1
Making Sense of Intuition

Overview

The main idea of this chapter is that intuition 'senses' whilst its counterpart, analysis, 'solves'. The power of intuition's sensing function is illustrated with the example of the 2008 credit crunch which brought the world financial system to its knees. The example of business venturing illustrates how experienced investors, so-called 'business angels', blend intuitive sensing and analytical solving to take high-risk decisions in the volatile world of entrepreneurship. The concepts of risk and uncertainty demonstrate the limits of rationality (that it is 'bounded') and illustrate how informed intuition expands experienced decision-makers' capabilities especially when rationality reaches its limits. The history of these ideas is traced back to one of the book's central figures, the Nobel Laureate Herbert Simon, and beyond to his intellectual forerunner, the intellectually curious business executive Chester Barnard. Intuition is defined. The differences between intuition and instinct are explained. A caveat is offered for those who are tempted to trust their intuition unreservedly. As well as helping us to take decisive and incisive action, intuition helps us to make sense of situations that initially do not make sense. Opening evidence is offered for how and why managers use intuition to take decisions; the conditions under which it is likely to be successful are discussed, and this idea is developed throughout the book. The chapter concludes with a discussion of intuition in the age of artificial intelligence (AI) and speculates on the prospects for an 'artificial intuition' as a new, and perhaps ultimate, form of AI.

Shadow Banking

Few executives or experts in the finance industry sensed the calamitous events that unfolded in the 2008 financial crash. This shortcoming prompted Her Majesty Queen Elizabeth II in a visit to the London School of Economics in November 2008 to inquire, with regal understatedness, why no one had noticed that the credit crunch was on its way. In the letter of reply to Buckingham Palace which followed—signed by over thirty eminent scholars, civil servants, and business leaders — the humble response to Her Majesty was that the crisis was hard for them to foresee because, engrossed and preoccupied as they were with mathematical detail, they, the experts, simply lost sight of the bigger picture.[1] In any crisis, prevention is always better than

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cure but did anyone in the industry have a feel for the bigger picture and a sense for the calamitous events that lay ahead? Were there any faint, which is not to say weak, signals that an impending global financial meltdown was about to take place; could the experts have used these to make sense of and avoid this catastrophic financial black swan?[2]

In the *Silo Effect: Why Putting Everything in its Place Isn't Such a Bright Idea* (2015) leading financial journalist and Cambridge-educated anthropologist Gillian Tett recounted how in 2007 leading macroeconomic and monetary policy experts, including some of the best financial brains in the world, sensed that something in the 'shadows' was causing the world economy to be tilted out of true. But they were unable to say what it was and why it gave them such cause for concern. The then Deputy Governor of the Bank of England, Paul Tucker, gave a speech in April 2007 to a conference for hedge fund managers organized by Merrill Lynch in London.[3] Tucker presented a seemingly upbeat account of robust growth, containment of inflation, and, most importantly for the audience, healthy returns for their sector.

However, against this optimistic assessment Tucker also felt a pointed unease: 'the dials on the economic instrument board did not seem to be moving in the normal way.' In the bigger picture, money was swirling around the economy at pace that did not make sense either to the policymakers or the economists.[4] Tucker suspected that the source of these incongruities and inconsistencies lay somewhere outside of the banks. But 'it was one thing to have a hunch … it was much harder to actually prove that something was wrong when there was so little data.'[5] Part of the problem was that the algorithms that were the engines of modern mathematical finance had become so complex that many of the brightest brains in banks, equities, and hedge funds even had trouble understanding their creations; as a result, they were quite simply getting their 'sums wrong'.[6] To make the point, Tett likened the multiple use of a single asset, such as a mortgage loan, to create new trading and hedging opportunities to a spinning out a single strand of sugar to make an enormous but insubstantial cone of candy floss.[7]

To make matters worse, the experts themselves lacked a language with which to even name the exotic financial innovations that Tucker intuited to be a root cause of his unease. When meltdown eventually came it was accompanied by the invention of the new, but now widely used, term 'shadow banking'.[8] Shadow banking was outside the known banking world. The shadow metaphor captured perfectly the intuitive 'felt-sense'[9] of disquiet and foreboding felt by a small group of financial experts. Tucker sensed that something about the system itself did not add up. He had an intuition, albeit only partially formed, that the problem was lurking in the shadows in the high-stakes world of high finance. The problem was intuitively sensed, but unfortunately it could not be analytically solved by the intervention of the central banks before it was too late. Tucker did not have extrasensory perception, but he did have an expert's intuition, which led him to sense that the road ahead was likely to give the global financial system a very bumpy ride. It did, and the effects are still being felt to this day, for example, in lower economic growth, increased income inequalities and government debt.

