fox, Armstrong, Anglim, & Balvin, 2002), the latter being unrealized or latent in nature. Abilities imply quantitative differences in levels of proficiency that are either innate or acquired over time through learning (Howe, 1996). The better the performance, the higher the presumed level of ability, with 'expert' performance only acquired through focused effort and deliberate practice (Ericsson, 1996; Ericsson & Charness, 1994).

In the cognitive abilities literature, especially the factor analytic literature, intuition is conceptually linked to fluid intelligence (*Gf*) (Horn & Cattell, 1966; Mackintosh, 1998; Stankov, 2003), induction and originality (French, Ekstrom, & Price, 1963; Torff & Sternberg, 2001), originality/creativity and the production of 'clever' interpretations (Carroll, 1993), and to divergent productions in unstructured tasks (Guilford, 1967). In his two-level architecture model of cognitive processing, Sun (1997) proposed that the top level captured conscious processes, while the bottom level captured intuition; the latter involved a gradual process of implicit learning to develop 'tacit' representations. His model accorded with the views of other researchers (e.g. Reber, 1989), in which intuition is seen as the end-product of a process of unconscious and 'bottom-up' learning and an outcome of unconscious implicit processes that may become explicit (Bowers, Regehr, Balthazard, & Parker, 1990).

In defining intelligence as the ability to deal with cognitive complexities of different kinds, Stankov (2003) stated that intuition and 'idiosyncratic knowledge' contribute to intelligent behaviour. Stankov argued that the that insignificant correlation between intuition and intelligence can be attributed to the infrequently accessed cognitive processes used in intuitive problem solving and the difficulties of obtaining satisfactory reliabilities with complex tasks. In this regard, intuition can be conceptualized as one

Table 2. Authors and definitions of intuition (in alphabetical order)

Source	Definition of intuition
Bastick (1982, p. 2)	A powerful human faculty, perhaps the most universal natural ability we possess
Bowers *et al.* (1990, p. 74)	Intuition is a perception of coherence at first not consciously represented but which comes to guide our thoughts toward a 'hunch' or hypothesis. Intuition has two stages: a guiding stage involving an implicit perception of coherence that guides thought, unconsciously toward a more explicit perception of the coherence in question. By a process of spreading activation, clues that reflect coherence activate relevant associationistic networks, thereby producing a tacit or implicit perception of coherence. A second stage involves integrating into consciousness a plausible representation of the coherence in question; it occurs when sufficient activation has accumulated to cross a threshold of awareness.
Dane and Pratt (2007, p. 9)	The defining characteristic of intuitive processing is that: (1) It is non-conscious. . .it occurs outside of conscious thought. While the outcomes of intuiting, intuitive judgments are clearly accessible to conscious thinking, how one arrives at them is not. (2) As a holistically associative process it may help to integrate the disparate elements of an ill defined problem into a coherent perception of how to proceed. For this reason intuitive judgments are said to become more effective relative to rational analysis as a problem becomes increasingly unstructured. (3) It involves a process in which environmental stimuli are matched with some deeply held non-conscious category, pattern or feature. (4) Intuitive processing has speed when compared with rational decision making processes.
Dreyfus and Dreyfus (1986, p. 56)	Intuition is manifested in the fluent, holistic and situation-sensitive way of dealing with the world
Jung (1933, pp. 567–568)	A psychological function that unconsciously yet meaningfully transmits perceptions, explores the unknown, and senses possibilities which may not be readily apparent
Miller and Ireland (2005, p. 21)	Intuition can be conceptualised in two distinct ways: as holistic hunch and as automated expertise. . . .Intuition as holistic hunch corresponds to judgment or choice made through a subconscious synthesis of information drawn from diverse experiences. Here, information stored in memory is subconsciously combined in complex ways to produce judgment or choice that feels right. 'Gut feeling' is often used to describe the final choice. Intuition as automated expertise is less mystical, corresponding to recognition of a familiar situation and the straightforward but partially subconscious application of previous learning related to that situation. This form of intuition develops over time as relevant experience is accumulated in a particular domain.
Polanyi (1964, p. 24)	Intuitions are implicitly or tacitly informed by considerations that are not consciously noticed or appreciated

Table 2. (*Continued*)

Source	Definition of intuition
Reber (1989, p. 232)	Intuition may be the direct result of implicit, unconscious learning: through the gradual process of implicit learning, tacit implicit representations emerge that capture environmental regularities and are used in direct coping with the world (without the involvement of any introspective process). Intuition is the end product of this process of unconscious and bottom-up learning, to engage in particular classes of action.
Rowan (1986, p. 96)	Intuition is knowledge gained without rational thought. It comes from some stratum of awareness just blow the conscious level and is slippery and elusive. Intuition comes with a feeling of 'almost, but not quite knowing'.
Sadler-Smith and Shefy (2004, p. 77)	Intuition is a capacity for attaining direct knowledge or understanding without the apparent intrusion of rational thought or logical inference
Shirley and Langan-Fox (1996, p. 564)	A feeling of knowing with certitude on the basis of inadequate information and without conscious awareness of rational thinking
Simon (1987, p. 29)	Intuition are – 'analyses frozen into habit'
Smolensky (1988, p. 82)	Intuition has the characteristics of being implicit, inaccessible and holistic. Intuition and skill are not expressible in linguistic forms and constitute a different kind of capacity, reflecting 'subsymbolic' processing.
Vaughan (1979, pp. 27–28)	Knowing without being able to explain how we know. Intuitive experiences have four discrete levels of awareness: physical, which is associated with bodily sensations; emotional, where intuition enters into consciousness through feelings; that is, a vague sense that one is supposed to do something and instances of immediate liking or disliking with no apparent reason; mental, which comes into awareness through images or 'inner vision'. This is an ability to come to accurate conclusions on the basis of insufficient information; and spiritual, which is associated with mystical experience, a holistic understanding of actuality which surpasses rational ways of knowing.
Westcott (1968)	Intuition involves awareness of things perceived below the threshold of conscious perception

