

Investigating human intuition

Knowing without knowing why



**Guy Claxton on
the value of
not always
understanding
what is going on.**

INTUITION has been an uncomfortable, and therefore, for most of this century a neglected, notion in psychology. It smacks too much of things from which psychology as an empirical science has had to distance itself: armchair philosophy, unbridled subjectivity, the unconscious, the dangerous worlds of aesthetics and even mysticism. If Freud's claim that dreams constitute the 'royal road' to the subconscious is suspect to a hard-nosed psychologist, how much more so the assertion by Spinoza, and later by Bergson, that intuition was the royal road to 'truth' itself? The *Oxford English Dictionary* still gives one sense of 'intuition' as 'immediate knowledge ascribed to angelic and spiritual beings, with whom vision and knowledge are identical'.

However, if we leave aside its most contentious connotations, psychologists are beginning to be able to unpack the concept of intuition in ways that are much more amenable to investigation, and even explanation, in cognitive terms. Over the last few years, studies have appeared that do indeed throw valuable light on the nature and the function of intuition, and in doing so, cause us to question some assumptions that have underpinned much of the research in cognitive science over the last 30 years. In this paper I shall bring some of these isolated strands of investigation together, in the belief that their collective implications may be of interest to the wider psychological community.

'Like a bolt from the blue'

Perhaps the most mundane sense of intuition is of knowledge — an answer to a question, a solution to a problem, a putative course of action — which comes to mind with a certain aura (or even conviction) of 'rightness', or at least plausibility or fruitfulness, yet without clearly articulated reasons or justifications. Such knowledge may come in a variety of different forms and guises. It may arrive abruptly 'like a bolt from the blue', or it

may emerge into consciousness much more slowly. It may be absolutely clear-cut, already formulated in all essential details, or it may be much more hazy: a hunch, an inkling or a glimmering of something that cannot yet be articulated. And it may, as I say, come with a sense of being transparently correct and 'obvious', or it may feel much more tentative.

One well-known strand of research that has explored in some detail the development of 'hunches' over time is that of Dianne Berry (e.g. Berry & Broadbent, 1984), Pavel Lewicki (Lewicki *et al.*, 1992), Arthur Reber (1993) and others on 'implicit learning', or what could equally well be called 'intuitive expertise'. Typically these studies show the different time course of acquisition of 'know-how' and explicit knowledge. Given a complex practical task to perform, expertise develops well in advance of the ability to articulate, explain or even consciously detect the patterns of information, picked up, as Reber puts it, 'by osmosis' over a series of trials, which are guiding action. One acts intuitively before one is able to act rationally, or even 'wittingly'.

A recent study by Antonio Damasio and others (Bechara *et al.*, 1997) has shown that choices in the 'hunch' phases of learning are reflected in such non-conscious indicators as anticipatory skin conductance responses. Interestingly, this study also showed that patients with bilateral damage to the ventromedial prefrontal cortex, who are characterized by impaired decision-making without any apparent loss of intelligence, do not show this pattern. Even though they, like the normal controls, eventually come to be able to articulate 'what's going on', they do not develop hunches, or their physiological correlates, along the way; and they seem unable to use the knowledge they can (accurately) articulate to guide their performance. Damasio speculates that intuition, far from being a fuzzy inferior way of knowing, actually remains the functional basis for informed choice even after conscious understanding has developed.

Learning intuitively may even be

superior, in some cases, to learning via a process of conscious, rational problem solving ('figuring it out'). An informal example, alluded to by Karmiloff-Smith (1992), is afforded by the Rubik cube, a puzzle in which the faces of a cube have to be rotated in order to align the colours of the mini-cubes of which it is composed. Children were often surprisingly good at learning how to do this. Their parents and teachers were often embarrassingly bad. One could argue that children are using an implicit learning approach, in which they simply play with the cube a lot, and pick up, without thinking, the perceptuo-motor patterns that emerge. Adults, on the other hand, try to figure out how it works — and it turns out that the cube is too complex for such an intellectual approach to be effective. Indeed Lewicki has demonstrated this superiority of non-conscious, non-intellectual learning when dealing with situations that embody, over time, complex patterns of contingency, in the laboratory.

Confusion helps intuitive learning

Berry and Broadbent have shown that intuitive learning is advantaged when these patterns are not only complex but counter-intuitive. (This is not a paradox. Rational problem solving has to simplify such situations by starting from plausible premises. It is precisely when these premises are in fact unfounded that the strategy of open-mindedly attending to what happens as you interact with the system proves its worth.) Coulson (1995) has preliminary data which suggest that implicit learning requires tolerance of a temporary state of confusion, and that complex, counter-intuitive predicaments are better mastered if this state of confusion — having given up the attempt to generate and hang on to conscious hypotheses — has been induced. While Masters (1992) has shown that people who try to fall back on conscious rationality when stressed show greater decrements in skilled performance than those who persist in operating intuitively — the phenomenon that sports-people call 'choking', or an attack of 'the yips'.

