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Intuitive decisions on the fringes of consciousness: Are they conscious and does it matter?

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Abstract

Decision making research often dichotomises between more deliberative, cognitive processes and more heuristic, intuitive and emotional processes. We argue that within this two-systems framework (e.g., Kahneman, 2002) there is ambiguity over how to map the System 1/System 2 axis, and the notion of intuitive processing, onto the distinction between conscious and non-conscious processes. However the convergent concepts of experience-based metacognitive judgements (Koriat, 2007) and of fringe consciousness (Mangan, 1993) can clarify intuitive processing as an informative *conscious feeling* without conscious access to the antecedents of the feeling. We stress that these intuitive feelings can be used to guide behaviour in a controlled and contextually sensitive manner that would not be permitted by purely non-conscious influences on behaviour. An outline is provided for how to empirically recognise these intuitive feelings. This is illustrated with an example from research on implicit learning where intuitive feelings may play an important role in peoples' decisions and judgements. Finally we suggest that our approach to understanding intuitive feelings softens rather than reinforces the two-systems dichotomy.

Key words: intuition, feeling, fringe consciousness, metacognition, two-systems model, decision making, judgment.

1 Introduction

The influential *two-systems* framework, within decision making and judgement research, dichotomises between processes that are characterised as heuristic, affective, and intuitive, versus those that are seen as more deliberative, cognitive, and rational. Following Stanovich and West (2000) we refer to these supposedly separable systems as System 1 (S1) and System 2 (S2) respectively. Kahneman (2002) declares there is considerable agreement over the properties of these systems which for S1 include being fast, automatic, effortless, associative, and difficult to control or modify, and which for S2 include being slower, serial, effortful, deliberately controlled, and relatively flexible. (For a detailed recent review of suggested S1 and S2 properties across the literature, see Evans, 2008.) Despite a tendency to associate S1 with non-conscious processing and S2 with conscious processing, we suggest that within representative formulations of this two-systems framework, such as Kahneman's (2002) summary of his Nobel Prize winning work and Epstein's (1994) seminal paper, there is considerable ambiguity over how to map the System 1/System 2 axis and the notion of intuitive processing onto the distinction between conscious and non-conscious processes. Our aim in this paper is to outline this ambiguity, to argue why clarification is important, to describe how the clarification can be made both theoretically and empirically, and to suggest how consideration of the consciousness dimension can soften the two-systems dichotomy.

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2 Consciousness in the two-systems framework

Kahneman (2002, p. 449) describes S1 as an *intuitive mode* of processing that leads to people having an *intuition*, defined as "thoughts and preferences that come to mind quickly and without much reflection". Is the label of *intuition* being used here to refer stipulatively to a family grouping of information processing characteristics that includes lack of consciousness? Or is it referring to a genre of subjective experience — which might be taken to imply an association with the conscious S2? Or does it depend? Or is there a sense in which intuitions are a bit of both?

2.1 Option 1: Intuitions as non-conscious behavioural dispositions

One possibility is that the influences of S1 processes are mere behavioural dispositions which do not directly carve their mark on conscious experience. This would be like the way in which non-conscious perception, for example of a word, can only be measured indirectly in terms of its influence on other more conscious processes — for example as a semantic priming effect on responses to a consciously presented probe word. Some aspects of Kahneman's (2002) two-systems framework are consistent with this interpretation.

Kahneman's concept of information *accessibility* lies at the core of his analysis of intuitive judgements and preferences. *Accessibility* is the ease with which particular mental contents come to mind. It is grounded in the relative activation level of representations that compete with each other to determine the result of response competition at some decision node in the information-processing system. The idea is then that a collection of empirically observable heuristic principles guide the activation level of response tendencies generated within the intuitive S1. Often these win the competition with the output of S2, in a process labeled *attribute substitution*: "A judgement is said to be mediated by a heuristic when the individual assesses a specified *target attribute* of a judgement object by substituting a related *heuristic attribute* that comes more readily to mind." (ibid. p. 466). Kahneman has made an important contribution to psychology by identifying many of these heuristic principles and by observing that the most accessible features are not always the most relevant ones for optimal decision making.

However, within this framework, the coming-to-mind of highly accessible attributes from S1 is not described as a conscious process. Rather, it is silent and effortless. So, for example, "Respondents who substitute one attribute for another are not confused about the question that they are trying to answer – they simply fail to notice that they are answering a different one." (ibid. p. 469). Similarly, Epstein (1994, p.716) describes his *experiential* system — which shares the basic properties used to delineate S1 and is contrasted with a *rational* system — as "intimately associated with the experience of affect, including vibes, which refer to subtle feelings of which people are often unaware."

According to this view, S1 does not give rise directly to conscious signals that we can be directly aware of as discrete entities. If S1 is to influence the contents of consciousness, it does so furtively and indirectly by modulating whatever conscious awareness we have of processes, or products of processes, within S2.

2.2 Option 2: Intuitions as conscious impressions

In apparent contrast with the above argument, Kahneman (2002) also refers to the notion that the intuitive processes of S1 generate *impressions*. The fact that Kahneman considers the impressions to be generated involuntarily is not in itself a barrier to the impressions being taken as conscious experiences. Even quite automatic processes can yield representational outcomes of which we are consciously aware; within the domain of perception this is common, for example when so-called pre-attentional processing yields conscious representations of basic aspects of a visual scene.

Given that verbalization is a common operational criterion for consciousness, Kahneman's view that the impressions need not be verbally explicit might also be taken to imply we are not talking here about *conscious* impressions. However, failure to be verbally explicit might merely imply difficulty in communicating the qualitative character or even presence of the impressions, despite the occurrence of a genuine phenomenology.