element of practical intelligence (PI) in Sternberg's (2003) triarchic theory of intelligence (the three components of which are creative, practical and analytical intelligences). PI is theorized to lie beyond conscious awareness, is difficult to articulate and comprises knowledge that is acquired experientially and stored tacitly (Hogarth, 2001). PI is non-analytical and adaptive in that it involves the ability to understand and deal with judgmental tasks in complex real world settings; it is sometimes labelled as the ability to be 'street-smart' (Sternberg & Wagner, 1986; Sternberg, Wagner, & Williams, 2000).

Some scholars have claimed that intuition is an innate ability, and that all humans possess it in some form; for example, Bastick (1982, p. 2) argued that intuition is ' . . . a powerful human faculty, perhaps the most universal natural ability we possess' and suggested that it may have a genetic component. In keeping with this claim, the capability to intuit could be regarded as an inherited 'unlearnt gift' (Moir & Jessel, 1989). Myers (2002, p. 33) offers an evolutionary explanation, in describing social intuition as an 'ancient biological wisdom' that comes into play in such situations as 'meeting a stranger in a forest':

> . . . one had to instantly assess whether that person was friend of foe. Those who could read a person accurately were more likely to survive and leave descendants, which explains why humans today can detect at a glance facial expressions of anger, sadness, fear, or pleasure. Small wonder that the first ten seconds of a relationship tell us a great deal, or that our capacity for reading non-verbal cues crosses cultures.

The ability to intuit in particular domains is acquired through experience and learning (Agor, 1989; Harper, 1989; Klein, 1998) and relies upon pattern recognition processes. Simon (1997) described experiments conducted by Chase and Simon (1973) in which chess grand masters and novices were each shown the layout of pieces from an actual chess game and asked to reproduce it; the chess experts did so with 95% accuracy, the novices with only 25% accuracy. The same task when repeated with the chess pieces arranged randomly resulted in both experts and novices scoring around 25% in terms of accuracy of recall. Simon interpreted this as evidence that chess grand masters (and by extrapolation other experts) hold in their memory not only a set of patterns, but also information about the significance of the pattern (including information concerning its emotional salience, such as the danger or satisfaction from previous episodes associated with it). The intuitive ability of an expert is derived in large part from the large numbers of patterns held in long-term memory. Simon estimated, for example, that chess grand masters hold 50 000 patterns in long-term storage. Chase and Simon's results indicated that the superior memory of experts is not photographic, but requires arrangements of chess pieces that can be encoded using associations with the experts' extensive knowledge of chess (see Ericsson & Delaney, 1999), typically acquired over 10 years or more of experience and practice (Ericsson & Charness, 1994).

Expert's intuitive ability is also derived from their capacity to recognize salient environmental cues and rapidly match those cues to commonly occurring patterns, responding in ways that lead to effective problem solving and decision making. For example, Klein's recognition primed decision (RPD) model combines two processes: the way decision makers 'size up the situation to recognize which course of action makes sense', and 'the way they evaluate that course of action by *imagining it*' (1998: 24 – emphases added). Klein's research into naturalistic decision making (NDM) utilizes Applied Cognitive Task Analysis (ACTA) in order to identify the key cognitive elements required to perform a task proficiently (see also Militello & Hutton, 1998). In the RPD model, intuitive decision making entails the use of experience to recognize key patterns that indicate the likely dynamics of a given situation in order to conduct the 'mental simulations' (Klein, 1998: 45) required to rapidly evaluate the alternatives and select a singular course of action (Klein, 1998: 31). By imagining people and objects 'consciously and transforming those objects through several transitions', experienced decision makers are able to project how the present will move into the future (Klein, 1998, pp. 73–74) and hence are able to make useful predictions. Although the notion of mental simulation is highly plausible in terms of its face validity and seems to be corroborated by his own empirical findings, in the exposition of his theory Klein is unclear about the degree of fidelity required of these mental simulations in order to render them useful in the complex, time pressured, 'life-or-death' situations in which he claims they are typically deployed. Given the basic restrictions of working memory capacity, these simulations must be inherently limited in terms of their overall fidelity; but even allowing for the fact that they are typically constructed on the basis of just three variables and six transitions, it is difficult to envisage such simulations being mentally rehearsed in 'real time' in the manner envisaged by Klein.

Acquired abilities enable individuals to perform particular tasks, whereas cognitive styles control the ways in which those tasks are performed; hence styles are qualitatively different, generalizable tendencies that cut across content. Similar to traits they represent a person's: 'typical modes of perceiving, remembering, thinking, and problem solving' (Messick, 1970, p. 188). Cognitive style thus differs from cognitive ability, in that it characterizes consciously preferred ways individuals arrive at judgments. Researchers also distinguish cognitive style from cognitive strategies (Kirton, 1989; Robertson, 1985; Sternberg & Grigorenko, 1997). Cognitive strategies, developed from cognitive styles, are optimal procedures used to perform specific tasks (Beckman, 2002). Hayes and Allinson (1994) argued that there is a single superordinate dimension of cognitive style that underpins the numerous facets of information processing identified by many previous researchers. They labelled this dimension 'intuition-analysis' and defined each pole of it thus:

> 'Intuition . . . refers to immediate judgement based on feeling and the adoption of a global perspective. Analysis . . . refers to judgement based on mental reasoning and a focus on detail' (Allinson & Hayes, 1996, p. 122).