Intuitive Angels

The 'sixth sense' and self-help intuition literatures are full of exotic interpretations of intuition's magical powers. These range from intuition-as-ESP[10] through to intuitive 'angels' with supernatural powers of intercession in human affairs.[11] The intuitions, and intercessions, of a different kind of angel are vital for aspiring entrepreneurs in the fast-moving, risky, and uncertain world of business venturing. The decision to try and found a successful start-up business means accepting the risk of failure. In the UK, around 20 per cent of start-ups fail within their first year, and at the end of three years around 60 per cent will have gone bust.[12] Starting up a business, especially in high-growth, fast-moving areas such as high-technology, requires a significant financial investment. Some of the largest sources of venture capital for tech entrepreneurs are low-profile, wealthy individuals, first referred to in the 1980s by William Wetzel as 'business angels'. Business angels provide capital directly to small, private, often start-up firms operating in conditions of high risk and extreme uncertainty. The have been made famous by TV shows such as 'Dragon's Den' in the UK and 'Shark Tank' in the USA. But how do business angels decide which business ventures are worth risking their hard-earned cash on?

Entrepreneurship researchers Laura Huang and Jone Pearce compared how much angel investors relied on hard analytics (such as financials and an entrepreneur's business plan) versus soft intuitions (such as their intuitive assessment of the opportunities and risks). They discovered that experienced business angels—who stood to make substantial losses if the venture failed—did rely on their intuition, but they used it in a complex and highly nuanced way far removed from the 'go-with-your-gut-instinct' exhortations so beloved of business biographies.[13] For successful angel investors, intuition is a skill that is absorbed, cultivated, and sharpened by constantly paying attention to experienced-based prototypes of what constitutes a potentially successful business venture, including market information, financials, product prototypes, etc. But the angels did not shy away from entering into high-risk investments by also relying on their gut feelings. They used their intuition as a way of managing uncertainties that were so extreme as to qualify as unknowable. One angel commented that investing is not about avoiding uncertainly but rather of embracing it: '[it is OK to] be uncertain. Bear the uncertainty. Embrace it. Go with it. Let that lead you to the interesting stuff. That's how I make my huge profits.'

The angels used their heads and their hearts by combining hard 'business viability data' (BVD) such as market size and business growth projections with softer 'person perceptions' of the founding entrepreneur. This intuitive assessment of the person was described by one investor as 'noticing right away, sometimes within five seconds of meeting the entrepreneur, how you feel about them and what your overall sense is for them as a person.'[14] But the angel investors did not allow their subjective person perception to overwhelm the objective BVD, or vice versa. They had clear goals in pursuit of which they were prepared to take a risk, acknowledging the possibility that they could lose their entire investment. They relied on a combination of intuitive

expertise and formal analysis to pick winners and predict extraordinarily profitable investments.

The stories of shadow banking in the credit crunch and business angels in business venturing illustrate two fundamental points about intuition. First, human beings possess a dual system of thinking: an 'analytical system' which is designed (by evolution) and adapted (by experience) for the general purpose of 'solving'; an 'intuitive system' which is designed and adapted (by evolution and experience) for the general purpose of 'sensing'. In the shadow banking case, the intuitive system was able to sense that something in the financial system was out of kilter without being able to say why precisely. Second, the intuitive system and the analytical system work best when their complementary sensing and solving capacities are used jointly and cooperatively. In the business angels' case, objective business viability data was used to solve and subjective person perception was used to sense; in combination, analytical solving and intuitive sensing provided an answer to the conundrum of whether or not to invest. The synergy of sensing and solving can result in extraordinary achievements not only in business but, as we shall see, in many other professional fields as well as in the arts, technology, and the sciences.

Decision-Making under Risk and Uncertainty

Shadow banking in high finance and the activities of angel investors in small firm start-ups occupy opposite ends of the business spectrum. However they both illustrate the challenges that decision-makers are confronted by with the uncertainty that characterizes the twenty-first century business environment. They also show how an informed and intelligent use of intuition is one way—and sometimes the only way—in which decision-makers can make sense of and take decisive actions in the face of risks that are hard to quantify and uncertainties so extreme as a to be unknowable.

In the 1920s the University of Chicago economist Frank Knight elucidated the distinction between risk and uncertainty; the term 'risk' refers to those situations where we do not know the outcome but can measure the odds (for example an airline can calculate the chances of a plane crash). Uncertainty, or 'Knightian uncertainty', on the other hand, refers to those situations where we cannot know all the information we need in order to set accurate odds in the first place (for example, the prospects for the airline business in fifty years' time on the other hand is incalculable).[15]

A little later, another of the most influential economists of the twentieth century, John Maynard Keynes, writing in 1937, illustrated the distinction between risk and uncertainty by reference to games of chance. In situations of risk the possible alternatives, their consequences and their probabilities are known. In such situations mathematical probability can be a helpful decision aid. For instance, the odds of a winning ticket in the UK's National Lottery can be expressed in probabilistic terms; the chances of a particular set of numbers coming up can be computed and expressed

as a risk (for example, one in 45 million for the jackpot). However, arriving at a similar assessment of probability is not possible in the complex, ambiguous, and dynamic environment in which many of our consequential personal and professional decisions are taken. To illustrate the difference between risk and uncertainty, Keynes, who was writing shortly before the outbreak of the Second World War, observed that 'the prospect of a European war is uncertain' and about this matter 'there is no scientific basis on which to form any calculable probability whatsoever. We simply do not know.' Decision-making under uncertainty is not the same as decision-making under risk. In risk, the probabilities of outcomes are knowable and optimum choices can be computed (for example, one in 45 million); under uncertainty, probabilities are not knowable (for example, the probability of a war between the USA and China) hence it is not possible to compute an optimum choice. Such choices can, however, be sensed.