So perhaps we can become directly conscious of the products of processes in S1. But if so, where is the conscious process? Is it in S1, which challenges the idea of S1 as a non-conscious system? Or is it in S2, which begs the question of how consciousness associated with processing in one system would manifest in another system?

2.3 Option 3: Sometimes S1 processes generate conscious impressions and sometimes they don't

A compromise solution is that options 1 and 2 are not mutually exclusive. This is supported by the variety of examples of everyday behaviour that the two-systems framework attempts to explain.

In some of Kahneman's (2002) examples of the influence of S1 on problem solving, people think they are responding on the basis of one set of rational criteria while in fact they are being biased by other criteria that are more accessible (the so-called *accessibility heuristic*). Here the workings of S1 may indeed be silent. The person would not feel as if he or she were having an intuition and the notion of non-conscious biases would seem more appropriate than that of intuition.

However there are other situations where the kinds of heuristically-based biases subsumed under S1 have a less hidden influence on both our behaviour *and experience*. For example, when making a rather arbitrary preference judgement, the rational S2 might fail to deliver any highly activated choice criteria. Now the murmurings of S1, pulling us in one direction or another for reasons we cannot introspect, may be felt consciously. As Kahneman

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claims, these conscious impressions may even be imbued with a feeling of high confidence. Now, to use a favourite cliché from philosophy of mind (Nagel, 1986), there is *something it is like* to be having the intuition. Now we are aware of the products of the heuristically-driven processes, even if unaware of the processes themselves.

The upshot is that there may be considerable variation in the extent to which the kinds of processes associated with S1 make their products available to consciousness. What is missing in the two-systems framework is an analysis of this variation in terms of (1) why the conscious variable is *functionally* important, (2) how to *conceptually* understand the relation between conscious and non-conscious processes in situations where we do have a conscious impression, or feeling, or intuition, and (3) how to distinguish *methodologically* between the various scenarios outlined above.

We take these issues in turn.

3 Question 1: The functional importance of the consciousness variable

It is important to clarify the precise manner in which intuitive processes are conscious because conscious processes have qualitatively different properties than non-conscious ones. The functional hallmark of consciousness is control over the behavioural influence of information, and the ability to integrate the information in a flexible manner with changing contextual demands and executive goals. This quality is supported by considerable convergent empirical data (Jacoby, Toth, & Yonelinas, 1993; Merikle & Daneman, 1998), and lies at the heart of the concept of *global accessibility* to information within Baars' (1988) Global Workspace model of consciousness.

In this model, which has been one of the most influential in the field of consciousness research, *access* does not refer to the simple notion of activation level, as in Kahneman's (2002) account of attribute substitution. Instead it refers to the ability to broadcast information *globally* among the many information-processing subsystems of the brain, as opposed to isolating the information within local non-conscious neural networks that have automatic influences on behaviour. This communication and cognitive integration is what gives conscious representations their qualitative advantages. At the implementation level, cognitive neuroscience is showing that this cognitive integration appears to be mediated by coherent neural activity distributed throughout the brain (Baars, 2002; Dehaene and Naccache, 2001). Note that we would concur with the view that consciousness is neither something that gives rise to these information processing qualities, not something that arises from them – those functional qualities are what consciousness *is*. To use the current metaphor from Dennett's philosophical take on consciousness, consciousness *is* "fame in the brain" (e.g., see Dennett, 2005).

Both Kahneman (2002) and Epstein (1994) stress the lack of control that people have over the influences of the intuitive system, and the lack of flexibility or sophisticated contextual sensitivity of that system. For example, in discussing why he considers that the experiential system is usually dominant, Epstein (ibid., p. 716) also writes that it operates outside of awareness and therefore that "the rational system fails to control it because the person does not know there is anything to control". By denying that the intuitive system possesses these central functional qualities of consciousness, these authors appear to be reinforcing a tacit assumption that the intuitions generated by S1 are largely non-conscious beasts of the mental jungle. If instead we conferred these qualities to intuitions, the intuitions would gain a crucial functional advantage. Indeed Epstein directly alludes to this functional advantage when he observes that knowing there is something to control is needed before one can control it. This is why the consciousness of S1 processes, intuitions, or whatever one wishes to call them, is such an important variable.

4 Question 2: The relationship between conscious feelings and non-conscious antecedents

4.1 Intuitive feelings as experience-based metacognitive feelings

How exactly might an intuition be a conscious representation rather than a mere behavioural disposition?

Koriat (2000, 2007) offers an insightful analysis in terms of his distinction between *experience-based* and *information-based* (or *theory-based*) metacognitive judgements. Information-based metacognitive judgements are based on explicit inferential processes. These are deliberate, analytic, slow, effortful, largely conscious, and draw on the contents of declarative information in long term memory. They therefore have some of the central characteristics of S2. For example, judgements of learning are influenced by our conscious expectations as to which types of learning strategy (e.g., generating a word versus just reading it) lead to the best memory.

By contrast, experience-based metacognitive judgements are based on rapid automatic inferences that are in

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one sense conscious and in another sense non-conscious. For example, we might have a *Feeling of Knowing* that we would be able to recognise the correct answer to a question that we cannot currently recall (Koriat, 1993; Metcalfe, 2000). The feeling is non-conscious in the sense that we do not have detailed conscious access to its information processing antecedents, variously suggested (Metcalfe, 2000) to be the searched-for information itself (cf. trace-access accounts), the relative accessibility of relevant partial information (cf. accessibility accounts), or the familiarity of memory cues (cf. cue familiarity accounts). It is nevertheless conscious in that there is a distinct phenomenology — something it feels like to have the feeling. And it is metacognitive since it conveys information about our past, current or future mental processes that permit two basic functions of on-line metacognition — namely the ability to monitor and then regulate those processes (Koriat, 1998; Nelson, 2001). Koriat (2007, p. 314) is clear that this type of "fast, unconscious, automatic inference results in a sheer subjective experience, and that subjective experience can then serve as the basis for noetic judgements". Experience-based judgements are like "immediate, direct impressions" which have "the phenomenal quality of a direct, self-evident intuition" (ibid.).