Hence, within this view intuition and rationality are conceived as opposite ends of a common bipolar dimension. Allinson and Hayes reported the development and validation of the Cognitive Style Index (CSI), an instrument designed to locate individuals along this putative unidimensional continuum. Despite exhibiting good internal consistency (e.g. Allinson & Hayes, 1996; Sadler-Smith, Spicer, & Tsang, 2000) and test–retest reliability (Allinson & Hayes, 1996; Armstrong, Allinson, & Hayes, 1997), recent factor analytic studies, using both exploratory and confirmatory procedures (Hodgkinson & Sadler-Smith, 2003a, 2003b), suggest that responses to this instrument are modelled more appropriately as two separate unipolar scales, in line with dual-process theories of social cognition and decision making, such as the cognitive-experiential self-theory (CEST) advanced by Epstein and his colleagues (e.g. Epstein, 1991; Epstein, Pacini, Denes-Raj, & Heier, 1996). This view accords greater agency to individuals, arguing that analytic and intuitive processing capabilities are served by cognitive systems that permit individuals to switch back and forth strategically from one approach to the other, as required, albeit moderated to some extent by stylistic preferences (see also Dane & Pratt, 2007; Sinclair & Ashkanasy, 2005).

Dual-process conceptions of intuition

It is clear from the foregoing review that the psychological literature has lacked a coherent overarching conceptual framework in which to place intuition. In consequence, the concept has been used in a haphazard and fragmented manner. However, we maintain that in the light of the conceptual advances outlined above, it is now possible to offer a more integrated and coherent account of the nature and role of intuition. For this purpose, we turn to dual-process theories in social cognition and cognitive psychology.

There is an emerging consensus that a useful distinction can be made between two basic systems of information processing (see, e.g. Bruner, 1986; Chaiken & Trope, 1999;

Evans & Over, 1996, 1997; Gilovich *et al.*, 2002; Johnson-Laird, 1983; Labouvie-Vief, 1990; Schroyens, Schaeken, & Handley, 2003; Sloman, 1996; Smith & DeCoster, 1999; Stanovich, 1999; Stanovich & West, 2000; Sun, 1997; Sun, Slusarz, & Terry, 2005). Although dual-process theories come in a number of forms, they reflect variously the generic fundamental distinction offered by Stanovich and West between System 1 and System 2 processes. System 1 processing is contextually dependent, associative, heuristic, tacit, intuitive and implicit/automatic in nature; hence, it is relatively undemanding in terms of its use of scarce cognitive resources. In contrast, System 2 processing is contextually independent, rule-based, analytic and explicit in nature; hence, it is relatively slow and makes greater demands on cognitive resources than its System 1 counterpart (Schroyens *et al.*, 2003; Stanovich, 1999; Stanovich & West, 2000). The cognitive-experiential self-theory (CEST) developed by Epstein and his colleagues (Denes-Raj & Epstein, 1994; Epstein, 1991, 1994; Epstein *et al.*, 1996) is representative of dual-process theories more generally and serves a useful basis upon which to anchor our discussion. As in the work of other dual-process theorists alluded to above, Epstein and his colleagues posit two parallel interactive modes of information processing, which they maintain are served by separate cognitive systems.

According to CEST, the rational system operates at the conscious level and is analytic, verbal and relatively affect-free. It enables information to be acquired through intentional, effortful engagement in deliberative analyses. The experiential system, believed to be the older of the two systems in evolutionary terms, in contrast, operates on an automatic, preconscious basis and is primarily non-verbal in nature. In particular, the experiential system is 'emotionally driven' (Epstein, 1994, p. 715). Action is assumed to be the product of the two systems, which usually engage in seamless interaction but which sometimes produce what are commonly identified as conflicts between 'the heart and the head' (Epstein, 2000, p. 671). We take the notion of 'experiential' in CEST to be broadly equivalent to 'intuitive' and to closely mirror intuition as depicted in this review.

Other researchers have drawn similar distinctions in terms of two parallel systems of information processing; for example, associative processing and rule-based processing are seen as parallel modes (Sloman, 1996; Smith & DeCoster, 1999). The associative mode, which takes the form of similarity-based retrieval and pattern recognition, provides information quickly and automatically and operates preconsciously, to the extent that we are only aware of the outcome (i.e. intuitive and affective responses to objects or events) and not of the process itself (see also Bargh, 1989). Rule-based processing uses symbolically represented knowledge, which, unlike the associative system that draws on features built-up slowly, can be acquired and built-up relatively quickly from a comparatively small number of experiences (Sloman, 1996; Smith & DeCoster, 1999). Stanovich and West (2000) noted that although the details of the corresponding elements of the different dual-process theories do not always match one another precisely, nevertheless, there are enough 'family resemblances' among them for the prototypical labels System 1 and System 2 to be applied generically across a broad spectrum of work spanning the cognitive sciences, including the body of work summarized in Table 3. In terms of functionality and utility, the two processing systems each have their own strengths and weaknesses; for example, System 1 provides evaluations and affective reactions without much attention from the receiver (Smith & DeCoster, 1999) and its promptings, based upon generalizations from past experiences, may be more adaptive than the analytical reasoning of System 2 (see Epstein, 2000).