It is self-evident that cognitive strategies that work well for problems that are well-defined, and capable of accurate decomposition and representation in verbal-symbolic terms, will be much less effective when the problem is ill-defined and/or cannot be successfully decomposed into describable components. Under such conditions, one will again work better in the absence of explicit understanding and articulate thought. Very little about a particular human face can be put into words, for example, so people who try, or are forced, to deal

with faces in verbal terms may perform less well than those who don't. Schooler and Engstler-Schooler (1990) have indeed shown that recognition is impaired if people are required to verbally encode the faces on inspection. Likewise, we can articulate rather little about the bases of aesthetic preferences. Thus when people are enjoined to 'think carefully', and be prepared to justify their decision, when choosing an art print to hang in their study, for example, they tend to be less satisfied with their choice a few weeks later than a control group who simply made the choice intuitively (Schooler & Melcher, 1995).

Intuition may rely on information that is not merely inarticulate but which is, in addition, of a rather faint or fleeting quality: liminal or even subliminal. Intuitions are often referred to, as I have already noted, as 'inklings' or 'glimmerings' of understanding, or as an ephemeral sense of having grasped something, only for it to dissolve and be lost in the next moment. In the early stages of implicit learning, for example, performance begins to exceed chance well before people think they are doing anything other than guessing. These 'guesses', in other words, even before they begin to develop into 'hunches', turn out to have greater validity than they are given credit for. People's *confidence* in their responses tends to track their conscious *comprehension* of what is going on, rather than their actual level of *competence*. Though intuition turns out to be a fallible guide to action (just as logic is), it seems as if people, especially adults, are disinclined to place on it even such weight as it will actually bear, preferring to stick with systematic thinking in situations where it is not the best tool for the job.

Kenneth Bowers (Bowers *et al.*, 1995) has demonstrated this underrating of intuition in situations where people are asked, for example, to select which one of a pair of sets of three words has a common associate. Thus when simultaneously presented with HOUSE — LION — BUTTER, and MAGIC — PLUSH — FLOOR, they are required to discover that the second trio has 'carpet' as a common associate, while the first has no equivalent. On the trials on which people are unable to find the linking word, they are asked to 'guess' which trio has the connection. Despite being quite unable to identify the link, and convinced that their responses are indeed complete guesses, they nevertheless pick out the correct trio with significantly better-than-chance reliability. In a parallel study, people were shown 15 words, one at a time, all of which has a common (low-frequency) associate, and were asked to write down a response, even if it seemed to be a complete guess, and to rank each response in terms of confidence. When a person did finally hit on

the linking association (typically on about the 12th or 13th word), their previous responses were tracked back to see if they had been unconsciously homing in on the target. Unbeknownst to their author, they had. Again it appears that what 'just pops up' in the mind may have greater validity than we think.

This process of 'popping up' has been observed in many studies of 'semantic priming', in which, for example, people are flashed a word (CAMEL, let's say) subliminally, and, though they are unable to report the word itself, they are nevertheless able to say to what category (ANIMAL) it belongs (e.g. Yaniv & Meyer, 1987). Phenomenologically, the response seems to bear no relationship to what has consciously preceded it: it just pops up. The 'unseen' stimulus may also manifest in other ways. Cambridge psychologist Mark Price (personal communication) tells of the time when he was testing his brother in one such experiment. After being unable to report the stimulus word and, on this occasion, its category, he suddenly burst out laughing in the middle of the following trial, explaining that an absurd fantasy about camels had just popped into his head from 'out of the blue'.

Sub-threshold priming

Though there is of course some technical and theoretical dispute, such phenomena are commonly accounted for in terms of subthreshold priming produced in a semantic network by 'spreading activation' (Yaniv & Meyer, 1987). Some kind of quasi-neural activation spreads out from the 'epicentre' (Greenfield, 1995) generated by the stimulus, even though the level (or duration) of activity at the epicentre itself may not be great enough to exceed the notional threshold for consciousness. If an associated concept is, for whatever reason, already primed, then the small amount of collateral stimulation it receives may be sufficient for it, rather than the original stimulus itself, to 'pop into your mind'. Likewise, in the Bowers studies, the target word may be given small but cumulative dollops of activation from each of the stimulus words of which it is a weak associate. Even though the cumulative activation of the actual target is still sub-threshold, it may nevertheless be sufficient to influence the 'guess' that is produced, or to bias a global assessment of, for example, which trio is in fact the one that possesses the link.

Intuition seems to operate over very different time scales. On the one hand, we say we responded 'intuitively' when a response occurred faster than thought — and here again there is some evidence that such lightning reactions may draw on weak, subliminal sources of informa-

tion which may not, on a more considered view, be adequate for consciousness. In his DPhil thesis, Geoff Cumming, a contemporary of mine at Oxford in the early 1970s, reported some intriguing observations in the course of his studies of a phenomenon called 'metacontrast'. This involved flashing a target letter on a screen, masking it with another stimulus, and seeing under what conditions it was still detectable. Normally people were asked to respond to a target as quickly as they could, consistent with making as few mistakes as possible. But when they were asked simply to be fast, they would frequently make a very quick correct response to the presence of the target and then, a moment later, apologize for having made a mistake. The 'reflex' response, it appears, was able to make successful use of stimulus information that was too weak to make it into consciousness on its own account: hence the (mistaken) apology. This fast access to faint stimuli — and the possibility that such access can be cultivated — is reminiscent of Linford Christie's insistence that, to win a world-class 100 metres, one must learn to 'go on the "b" of bang!'. If you wait till you've consciously heard the gunshot, you've already lost the race.