Koriat's theoretical framework can help us to understand various classes of experiential judgement that have been the focus of considerable empirical investigation and which are examples of the kinds of hunches, gut feelings or intuitions that are often felt to guide our daily behaviour. In addition to Feelings of Knowing, these include *Feelings of Familiarity* that we have encountered a certain object or situation before, even if there is no longer any explicit episodic memory of the encounter (Dunn, 2004), *warmth feelings* that we are approaching the solution to a problem (Metcalfe, 1986; Metcalfe & Wiebe, 1987), the Tip of the Tongue state (which might be considered a variety of Feeling of Knowing) (Brown, 1991), and *Feelings of Preference* for one item or decision path without having reasoned grounds for the preference. For example, we may show higher preference ratings for an abstract shape that we have been pre-exposed to, even if we are unable to guess whether we have encountered it before. This *mere exposure effect*, which is at the heart of commercial advertising, has even been claimed when the visual pre-exposure of random shapes is performed at near subliminal durations (Bornstein, 1992; Kunst-Wilson & Zajonc, 1980).

To take another example, in the *dyads of triads* task where participants are shown two sets of three visually displayed words on each trial, people can experience a conscious *Feeling of Coherence* for which of the two triads contains words that share a common semantic associate, even if the common associate cannot be consciously retrieved from memory (Bowers, Regehr, Balthazard, & Parker, 1990). In a variation of this task, in which participants are required to indicate whether they have a feeling of coherence to single triads, Bolte and Goschke (2005) propose these feelings as a paradigmatic example of what we mean by an intuition.

Even if there is ongoing debate over the precise nature of the heuristic cues that drive some of these subjectively experienced feelings (e.g., Koriat & Levy Sadot, 2001), what these examples of feelings have in common is their metacognitive informational content, and the lack of conscious access to the antecedents of the feelings. Crucially, they also share the empirical observation that subjective ratings of the feelings can be veridical. That is, the ratings can under the right conditions predict past or future mental states with above chance accuracy, even if it is sometimes possible to artificially distort the feelings. For example, in the so-called *Remember-Know paradigm*, Feeling of Knowing ratings that a given letter string has been presented to you previously are above chance, even if you cannot explicitly *remember* the learning episode (Gardiner, 1988; Tulving, 1985). However, even if you have never seen a particular non-word letter string before, this Feeling of Knowing can be misleadingly enhanced by increasing its orthographic regularity (Whittlesea & Williams, 2001).

In addition, there are well known examples of situations in which it seems to be *advantageous* to make intuitive decisions based on rapid feelings, rather than deliberating analytically on our decisions, or attempting to introspectively access the antecedents of these feelings. Wilson and Schooler (1991) showed that preference ratings of novice jam tasters are more in line with those of experts if the ratings are made quickly and intuitively. Similarly, people are more likely to be satisfied with their choice of wall-posters if they are chosen in a non-deliberative manner (Wilson et al., 1993).

An explicit distinction between the consciousness of feelings and the non-consciousness of their antecedents is also found beyond the kinds of metacognitive feeling outlined above. In the context of attitude research, Gawronski, Hofman and Wilbur (2006) make a similar distinction between conscious awareness of an attitude — which they refer to as *content awareness* — and awareness of the origin of an attitude — referred to as *source awareness*. They also propose the additional category of *impact awareness* which refers to our awareness, or lack of awareness, of the influence of an attitude on other psychological processes. The usefulness of this last category for characterising the relation between conscious and non-conscious processes is not confined to attitude research. We can be aware of wearing a heavy back-pack, but not of how the conscious sensation of weight influences our judgement of the gradient of a hill (Proffitt, 2006).

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The same distinction has again been made in the area of implicit learning, where complex regularities in our environment are learned without full awareness of what has been learned, or sometimes even without awareness that learning has occurred at all. Children's learning of the rules of language is a commonly cited example. Implicit learning has been extensively studied in rather artificial laboratory paradigms but is probably involved in a wide range of everyday decision making situations. Lieberman (2000) suggests that intuition is the subjective experience associated with implicitly learned knowledge, and argues that many processes important to social intuition depend largely on implicit learning. These include the formation of impressions on the basis of stereotypes or implicit attitudes, non-verbal decoding (i.e., drawing inferences about the mental state or dispositions of another person on the basis of non-verbal cues), and certain forms of social decision making. Ambady, Krabbenhoft and Hogan (2006) propose a role for implicit learning in personality judgement. And situations where intuitive consumer choice is claimed to be more advantageous than deliberative judgements often involve appraisal of complex information (e.g., Dijksterhuis, Bos, Nordgren & van Baaren, 2006; Wilson et al., 1993), making it likely that the choices are at least partly driven by implicitly learned knowledge.