The question has arisen of the overlap between System 2 and general intelligence. Epstein *et al*'s claim that their measure of rational thought does not correlate with

Table 3. Properties illustrative of System 1 processing and System 2 processing

Theory	System 1	System 2
Cognitive-experiential self-theory (Epstein, 1994, 2000)	Preconscious, automatic, effortless, rapid; minimally demanding of cognitive capacity; intimately associated with affect; holistic; associative; imagistic; experienced passively; self-evidentially valid; long evolutionary history	Conscious; verbal; effortful; demanding of cognitive resources; affect-free; relatively slow; experienced as volitional; requiring evidence and logic to support beliefs; brief evolutionary history
Associative and Rule-based Processing (Bargh, 1989; Sloman, 1996; Smith & DeCoster, 1999)	Similarity and contiguity, personal experience	Symbol manipulation, language, culture and formal systems
	Associationistic relations	Causal, logical and hierarchical relations
	Reproductive	Productive and systematic processing
	Overall feature computation	Abstraction of relevant features
	Automatic	Strategic
Automatic and controlled social cognition (Adolphs, 1999; Klein & Kihlstrom, 1998; Ochsner & Lieberman, 2001; Lieberman *et al.*, 2004)	Implicit, tacit or automatic self-processes that operate without effort, intention or awareness. Leads to judgments based on accumulated experience without the explicit retrieval and evaluation of autobiographical evidence. Affective, slow to form, slow to change relatively insensitive to ones' thoughts about oneself and behaviour and relatively insensitive to explicit feedback from others.	Effortful and intentional social cognition. Relies on symbolic representations and explicit autobiographical evidence, organized into propositions and processed serially in working memory and episodic memory. Called on to respond flexibly when habits and instincts are ill-equipped for the task.

mental ability or standard intelligence scores was supported by observed low levels of shared variance (1.96%) between 'need for cognition' (rational processing) and GPA (Epstein *et al.*, 1996), a finding confirmed by Handley, Newstead, & Wright (2000). The view that emerges from the work underpinning the System 1 and System 2 distinction is that each system represents qualitatively different modes of processing. Kahneman (2000, p. 683) argued that System 1 may have its own kind of 'intuitive intelligence', to the extent that: 'Some people may have particularly nuanced and subtle representations of persons and social categories. These people will make better judgments by [the] representativeness [heuristic] than others, and consequently may achieve greater predictive accuracy than others.'

As discussed in the next section, these dual-process formulations, stemming from a long-standing body of theoretical reasoning and empirical evidence in cognitive psychology (Gilovich *et al.*, 2002) and social cognition (Chaiken & Trope, 1999), are compatible with the findings of more recent work in the emerging field of social cognitive neuroscience (Lieberman, 2000, 2007) that has begun to identify the neural correlates of dual-process models, suggesting that intuition involves a complex interplay of cognitive, affective and somatic elements.

Cognitive, affective and somatic mechanisms underpinning dual-process conceptions of intuitive judgment

Recent studies by Lieberman *et al.* (2004) using functional magnetic resonance imaging (fMRI) have identified two processing systems, each serving distinctive aspects of social cognitive functioning in respect of self-knowledge, the intuitive (reflexive) system (which they refer to as 'the X-system') and the analytic (reflective) system (known as 'the C-system'). The phylogenetically older X-system entails the use of non-reflective consciousness, based on parallel processing, and is fast operating, slow learning and spontaneous. The phylogenetically younger C-system, in contrast, entails the use of reflective consciousness, based on serial processing, and is slow operating, fast learning and intentional (Lieberman, 2007). The locus of the X-system (which may be taken as broadly equivalent to the intuitive or experiential system of Epstein and colleagues) is a network of neural structures consisting of the basal ganglia, ventro-medial prefrontal cortex (VMPC), nucleus accumbens, amygdala and lateral temporal cortex. In keeping with the predictions of the various dual-process theories summarized in Table 3, the X-system's intuitively based knowledge is located in neural substrates that are slow to form, slow to change and relatively insensitive to explicit feedback from others (Lieberman, 2000; Lieberman *et al.*, 2004).

Understanding of the role of affect in intuitive judgments has also benefited significantly from research that has explored the somatic aspects of decision making. For example, in the 'Iowa gambling task' experiments conducted by Damasio and his colleagues, normal control participants (i.e. individuals without damage to the ventro-medial region of the prefrontal cortex: VMPC) began to choose advantageously before they were consciously aware which strategy worked best; moreover, they generated anticipatory skin conductance responses (SCRs) – referred to as 'somatic markers' – before they exercised a risky choice and before they became consciously aware of the strategy they were adopting. In contrast, participants with VMPC damage continued to choose disadvantageously, even after they realized the correct strategy; they also failed to demonstrate any anticipatory SCRs (Bechara, Damasio, Tranel, & Damasio, 1997; Bechara, Tranel, & Damasio, 2000). Bechara (2004) proposed a 'body loop' mechanism, in which a somatic state is enacted and its signal relayed to the cortical and subcortical regions of the brain hypothesized to underpin conscious and non-conscious decision processes. Specifically, the VMPC amygdala, brain stem nuclei and somato-sensory/insular cortices are implicated in the chain of physiological events associated with this mechanism. When an emotion has been expressed more than once, representations of it are formed in the somato-sensory and insular cortices. As a result, the body loop may be bypassed and a fainter image of the emotional or somatic state created. Bodily feedback is 'imagined' and represented cognitively in working memory and thus influences feelings and decisions. Bechara refers to this mechanism as the 'as–if' loop. The autonomic responses associated with intuitions based upon previous experiences and emotional states may guide decision-making processes and outcomes in advance of conscious awareness.