Creativity and 'incubation'

But the area in which there is perhaps the strongest anecdotal evidence of the value of intuition is at the other end of the speed continuum, in the realm of creativity and 'incubation'. The reflective writings of Kekulé, Poincaré and Einstein in science and mathematics, and of Mozart, Henry James and A.E. Housman in the arts, along with many other anecdotes bearing witness to the creative value of patience and reverie — of daring to wait and to drift — are too well known to bear repeating. An ongoing survey of the attitudes to intuition of contemporary Nobel laureates in science and medicine (Marton *et al.*, 1994) is perhaps less well known. Out of the 83 laureates surveyed, 72 strongly implicated intuition in their success. Sometimes it came in the form of a prompt as to which direction to take. Michael Brown (Medicine 1985) said: 'We felt at times there was almost a hand guiding us, because we would go from one step to the next, and somehow we would know which was the right way to go; and I really can't tell how we knew that...'. Sometimes intuition manifested as a sense of rightness about certain observations. Stanley Cohen (Medicine 1986) said: 'I am not always right, but I do have feelings about what is an important observation and what is probably trivial.' While sometimes intuition appears as an abrupt insight following a

period of 'incubation', Konrad Lorenz (Medicine 1973) said: 'If you press [too hard]... nothing comes of it. You must give a sort of mysterious pressure and then rest, and suddenly BING!... the solution comes.'

The recent collection of papers on *The Nature of Insight*, edited by Sternberg and Davidson (1995), offers a variety of evidence for, and cognitive models of, the relationship between incubation and insight. It seems as if the mechanism of incubation may be at least fourfold. A period away from concentrated problem solving may allow time for an unrecognized misleading assumption, dissolved in the way in which the problem has been formulated, to dissipate, thus opening up new lines of inquiry (Smith, 1995). A well-formulated impasse may be resolved through an accidental association triggered by unrelated life events (Seifert *et al.*, 1995). Or a slow mingling of spreading activation trails may throw up a new metaphor, perspective or connection that conjoins originally unintegrated aspects of the problem space (Bowers *et al.*, 1995).

The fourth ingredient of incubation involves the broadening of the number of elements and associations of a problem which can be simultaneously active when one is not straining for a solution. A whole body of work, summarized by Easterbrook (1959) — much of it carried out at the Applied Psychology Unit in Cambridge in the 1950s — attests to the restriction of attention under conditions of stress or pressure. Even positive rewards for performance have the effect of narrowing the range of data and strategies selected to those pre-judged to be focal or plausible. Faced with a routine problem, such restriction is efficient. Faced with a problem that demands a greater degree of insight or creativity, this predetermination is disastrous. All in all, there seems increasing reason to concur with the author of the book of Ecclesiasticus, who wrote: 'The wisdom of a learned man cometh by opportunity of leisure, and he that hath little business shall become wise.'

I hope this brief review has given a taste of the range of research that is helping to explicate the notion of intuition, and to develop our understanding of what it is good for and how it works. (A fuller discussion may be found in Claxton, 1997.) Taken together, these studies seem to amount to an increasingly powerful assault on the Cartesian assumption that 'mind' is all and only that which is conscious (as well as, in its highest forms, rational, systematic and articulate: see e.g. Oaksford, 1997); that this rational decision-making centre is not so much a theatre (Baars, 1997; Dennett, 1991) as the home base, the command module, of personal identity; and consequently that whatever is non-conscious must be not intelligent and not

'me'. The pathologized notion of the un- or sub-conscious developed during the 19th century as a counterblast to the Enlightenment's shrunken view of mind, unfortunately preserved exactly these qualities, and until very recently it was the only view of the non-conscious aspects of the human psyche that we had.

The 'intelligent unconscious'

Cognitive science is now well on the way to resuscitating the idea of the 'intelligent unconscious' and along with it, the neglected faculty of intuition. And this 'rebalancing' of the dominant folk theory of mind is of more than academic interest. In many areas of public and even private life, the Cartesian model has led to the assumption that explicit, articulate thinking is the most powerful form of cognition — the one to be trained most assiduously in schools, colleges and universities, and the one to be relied upon most heavily in formal situations of learning, problem-solving or decision-making. Ways of knowing that are hazy or metaphorical have consequently tended to be skimmed, rushed, concealed or denigrated — to the detriment of both unselfconscious virtuosity, and real-life ingenuity. The subtle interplay between clarity and confusion, incubation and elaboration, the value of which has been recognized for centuries by creative artists and scientists alike, may be about to make its reappearance in other, more widespread areas of social cognition. The implications for education, management learning and the legal process, to name but three such domains, could be enormous.

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