There has been a vigorous debate over whether so-called implicit learning is really based on non-conscious learning, or could instead be mediated by consciously learned fragments of the target knowledge. However more recently there has been a move to find a middle ground between these extremes and propose that the learning is often guided by processes that are neither fully conscious nor fully non-conscious (Cleeremans & Jiménez, 2002; Dienes & Scott, 2005, Norman, Price, & Duff, 2006). This move has been long pre-empted by a recognition that implicit learning situations involve subjectively experienced *intuitive* feelings. For example, Reber (1989) suggested that:

> It [intuition] is a cognitive state that emerges under specifiable conditions, and it operates to assist an individual to make choices and to engage in particular classes of action. To have an intuitive sense of what is right and proper, to have a vague feeling of the goal of an extended process of thought, to "get the point" without really being able to verbalize what it is that one has gotten, is to have gone through an implicit learning experience and have built up the requisite representative knowledge base to allow for such judgement. (p. 233)

A role for intuitive feelings in implicit learning has also been implicated in the Iowa Gambling Task where participants attempt to learn which of several card packs are associated with optimal rewards (Bechara, Damasio, Tranel & Damasio, 1997; Bierman, Destrebecqz & Cleeremans 2005). In this classic paradigm, which is often used to study decision making in healthy people as well as after brain damage, it is claimed that normal participants pass through a *hunch phase* in their learning. During this phase, they show behavioural signs of having implicitly learned the predictive rule at an intuitive level while still unable to verbalise the rule (see for example De Vries, Holland, & Witteman, 2008).

Dienes and Scott (2005) define these intermediate states in implicit learning paradigms as situations where we have conscious metaknowledge (or *judgement knowledge*), for example of the next move in an implicitly learned sequence, but where we do not have any detailed conscious *structural knowledge* about the patterns we have learned. This closely mirrors the above distinctions between *experience-based* and *information-based* judgement, or between *content awareness* and *source* awareness.

What all these related distinctions argue for, rather more clearly than Kahneman (2002) or Epstein (1994), is that we can be directly conscious of the *products* of processes which have a broadly automatic information-processing style. The end product of the perhaps heuristically driven metacognitive assessment is a conscious signal in its own right. It therefore bears the qualitative advantages of a conscious signal, and we have control over whether we heed the signal or ignore it. As Koriat (2007, p. 301) points out, this means that "when people realize that their subjective experience has been contaminated, they tend to change their judgements so as to correct for the assumed effects of that contamination".

Nevertheless Koriat still appears to strongly endorse the two-systems framework, equating his experience-based versus information-based metacognitive judgements with Kahneman's (2002) S1 and S2 respectively, and proposing that they relate to two "components or states of consciousness" (Koriat, 2007, p. 301). This is reminiscent of the argument in implicit learning research that implicit and explicit learning are mediated by separable neuro-cognitive systems (Reber, 1997).

4.2 Intuitive feelings as fringe consciousness

An alternative but overlapping framework for understanding intuitive feelings is provided by Mangan's (1993, 2001, 2003) revival and elaboration of the Jamesian concept of *fringe consciousness*. This concept, which will be less familiar to many readers, is very much driven by a phenomenological dissection of the contents of conscious experience. Like Koriat's (2007) analysis,

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there is much emphasis on the idea that experiences we would call intuitive feelings are to be considered as conscious signals in themselves, and in many crucial aspects the idea of fringe consciousness is very close to Koriat's notion of experience-based judgement. But, in contrast to Koriat, Kahneman (2002) or Epstein (1994), the fringe consciousness framework does not attempt to split the information processing system into a dichotomous S1 and S2. Instead, intuitive feelings are seen as a manifestation of a vital component of consciousness that functions as an interface between the non-conscious and the conscious.

Mangan's core idea is that the stream of consciousness contains not only a *nucleus* of focally-attended sensory information but also a *fringe*, which acts as kind of interface between the nucleus and a *contextual background* of largely non-conscious information processing. Affective and cognitive signals within this fringe of consciousness provide a summary of otherwise unavailable non-conscious processes that are relevant to ongoing, conscious, mental tasks. In particular, they summarise the degree of fit or integration between the conscious and non-conscious levels of processing. As Mangan puts it, "The non-sensory fringe is able to finesse the limited capacity of consciousness by using just a few wisps of vague experience to represent summary facts about states of non-conscious information that are otherwise far too complex for direct conscious representation." (Mangan, 2001, ¶ 5.2). Following James (1890), Mangan (2001) argues that fringe experiences are especially dominant during the brief, vague, transitionary (or *transitive*) periods of experience that punctuate the passage between the successive moments of stable, clear (or *substantive*) consciousness in the everyday stream of consciousness.

The concept of fringe consciousness is very wide ranging. Various authors have criticised the looseness of the concept and attempted to define subcategories of fringe experience more precisely (see for example Galin, 1993; 1994; McGovern 1993; Norman, 2002; Price, 2002). Routinely studied metacognitive and evaluative judgements such as Feelings of Knowing, Familiarity, Preference, Coherence and so on, which are considered by Mangan to be important examples of fringe consciousness, can be taken as one of these subcategories (Price, 2002). Mangan (2001) suggests these are all manifestations of a core relational Feeling of Rightness. Although the precise phenomenology of these feelings is a matter for careful empirical study, Mangan seems in agreement with Koriat (2000, 2007) that the experiences are the conscious product of processes that are (at least currently) non-conscious. There is also agreement that the functional role of the feelings is to monitor ongoing cognition and thereby facilitate control of the direction of thoughts and behaviour. The functional advantage of having a *conscious* feeling to do these jobs, rather than relying on non-conscious automatic processes, is again that conscious processes are more flexible. We therefore benefit from a much higher level of behavioural choice, for example in deciding whether to follow a hunch that feels convincing but could be misleading, or in deciding whether to invest further effort in a so-far unsuccessful memory search.

According to Mangan (2001), fringe consciousness often has a very transient and fleeting nature since attempting to attend to the experience may instantly retrieve its previously non-conscious antecedents into consciousness. This implies some divergence from Koriat's (2000, 2007) position. Although the immediate antecedents of the feeling are non-conscious, the suggestion is that the feeling can often direct us to related information that is *potentially* accessible, rather than permanently inaccessible.