In cognitive terms, Bauman and Kuhl (2002) argue that extended associationistic networks are activated automatically on exposure to a stimulus (e.g. word triads) and that parallel processing of information is initiated, which is holistic and implicit and may give rise to an intuitive 'sense' of coherence (cf. Anderson, 1983, 1990). If the neural activation exceeds the requisite threshold, non-conscious thoughts become explicitly available to conscious awareness and an insightful 'illuminative' moment is likely to be experienced (Kihlstrom, 1999). If, however, activation remains below the requisite threshold level of conscious awareness, the initial judgment (the coherence judgment) remains as an intuition. The extended semantic networks that enable these intuitive judgments to arise are referred to by Kuhl and his colleagues as 'extension memory' (Bauman & Kuhl, 2002; Bolte, Goschke, & Kuhl, 2003). fMRI studies indicate that the extended and overlapping semantic networks required for insight problem solving are associated with activation in the anterior superior temporal gyrus (aSTG) region of the right hemisphere (Bowden & Jung-Beeman, 2003; Jung-Beeman *et al.*, 1994, 2004). Related work has implicated the median orbito-frontal cortex (OFC), the right lateral portion of the amygdala complex and the ventral-occipito-temporal (VOT) regions as areas in which intuitive judgments of visual coherence are generated, prior to problem solution (Volz & von Cramon, 2006).

In sum, three major lines of evidence from social cognitive neuroscience and related fields have strengthened considerably the various dual-process formulations outlined in Table 3. Hence, it seems reasonable to conclude that Stanovich and West's (2000) System 1 and System 2 distinction, typified by dual-process theories such as CEST (Epstein, 1994), the associative/rule-based theory (Sloman, 1996; Smith & DeCoster, 1999), and the more recent C-system–X-system distinction (Lieberman, 2007; Lieberman *et al.*, 2004), provides a highly plausible framework for understanding the dynamics of intuitive and analytic processing. Each mode of processing is served by cognitive systems with their own neural substrates.

Although dual-process formulations provide a promising foundation for the development of a more integrated and coherent account of intuition, there are several issues that have yet to be resolved, not least the relative importance of each system across diverse settings and tasks and the related question of how precisely the two systems might interact. Moreover, as Perruchet and Vintner (2002) have noted, most psychological models of dual-processing are predicated on the assumption that unconscious representations are accessed using algorithms that are unable to operate within the functional constraints of conscious thought in working memory (see also Dijksterhuis, 2004; Dijksterhuis & Meurs, 2006; Mangan, 2000; Velmans, 1991). Future work directed to the closure of this gap might investigate the complementary roles of working memory (Baddeley, 1997; Baddeley & Hitch, 1974) and long-term working memory (LTWM) (Ericsson & Kintsch, 1995; Gobet, 2000) as the potential mechanisms by which cognitive, affective and somatic processes are integrated in the joint operations of the cognitive and experiential systems. These unresolved issues notwithstanding, as summarized in Table 4, we maintain that dual-process formulations offer the most promising way forward for the development of an integrated account of the ways in which the perceptual, somatic and situation appraisal mechanisms associated with intuitive processing interact with the cognitive mechanisms underpinning conscious (rational) awareness.

Operationalizing intuition

Accuracy in intuition

Many researchers (e.g. Agor, 1989; Behling & Eckel, 1991; Bowers *et al.*, 1990) agree that intuition is characterized by intense confidence in the intuitive feeling. As Bastick (1982) noted, there appears to be a subjective certainty of correctness associated with intuition. However, there is disagreement as to whether intuitive judgments and feelings are necessarily 'correct'. Vaughan (1979, p. 45), for instance, states unequivocally that 'intuition is true', while Bowers (1987, p. 73) believes that 'intuition presupposes the possibility of mistakes and, indeed, depends on this possibility for its very existence.' The assertion that truly intuitive individuals are generally 'right' in their judgments has been found to be fallible in the domain of problem solving (Nisbett & Ross, 1980; Ross, 1977; Tversky & Kahneman, 1983). Meanwhile, Claxton (2000) notes that grandiose claims of incorrigibility regarding revelations of unquestionable 'truths' contrast with the fact that intuitive judgments can be wrong and are better treated as 'hypotheses' to be tested (see also Myers, 2002).

The sources of bias associated with intuitive heuristic judgments (representativeness, availability and anchoring and adjustment) have been well documented within the behavioural decision-making literature (Kahneman, Slovic, & Tversky, 1982; Kahneman & Tversky, 1979, 1982; Tversky & Kahneman, 1986). However, this laboratory-based body of research has tended to take advantage of participants' ignorance of arithmetical and statistical principles rather than focusing on their experience and knowledge and to require participants to generate intuitively a final solution to a problem (Bowers *et al.*, 1990). However, it is possible that intuition may be more useful for generating hypotheses that need further testing before they are considered valid (Atkinson & Claxton, 2000). It follows from the above arguments concerning the need to advance understanding of the ways in which the cognitive, affective and somatic components of intuition interact, and the unresolved question of the accuracy of intuitive judgments, that there is a continuing need for the development and validation of multiple approaches to its assessment, including traditional self-report measures and techniques to capture intuitive behaviour and performance in laboratory and field settings.

Measuring intuitive ability

One approach to the assessment of intuitive ability could entail the use of measures of PI. In recent years, researchers have devised a number of simulation instruments to capture individual differences in PI. Principal among these have been situational judgment tests (SJTs), in which participants are presented with a series of scenarios and associated response options (Hanson & Ramos, 1996; Weekley & Jones, 1997). Other approaches include the use of vignettes based on themes in popular magazines (see

Table 4. Integrative summary of current scientific knowledge regarding intuition and intuitive processing

Element	Processes and responses	Sources
Perception	Process of intuiting occurs when individuals are confronted with cues that require them to 'cut through' detail and arrive rapidly at solutions to complex problems in dynamic situations	Dane and Pratt (2007), Klein (1998), and Sadler-Smith and Shefy (2004)
	Intuiting is an automatic self-process, initiated on the basis of explicitly or implicitly perceived cues that operates without effort, intention, conscious awareness or deliberative analytical judgments	Adolphs (1999), Klein and Kihlstrom (1998), Lieberman (2007) and Lieberman *et al.* (2004)
	In complex judgmental problems, overt reasoning is preceded by a non-conscious biasing step that uses neural systems other than those that support declarative knowledge. The affective processes are activated in advance of conscious awareness.	Bechara *et al.* (1997), Ochsner and Lieberman (2001)
	Non-conscious biasing steps guide behaviour in advance of conscious awareness and before higher cortical areas are activated	Carlson and Buskist (1997), Duckworth, Bargh, Garcia, and Chaiken (2002), and Nisbett and Wilson (1977)
Situation appraisal	Judgments and perceptions of coherence are influenced by information that is not accessible to conscious awareness	Bauman and Kuhl (2002), Bolte *et al.* (2003), Greenwald (1992), Kihlstrom (1987), Reber (1993), Schacter (1987), and Wilson (2002)
	The limbic system has evolved to err on the side of avoidance, as a means of increasing the chances of survival. Stimuli are appraised for potential negative outcomes (somatic markers function first-and-foremost as an 'alarm') and positive ones. Somatic markers serve as an 'early warning' and highlight any potentially negative outcomes of a particular choice.	Damasio (1999) and Le Doux (1996)
	Non-conscious perception is rapid but unconscious processes are relatively inflexible, their application giving rise to automatic behaviours which are slow to form and slow to change	Lewicki, Hill, and Czyzewska (1992) and Lieberman *et al.* (2004)

Table 4. (*Continued*)

Element	Processes and responses	Sources
Cognitive mechanisms	Extended semantic (associationistic) networks are activated automatically on exposure to a stimulus and parallel processing of information is initiated in 'extension memory' through processes of spreading activation beneath the level of conscious awareness. Information processing demands of complex decision making are high and exceed the processing capacity available in conscious thought.	Bauman and Kuhl (2002), Bolte *et al.* (2003), Dijksterhuis (2004), and Dijksterhuis and Meurs (2006)
	The overlapping semantic networks required for insight problem solving are associated with activation in the anterior superior temporal gyrus (aSTG) region of the right hemisphere	Bowden and Jung-Beeman (2003), Jung-Beeman *et al.* (1994), and Jung-Beeman *et al.* (2004)
	Intuitive judgments of visual coherence prior to problem solution are generated in the median orbito-frontal cortex (OFC), the right lateral portion of the amygdala complex and the ventral-occipito-temporal (VOT) regions	Volz and von Cramon (2006)
Somatic mechanisms	Affect plays a central role in System 1 processes	Epstein *et al.* (1996)
	Somatic markers (e.g. in the form of skin conductance responses: SCRs) associated with a non-conscious biasing step provides neurobiological evidence in support of the notion that judgments are guided somatically as well as cognitively	Bechara *et al.* (1997)
	Particular contexts trigger specific somatic or physiological responses, affect-laden associations being formed through learning or previous experiences. The activation of somatic states precedes conscious awareness of somatic states.	Bechara and Damasio (2005) and Le Doux (1996)
	In the 'body loop' mechanism, a somatic state is enacted and its signal relayed to the cortical and subcortical regions of the brain that underpin decision processes. In the 'as–if body loop' mechanism, the body loop is bypassed, a fainter image of the emotional or somatic state is created as a result of an emotion having been expressed more than once and bodily feedback is 'imagined' and represented cognitively in working memory.	Bechara (2004)

Table 4. (*Continued*)