However, as pointed out by Norman (2002), there is a tension between this proposal that feelings in fringe consciousness tend to be difficult to attend, and all the empirical research showing that we can indeed hold our attention on certain feelings for long enough to rate them introspectively and assess something of their quality. Norman resolves this tension by suggesting that the ability to retrieve non-conscious context information varies, and that the classic examples of introspectable intuitive feelings occur when such retrieval is *not* immediately successful, and where the fringe consciousness therefore has a more "frozen" sustained quality. In situations like this, there is actually a slight sense in which the term *fringe consciousness* is misleading. This is because the experience is no longer the conscious flag for unattended metacognitive signals, waving away in the background, but is now a sustained part of the focus of attention. Elsewhere we have therefore suggested that the term *cognitive feeling* may be more appropriate for this subset of fringe consciousness (Price & Norman, in press).

Even if the fringy nature of the phenomena subsumed under the concept of fringe consciousness is a variable and dynamic feature, the concept enriches our understanding of intuitive feelings in many ways. It places these feelings within the general landscape of conscious experience and stresses the potential continuity of the feelings with more fleeting examples of the fringe. It stresses the general functional role of the feelings: They provide summary signals such as online metacognitive assessments which are automatically generated and, as Kahneman (2002) describes, may be heavily influenced by a host of heuristic cues. The feelings indicate the relationship, or the directional fit, between ongoing conscious and non-conscious processes, helping us to know whether we are on the right mental track. And the feelings can point us towards the existence of relevant information waiting to be consciously retrieved from active but as yet non-conscious representations.

The type of information provided by fringe consciousness has parallels with Schwarz and Clore's (1983) hypothesis of affect-as-information, and with related proposals that nonaffective feelings provide an important source of information for everyday judgements and decisions (Clore & Huntsinger, 2007). However, fringe consciousness is conceptualised without reference to the two-systems dichotomisation of mental life. The monitoring and control functions of fringe consciousness are not properties of an S2 that is separate from the S1 that generates the feelings. Rather than stressing separation between systems, the fringe is seen as an intermediate point on a graded dimension of consciousness. It bridges between the more automatic processes and the more controlled conscious processes that play an interconnected role in driving all aspects of mental life. Mangan's (1993, 2001, 2003) emphasis on the ubiquitous role of more fleeting fringe feelings within moments of transitory consciousness similarly underlines the fact that the fringe is not a property of one system or another, but an integral part of the stream of consciousness whatever type of mental activity is being engaged in.

We would therefore suggest that the concept of fringe consciousness provides a useful complimentary approach to understanding intuitive processes. It is regrettable that there has been a mutual lack of communication between (a) the fringe consciousness literature, (b) piecemeal empirical research on particular examples of intuitive feelings, and (c) Koriat's invaluable theoretical overviews and the insights of the heuristics and biases tradition within decision making and judgement research.

5 Question 3: Operationalising conscious intuitive feelings

So far we have suggested that there is a conceptual and functional difference between the notion of intuitions as non-conscious behavioural dispositions, and the notion of intuitions as conscious impressions or feelings. We have then outlined convergent theoretical frameworks that help us to understand the nature of at least some types of intuitive feelings. But in any given situation, how can we empirically distinguish whether we are dealing with non-conscious dispositions, conscious feelings, or mental states dominated by more rational and deliberative thought?

5.1 A core definition

Price (2002) has proposed a set of practical operational definitions with this aim. These definitions are particularly directed at identifying the kinds of conscious intuitive feelings that fall on the more cognitive than affective end of the mental spectrum. However the basic approach could be adapted to any category of intuitive feeling. The definitions are based on (a) the above integration of Koriat's (2000, 2007) experience-based metacognitive judgements and Mangan's (1993, 2001) fringe consciousness, (b) currently accepted functional definitions of consciousness, and (c) methods of distinguishing between conscious and non-conscious processes in the areas of implicit perception and implicit learning, where this issue has perhaps been thrashed out more than anywhere else. There are two sides to the operationalisation. One is to distinguish an intuitive feeling from a fully explicit, rational mental representation that includes conscious awareness of the premises of the representation. The second is to distinguish an intuitive feeling from an entirely non-conscious behavioural disposition.

5.1.1 Intuitive feeling or fully explicit?

Here we need to consider the conscious informational content of the mental state. Following Koriat and Mangan, the contents of consciousness may be regarded as intuitive feelings when (a) there is awareness of, for example, some metacognitive information, and when (b) it can be shown that there is no *current* conscious access to the information-processing antecedents of this information. For example, we might be aware *that* one of two word trigrams has a common semantic associate, but have no access to what this common associate is or to why we can tell. Given the retrieval function of fringe consciousness, we may still gain conscious access to aspects of those information-processing antecedents after a time delay (which may even be very short). Also note that it can be far from trivial to establish the absence of any conscious antecedents at all; for example, many claims to have demonstrated implicit learning have been challenged by evidence that performance is based on conscious fragmentary knowledge of the learned patterns.

5.1.2 Intuitive feeling or non-conscious disposition?

Here the issue is whether information that influences behaviour also directly gives rise to a conscious impression of any sort. For example, a non-conscious orientation response might drive us to choose a previously seen item over a novel one, while feeling as if we are making a random choice. Conversely, we might have a distinct feeling of preference for one item. Two approaches to operationalising the presence of some conscious experience are possible.

First, we can ask people to report their phenomenology. The feeling might be expressible in *subjective self-reports* — for example, introspective ratings of experience along a relevant dimension – which are established

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as veridical by showing they predict future performance on another behavioural measure of the information's influence. This method of checking that the subjective ratings are veridical rather than spurious nevertheless has a potential danger: The use of a rating scale to avoid the methodological pitfalls of open-ended introspective reports (such as conservative response bias) may just end up as a fancy forced-choice judgement in which experimental participants guess one of several values on the scale. Since it is possible that judgements which feel like completely random guesses may themselves be automatically biased by non-consciously processed information (Reingold & Merikle, 1988), a positive correlation between ratings and behaviour *need* not imply conscious representation of the information in question. Price (2002) therefore suggests it is prudent to record ratings on several dimensions to ensure that correlations are only found on relevant dimensions.

Since people may sometimes find it difficult to verbalise or otherwise communicate very subtle feelings, an alternative and more behavioural operationalisation is possible: The feeling should also be able to *guide behaviour flexibly in accordance with changing contextual demands*. As described earlier, this is an application of Baars' (1988) functionalist criterion that conscious information is globally accessible to other cognitive subsystems. This criterion is the basis of Jacoby's Process Dissociation Procedure (PDP) which is widely used to distinguish between, and even to quantify, the relative behavioural influences of conscious versus non-conscious processes in domains such as implicit learning, implicit memory and implicit perception (Jacoby & Kelly 1992; Jacoby et al. 1993). Typically, the PDP involves a so-called *exclusion instruction* which asks people to inhibit the usual influence of information on behaviour. The assumption is that people can only comply with exclusion instructions when the information in question is consciously represented.

5.1.3 Summary and further considerations

This set of empirical recommendations leads to the following summary operationalisation of intuitive feelings. Intuitive feelings can be distinguished as (a) consciously experienced feelings which (b) provide a condensed overview (e.g., metacognitive or affective) of information that is to some degree inaccessible to consciousness, and which (c) can either be expressed as subjective ratings which are predictive of behaviour or (d) can be shown to guide behaviour in a flexible manner.

Although this operationalisation can be applied in a given experimental context to distinguish between non-conscious dispositions, conscious feelings, and explicit representations, we would admit that it remains underspecified as a full definition of an intuitive feeling. After all, if we are conscious of the distance of an object on the basis of non-conscious stereoscopic computations, we would not find it natural to refer to our judgement of distance as a feeling. There are probably several factors which play into our willingness to refer to a mental state with the natural language labels of *intuition*, *feeling* or *hunch*. Speculatively, these may include difficulty of verbal expression, the unexpectedness of the gap between a conscious representation and its non-conscious information processing antecedents (Price, 2002), and perhaps the level of confidence in the information conveyed by the feeling. The way these labels are applied may also vary considerably across individuals and cultures. (See Price, 2002, or Price & Norman, in press, for a slightly expanded discussion of these points).

5.2 An example: Intuitive feelings in implicit learning

There are a number of reasons why implicit learning is a particularly appropriate area to study intuitive feelings with these proposed operational definitions.

First, as outlined earlier, implicitly learned information undoubtedly contributes to everyday decision making and judgement. Second, the main debate in implicit learning has been precisely about what people are, or are not, conscious of. Exploring gradations of consciousness in implicit learning may therefore help to resolve this debate. Third, it is possible to create relatively simple artificial implicit learning environments and to fine tune details of their structure in ways that make it easier to apply the operational definitions and test whether functional intuitive feelings are really present. Fourth, Norman (2002) has argued that implicit learning experiments provide a situation where intuitive feelings are likely to be particularly salient, stable over time and introspectively accessible.

Additionally, it is often possible to experimentally manipulate the degree of conscious awareness of learned information, as function of either the time course of the experiment, task difficulty, or time constraints on performance. This allows comparison, in one study, of a dynamic gradation from fully non-conscious behavioural dispositions, to intuitive feelings, to fully explicit knowledge.

As an example of how we can search for the role of intuitive feelings in implicit learning paradigms, consider a recent study of ours using a modified version of the serial reaction time (SRT) procedure (Norman, Price, Duff, & Mentzoni, 2007). In the traditional version of this task (Nissen & Bullemer, 1987), participants watch a small circle jump between 4 linearly arranged position markers in a fixed repeating sequence of 12 moves, and press one of 4 keys to indicate each new position as fast as pos-

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sible. As is typical, sequence learning during the training phase of our experiment was indicated by longer key press RTs on trials where the usual sequence was violated. However, in order to move beyond previous polarised controversy over whether sequence learning in the SRT is associated with conscious (*explicit*) or non-conscious (*implicit*) sequence knowledge, our experiment applied a novel SRT procedure which allowed us to test whether learning might lead to intuitive feelings such as feelings of rightness or anticipation for where the target will occur next in the repeating visual sequence.

First, to rule out fully explicit knowledge, we had to show that participants know *which* position will occur next without knowing *why* – that is, without having conscious access to sequence information which is the non-conscious antecedent of the positional information. In the traditional SRT task, this is problematic since stimulus displays only vary on one perceptual dimension, namely target location. It is then trivial for participants to work out that any predictive regularity in upcoming target locations must be based on previous target locations. This in turn makes it practically impossible to rule out the possibility that participants have conscious access to the antecedents of a veridical representation of where the next target will be. Denial of any knowledge that there was a regular sequence could merely be put down to conservative response bias or to experimental demand. And if people admit they knew there was a sequence but cannot verbalise the details of the sequence, it is difficult to rule out conscious partial knowledge of the sequence.

To by-pass these problems, we camouflaged the real antecedents of target location — that is, previous target locations — by providing some alternative decoy antecedents. These took the form of random changes in the colour and the shape of the target, and of each of the 4 position markers. By adding these two additional but irrelevant perceptual dimensions to the display, it becomes rather difficult to tell even the general nature of the pattern that governs target position; it could logically be patterns of previous position, or colour, or shape, or any combination of these. Suppose participants are retrospectively told there was a pattern to where the targets appeared, and are asked to verbally express which variables predicted the target location. Verbal reports which omit any mention of previous target locations, and instead focus on colour or shape, can now be taken as much more convincing indicators of a lack of conscious access to the antecedents of the nevertheless conscious feelings.