Element	Processes and responses	Sources
System 1 response	The experiential system under many circumstances is more effective than the rational system in solving problems. In some individuals, System 1 may have developed to the extent that nuanced and subtle representations of persons and social categories are possible, by virtue of the more effective use of the representativeness heuristic, in turn giving rise to greater predictive accuracy.	Epstein (1994) and Kahneman (2000)
	The relative influence of the intuitive and rational systems is determined by various parameters including individual differences and levels of familiarity with the task, situation or domain. Emotional arousal, associationistic relations and pattern recognition processes in time pressured and complex judgmental situations shift the balance of influence in the direction of the experiential system.	Damasio (1999), Klein (1998), Le Doux (1996), and Smith and DeCoster (1999)
System 2 response	One of the functions of System 2 is to serve as a 'system override' of the intuitive system (System 1)	Stanovich and West (2000)
	The function of explicit cognition is to oppose or counterbalance the influence of implicit cognition	Kelley and Jacoby (1996)
	It may be possible to compensate for experiential processing, through being made more aware of its effects and by developing self-regulation strategies	Burke and Sadler-Smith (2006), Epstein and Pacini (1999), Hogarth (2001), and Sadler-Smith and Shefy (2004)
Outcomes of intuitive episodes	Research should distinguish between non-conscious processes (intuiting) and outcomes (intuition). Dual-process theories are overly focussed on 'process'. Associative processes demanded of complex judgment and creative problem solving may be hindered by conscious thought, resulting in less satisfactory outcomes.	Dane and Pratt (2007), Dijksterhuis (2004), and Dijksterhuis and Meurs (2006)
	Intuitions are 'fringe experiences' and may manifest as 'tip of the tongue' (TOT) phenomena, and 'feelings of knowing' (FOKs). TOT and FOK are phenomenologically important in developing an integrated understanding of System 1 somatic responses, and the dynamics of affect and cognition in complex judgmental and creative problem solving.	Dorfman, Shames, and Kihlstrom (1996), Ippolito and Tweney (1995), Litman and Reber (2005), and Yaniv and Meyer (1987)
	The intuitive experience is neither purely cognitive nor purely affective; rather, it is a fusion of cognition and affect	Claxton (2000) and Laughlin (1997)

Sternberg, 2003, for a full discussion of these tests). Approaches that can be regarded as measuring intuitive ability more directly include Westcott's Test of Intuitive Ability (Westcott, 1968), the Accumulated Clues Task (Bowers *et al.*, 1990), and the Waterloo Gestalt Closure Task (Bowers *et al.*, 1990). Tests such as these are constructed on the premise that intuitive individuals are willing to make inferences based on little information and are likely to come to correct conclusions.

The primary instrument that was used initially in the empirical testing of CEST, the Rational–Experiential Inventory (REI), comprises 31 items organized into two unipolar measures: 'Need for Cognition'(NFC), a shorter 19-item modified version of the established scale by Cacioppo and Petty (1982), and 'Faith in Intuition' (FI), a scale developed specifically for the REI. The purpose of the REI was to assess individual differences in preferences for use of either or both the rational and experiential systems in the processing of information (Epstein *et al.*, 1996). In keeping with the original NFC, the REI version of this scale operationalized rational thinking as: 'the extent to which individuals report that they enjoy and engage in, or dislike and avoid, cognitive activities' (Epstein *et al.*, 1996, p. 394). The FI scale comprised 12 items, designed to assess: 'confidence in one's feelings and immediate impressions as a basis for decisions and actions' (Epstein *et al.*, 1996, p. 394). Consistent with the predictions of CEST, Epstein *et al.* found that the two scales were orthogonal ($r = -.07$), thus confirming the independent nature of the rational and experiential systems, and predicted a wide variety of self-reported personality, coping and adjustment variables, as well as participants' degree of heuristic thinking in response to a series of vignettes. Subsequently, Pacini and Epstein have reported two studies using a longer, revised (40 item) version of the REI (Epstein, Pacini, & Norris, 1998). In contrast with the original version, an explicit distinction is drawn in the revised REI between 'engagement' and 'ability' in respect of the major theoretical constructs underpinning CEST. Rational ability refers to the capacity to think logically and analytically, whereas rational engagement refers to a reliance on, and enjoyment of, thinking. Experiential ability, in contrast, refers to the capability to act upon intuitive impressions and feelings, while experiential engagement is defined in terms of a reliance on, and enjoyment of, feelings and intuitions in making decisions (Pacini & Epstein, 1999). However, the findings of recent factor analytic studies of this revised REI, as reported by Hodgkinson, Sadler-Smith, and Sinclair (2006), cast doubt on the construct validity of the distinction between 'ability' and 'engagement', as discussed more fully below.

Measuring intuitive style or strategy

The majority of measures of style and strategy intuition have been designed as self-report inventories, typically using problem-solving or associative tasks (see, e.g. Hayes & Allinson, 1994; Myers & McCaulley, 1986). While these measures differ in terms of their theoretical underpinnings and their psychometric properties, what unites them is a common focus on enduring and preferred ways of responding to information-processing demands. Examples include the Cognitive Style Index (CSI) (Allinson & Hayes, 1996) and the aforementioned Rational–Experiential Inventory (REI) (Pacini & Epstein, 1999), both of which as noted above have been the subject of critical scrutiny by Hodgkinson and his colleagues (Hodgkinson & Sadler-Smith, 2003a, 2003b; Hodgkinson *et al.*, 2006). Neither the CSI nor the latest version of the REI exhibits factor structures that are entirely in keeping with their underlying theory. For example, the REI appears to have item content problems with the experientiality engagement subscale as a result of the conflation of style or trait with strategy. Other procedures designed to operationalize CEST constructs, such as Pacini and Epstein's measures of heuristic processing, exhibit unacceptable reliability estimates (self-perspective = 0.46; protagonist perspective = 0.50) and need further refinement. In spite of the endorsement offered by Coffield and his colleagues in their critical review of the field (Coffield, Moseley, Hall, & Ecclestone, 2004), the CSI is seriously problematic in three significant respects: firstly, empirical tests of its factor structure show it to be wholly inconsistent with its declared theoretical basis (a putative one-dimensional, bipolar cognitive continuum that draws upon literal interpretations of hemispheric differences in brain function as its theoretical foundation); secondly, of related concern, it does not appear to be cognizant of state-of-the-art dual-process formulations, as reviewed above; and thirdly, a semantic analysis of the content of its items shows it to bear little relation to the intuitive domain as such but to be more concerned with impulsivity and heuristic processing (Hodgkinson *et al.*, 2006).

One of the most widely used self-report measures of intuitive style is the Myers–Briggs Type Indicator (MBTI; Myers & McCaulley, 1986), in which respondents are asked to describe how they 'usually feel or act'. Closer inspection of the 'sensing-intuition' (SN) scale reveals that none of the items assess affective or behavioural aspects of intuition (Langan-Fox & Shirley, 2003). Moreover, as observed by Hodgkinson and Clarke (2007), a number of studies have yielded findings in connection with the construct validity of this instrument and various behavioural predictions that are incompatible with the Jungian theory underpinning it, thus raising questions regarding its suitability for the assessment of individual differences in cognitive style.

Intuitive episodes rather than self-report accounts of preferences might be better understood through the use of a judicious mix of assessment methods, which could include the critical incident technique (CIT) (Flanagan, 1954) in conjunction with repertory grid procedures (Kelly, 1955). The primary advantage of these methods is their ability to access relatively detailed subjective reports of specific instances of intuition in use, albeit ex-ante, as opposed to general reflections on past episodes. The CIT, for instance, could be used to compare and contrast specific decision episodes in which participants had variously used intuition to good effect or otherwise, while repertory grid and related techniques could be employed in a complementary fashion to uncover individuals' dimensional and categorical representations of such episodes, much as social cognition researchers have investigated representations of social episodes (e.g. Forgas, 1976, 1978; Forgas, Brown, & Menyhart, 1980).

Another promising approach could involve the use of time-pressured decision tasks in experimental settings, accompanied by knowledge elicitation techniques such as causal cognitive mapping (Clarkson & Hodgkinson, 2005; Green & McManus, 1995). The primary advantage of this particular combination of methods lies in its potential to reveal the ways in which individuals' representations of decision problems differ when switching from System 1 (intuitive) type processing to System 2 (analytic) type processing (for an empirical demonstration of this approach, see Maule, Hodgkinson, & Bown, 2003).

The experience sampling method (ESM) (Csikszentmihalyi & Larsen, 1987) might also provide rich descriptions of intuitions. This would entail asking participants to record where they are, what they are doing, and how they feel when an intuitive episode occurs. However, given the burdensome nature of ESM, especially upon participants, Kahneman and his colleagues have suggested the Day Reconstruction Method (DRM) (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) as an alternative. The DRM assesses how people spend their time and how they experience the various activities and settings of their lives, combining features of time-budget measurement and experience sampling and may be used to recover affective experiences. Adopting the DRM approach, the context of the previous day is evoked in order to elicit specific and recent memories, thereby reducing errors and biases of recall (Kahneman *et al.*, 2004) of the sort to which methods such as the CIT may be prone. Participants systematically reconstruct their activities and experiences of the preceding day with procedures designed to reduce recall biases. Given that many variations of the method are possible, it has the potential to be adapted to the study of intuitive episodes as an alternative to the CIT or ESM.

Inter-disciplinary investigations are also needed into the neuropsychology of intuition, using brain imaging techniques, along the lines of the fMRI studies recently reported by Lieberman (2000) and Lieberman *et al.* (2004), as summarized earlier, in conjunction with the above cognitive mapping techniques and the CIT. Given the emphases ascribed to the unconscious and preconscious in the experiential system, researchers developing new measures need to be cognizant of problems in establishing what is 'unconscious', and 'preconscious' (see also Perruchet & Vintner, 2002).

Summary and conclusions

As argued at the outset, within psychology the concept of intuition has until comparatively recently been regarded as scientifically weak and thus consigned to the fringes of the discipline. In this article, we have reviewed, albeit briefly, the considerable body of theory and research that has emerged over recent years, spanning a wide variety of domains of application including management and education. This research clearly demonstrates that the concept of intuition has emerged as a legitimate subject of scientific inquiry, one that has important ramifications for education, personal, medical and organizational decision making, personnel selection and assessment, team dynamics, training and organizational development. Recent theory and research point to clear differences between insight and intuition and to the role of intuition as an antecedent of creativity (rather than earlier views in which intuition was conflated with insight and creativity). A much clearer picture is now also emerging of the roles that implicit learning, tacit knowledge, pattern recognition and expertise play in intuitive judgment.

These developments notwithstanding, we have argued that there is a need for further advancement of our understanding of intuition in terms of its underlying somatic, affective and cognitive components. In particular, there is a pressing need to understand more fully how these various components are integrated. Recent advances in dual-process theory have been highlighted as an important vehicle for this purpose, but several problems with this body of work have also been identified that need to be resolved in taking intuition research forward within a dual-process formulation.

Finally, we have raised a number of measurement and related methodological issues arising from an over-reliance on psychometrically weak self report measures and called for the adoption of other, more direct approaches to the assessment of intuitive episodes and intuitive judgments. Several potentially profitable ways forward as a means of resolving these issues have been suggested. The conceptual clarity and compelling architecture that recent advances in dual-process theory provide have set the stage for a resurgence of inquiry into a construct that has the potential to contribute to a unified account of psychological functioning, across a wide range of domains of application, from the laboratory to the field. Our ultimate hope is that this article will stimulate the vigorous programme of work now required to meet these pressing challenges.

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