Next we had to rule out the opposite possibility that performance in the SRT is mediated by completely non-conscious behavioural dispositions to orient to particular positions on the computer display or to pre-program particular motor responses. Previous SRT studies have tried to do this using various objective tests of conscious sequence knowledge, such as fragment generation tasks where people try to tap out sequence fragments on the response keyboard (Perruchet & Amorim, 1992). The problem is that above-chance performance on these tasks might be also mediated by non-conscious automatic response tendencies (Cohen & Curran, 1993; Goschke, 1998). Some studies have therefore tested whether people can follow the instruction to generate a sequence of movements that is *different* from the training sequence (Goschke, 1998; Destrebecqz & Cleeremans, 2001). This is an example of a so-called *exclusion task*. It requires people to refrain from using learned sequence knowledge and this is assumed to require the kind of flexible control over knowledge that is only possible with conscious representations. However even this logic has been challenged; for example, successful exclusion might be possible via a general voluntary inhibition of the influence of implicit sequence knowledge, and not require detailed, conscious, move-by-move knowledge of the sequence (Dienes & Scott, 2005; Norman et al., 2006). To test for conscious knowledge of which sequence position comes next, we therefore needed a more robust measure of the ability to use sequence knowledge in a flexible manner.

Our novel measure of cognitive flexibility, referred to as the *generation rotation task*, also required some changes to the standard SRT paradigm. In the training phase of the experiment, the 4 possible target position markers were now arranged as the 4 corners of a square, rather than linearly. On each trial of the subsequent generation rotation task, participants were then presented with a short sequence of target moves, and asked to indicate the anticipated location of the next target in an indirect manner. They had to indicate a location which was rotated from the actual target position by one or two positions around the square layout, in accordance with a number presented in the centre of the screen *after* the end of the presented sequence. The central number could be positively (+1, +2) or negatively (-1) signed, indicating clockwise or anticlockwise rotation, and varied randomly from trial to trial. Therefore to comply with instructions, the knowledge of the anticipated position had to be held in working memory and integrated flexibly with the context provided by the upcoming and randomly varying number cue. In other words, the task now involved a complex stimulus-response mapping which required specific, on-line, conscious knowledge of the next move.

Incorporating these methodological changes into the SRT experiment allowed us to identify a subgroup of participants who both:

(a) Showed above-chance performance in the generation rotation task – this implied flexible conscious anticipation of individual sequence moves and ruled out purely non-conscious knowledge.

(b) Made no mention, in their verbal reports, that target

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position is influenced by previous target position — this implied no awareness of the antecedents of their sequence knowledge.

This pattern of results supported the notion that these participants were using conscious intuitive feelings to drive their responses in the rotation task. If the learned sequence knowledge had been completely unconscious, rotation performance would have been at chance, and if the knowledge had been fully conscious, verbal reports would have referred to the spatial sequence as the critical predictive variable. Our findings support the hypothesis that learning is not always easily classifiable as either purely implicit or purely explicit, but sometimes gives rise to intermediate states of awareness of the learned knowledge which correspond to intuitive feelings.

6 Conclusion: Intuitive feelings without a two-systems framework

The two-systems framework evolved to emphasise the role of non-conscious and irrational processes in guiding our behaviour. We have suggested that influential presentations of this framework have shortcomings when it comes to specifying the detailed relation between consciousness and information processing.

First, it is unclear whether and how consciousness is supposed to be a property of only S2, or of both S1 and S2. Second, there is a failure to discuss how we can functionally and empirically distinguish between (a) automatic and non-conscious biases on our behavioural dispositions which have no influence on consciousness or which only indirectly modify the contents of consciousness, (b) automatic and non-conscious processes whose product we are directly conscious of in the form of what we might want to call an intuitive feeling, and (c) fully conscious processes where we are to a larger extent aware of the antecedents of our conscious representations.

In this paper we have focused on the concept of intuitive feelings. We have argued that Koriat's (2000, 2007) concept of experience-based metacognitive judgement and Mangan's (1993, 2001, 2003) concept of fringe consciousness offer a convergent framework to define a class of cognitively oriented intuitive feelings. We have stressed that these intuitive states are conscious states, not unconscious automatisms, and have explained why this is functionally important. Lastly, we have suggested how such states can be empirically distinguished and illustrated our arguments with research in implicit learning where intuitive feelings may play an important role in guiding decision behaviour.

Intuitive feelings can be thought of as providing a kind of summary interface between non-conscious and conscious processes. They have a monitoring and control function and may sometimes help us to retrieve information into consciousness. Functionally, they are conscious in the sense that the information they convey is globally accessible (Baars, 1988) and can be used to guide behaviour in a flexible and contextually appropriate manner (Price, 2002). This is what gives them crucial advantages compared to processes which are completely non-conscious. The feelings may also be reportable, either verbally or in the form of predictive introspective ratings, even if they are communicatively vague in the sense that they are difficult to describe and communicate to others or even to oneself. Inability to quickly retrieve the non-conscious antecedents of feelings into consciousness will make them more salient and easier to introspect (Norman, 2002).

This concept of intuitive feelings is not dependent on the S1 versus S2 distinction. All we need are the ideas that decision making and judgement, just like other domains of information processing such as perception, are a mishmash of more conscious and more non-conscious processes, and that our minds are full of so-called fringe conscious signals which help to direct the onward flow of cognition. Intuitive feelings are one subset of these signals. The information conveyed by the feelings is conscious in the same way that anything else is conscious, by virtue of being globally accessible to many other information processing sub-systems. Mangan's (1993, 2001, 2003) fringe consciousness approach is particularly helpful in helping us to see the feelings as an intermediate point between fully conscious and fully non-conscious processes, rather than as an aspect of either an intuitive or a rational system. Implicit learning paradigms, which allow non-conscious behaviour, intuitive feelings, or explicitly mediated behaviour to be observed across different participants, different experimental conditions, or different stages of a study, are a particularly useful way to illustrate and study these states as dynamic gradations of consciousness (Cleeremans & Jiménez, 2002; Norman, Price & Duff, 2006).

If we do not need the two-systems framework to explain phenomena such as intuitive feelings, where does this leave the status of the two-systems framework? The very idea of a rational conscious system that rumbles along in semi-independence from automatic non-conscious processes is perhaps a conceit that hangs on from the days when the importance of the latter was not even recognized. Violation of the sanctity of *the rational* does not require postulating a distinct system for *the irrational*. Rather, the inter-relation between the types of processes subsumed under S1 and S2 is so intimate as to melt the usefulness of the dichotomy. Kahneman (2002) often draws on analogies between intuition and aspects of perception, but nobody would argue for two distinct perceptual systems on the grounds of the distinction be-

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tween automatic (or pre-attentional) and controlled (or attentional) processing styles. Perception is instead considered to be mediated by a whole myriad of systems which have both automatic and controlled components.

We suggest that a more profitable way to categorise mental phenomena is to situate them in a multidimensional space where three of the principle axes are:

(a) The distinction between automatic and controlled processing styles. Typical comparative lists of S1 versus S2 properties (e.g., Epstein, 1994; Kahneman, 2002) read very much as lists of the distinguishing properties of the familiar cognitive division between automatic and controlled (or attentional) processes. It should therefore be noted, as pointed out by Shiffrin (1997), that the automatic versus controlled distinction is a labelling convenience applied to a continuum of dissociable properties, rather than an inviolate black and white dichotomy.

(b) The distinction between non-conscious and conscious processing. Again note this is a gradation rather than a dichotomy. The degree of consciousness can be operationalised by batteries of behavioural measures as exemplified by research on implicit learning.

(c) Relative cognitive versus emotional content. This paper has focused on intuitive feelings with a strong (meta)cognitive content, which reflects the authors' empirical background. The relationship of these types of feeling to the more emotional feelings discussed by other contributors to this volume (e.g., Pfister & Böhm, 2008) is an important topic for future exploration. For example, do all intuitive feelings contain an emotional component? Or in what sense can emotions sometimes be thought of as *intuitive* emotional feelings? Mangan (1993) certainly considers emotions to be an important part of everyday fringe consciousness. Moreover, our current analysis of intuitive feeling has much overlap with the insightful fractionation of the concept of emotion by Pfister and Böhm (2008). Their proposal that emotions are an integral part of most decision making processes, rather than external influences acting *on* rational processes, is very much in line with the Jamesian notion of transient fringe consciousness pervading all our mental life. Also, at least some of the functional dimensions that Pfister and Böhm use to characterize emotions are extremely close to the proposed functions of fringe consciousness.[1] We would suggest that, as with more cognitive feelings, emotional signals vary in the extent to which they are consciously accessible, and in the extent to which they can therefore be used to guide behaviour in a flexible, contextually sensitive manner. An emotional feeling would be *intuitive* to the extent that there was a conscious summary signal of some kind, but limited access to the antecedents of that signal. In short, the kind of analysis we have provided of the consciousness of cognitive feelings can also be applied to more emotional feelings. For a brief discussion of the overlap between cognitive feelings and emotional feelings see Price and Norman (in press). Note however that the distinction is best thought of as a gradation in the relative (meta)cognitive versus emotional content of the feeling, with emotional content perhaps being related to the degree of associated visceral signals and/or the strength of motivational/prioritizing signals. There will also be gradation in the extent to which the more cognitive and the more emotional components of the feeling can be considered separable in terms of discrete phenomenologies and neuro-cognitive substrates.

The challenge for the future is to map and extend the details of this multidimensional space. Our attempt to operationalise intuitive feelings is one step in this direction, and it contrasts with Kahneman's (2002) admission that there is a lack of overriding theory to account for the phenomena subsumed under S1. For example, Kahneman states:

> The status of accessibility factors in psychological theorizing is, in principle, similar to the status of perceptual grouping factors. In both cases there is no general theory, only a list of powerful empirical generalizations that provide a sound basis for experimental predictions and for models of higher level phenomena. (p. 481)

Our account also provides a concrete example of the proposed mixing of S1 and S2 properties that Evans (2008) speculates are demanded by a fractionation of the two-systems view.

The mere conceptual label of *intuitive feeling* is not in itself important. What is important are the empirical criteria which can be used to measure whether such feelings are really involved in any given situation. Other categories of processes commonly subsumed under S1, such as completely non-conscious biases on cognition, can be operationalised in a similar manner. This will allow us to identify the relation between the empirically observed heuristics and biases of decision making research, and different parts of the multidimensional space, including intuitive feelings. The extent to which different parts of the multidimensional space are then considered to be separable systems or sub-systems will be decided by progress in unravelling their precise information-processing and neural basis.

[1]For example, (1) The summary function of fringe consciousness, and Mangan's (1993) suggestion that evaluative feelings of rightness or wrongness are prototypical subjective experiences of fringe consciousness, are both mirrored in Pfister and Böhm's *information function* of emotion, which condenses complex evaluative information onto a single positive-negative dimension; (2) The retrieval function of fringe consciousness, and again its summary function (especially regarding relational information), mirrors their *relevance function* of emotion, which directs attention to relevant information, especially on the relation of self to some event.

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