In a speech to the Economic Club of Washington in 2018 Jeff Bezos described how Amazon made sense of the conundrum of if and how to design and implement a loyalty scheme for its customers. This consequential decision was taken under uncertainty. For some time, Amazon had been searching for an answer to the question of 'what would a loyalty program for Amazon look like?' A junior software engineer came up with the idea of fast, free shipping. But a big problem was that shipping is expensive. Also, customers like free shipping so much that the big eaters at Amazon's 'buffet' would take advantage by free-shipping low-cost items, which would not be good for Amazon's bottom line. When the Amazon finance team modelled the idea of fast, free shipping the results 'didn't look pretty'. In fact, they were nothing short of 'horrifying'. But Bezos is experienced enough to know that some of his best decisions have been made with 'guts … not analysis'. In his speech he reminded his audience that 'if you can make a decision with analysis, you should do so. But it turns out in life that your most important decisions are always made with instinct and intuition, taste, heart.'[16]

In deciding whether to go with Amazon Prime, the analysts' data could only take the problem so far towards being solved. As a seasoned executive and experienced entrepreneur, Bezos sensed that the Prime idea would work. Prime was launched in 2005. It has become one of the world's most popular subscription services, with over 100 million members who spend on average $1400 per year compared to $600 for non-prime members.[17] The launch of Amazon Prime is a prime example of a CEO's informed and intelligent use of intuition paying off in decision-making under uncertainty. The customer loyalty problem for Amazon was uncertain because probabilities and consequences could not be known at the time. No amount of analysis could reduce the fast, free-shipping solution to the odds of success or failure. Under these circumstances Bezos had to go with his gut. This is not an uncommon CEO predicament. In business, decision-makers often have to act instinctively, even though they have no way of knowing what the outcome is likely to be. Bezos did not know whether Prime would work or not, nonetheless he used his intuition to sense what the likely outcome might be and make his judgement call. In the case of Amazon Prime, going with his gut worked out well.

Decision-Making under Radical Uncertainty

Oxford economist John Kay and former Bank of England Governor Mervyn King in their book *Radical Uncertainty: Decision-making for an Unknowable Future* (2019), distinguished further between two types of uncertainty: 'resolvable uncertainty' and 'radical uncertainty'. Resolvable uncertainty can be looked up; for example, to resolve any uncertainty regarding 'what is the capital of Mongolia?' the answer, Ulaanbaatar, is discoverable and resolvable quickly and easily at the click of a mouse. However, radical uncertainty cannot be resolved in any similar way because radically uncertain situations tend to be volatile, uncertain, complex, and ambiguous. The problems that abound in a radically uncertain world, unlike the problem-solving puzzles that are studied in many psychology laboratories, tend to be ill-defined and loosely structured. As a consequence, under conditions of radical uncertainty a decision-maker will often have to admit that they simply 'do not know' but have nonetheless to take decisions, even though they do not know what the outcomes of their actions are likely to be.

Kay and King described the decision-making dilemma faced by President Barack Obama on whether or not to storm the compound in Abbottabad where the al Qaeda leader Osama Bin Laden might have been hiding as a classic case of radical uncertainty. The CIA's team leader put the probability of Bin Laden being in the compound at 95 per cent. Other advisers put it as low as 30 per cent. Averaged out, the decision was 50:50. Obama's challenge was that probabilities were being used by his aides to disguise uncertainty. The president was the one who had to sense what the outcome might be. He had to take the decision of whether or not to storm the compound. This was in spite of the fact that at 50:50, the probabilistic risk assessment that Bin Laden was in there was not much better than flipping a coin. Obama 'made his peace with 50:50'. He approved the raid.[18] It took place on 2 May 2011. As we know, Bin Laden was killed by a team of US Navy Seals. His body was buried at sea from the USS Carl Vinson later that same day.

In his autobiography, *A Promised Land* (2020), Obama related how he often relied on his intuition when taking consequential decisions. For example, when deciding whether to run for president or to go back to being a law school professor he remarked that he had to 'decipher what I was feeling in my gut'.[19] When deciding whether to go with Joe Biden as his running mate his 'gut' told him that 'Joe was decent honest and loyal'.[20] In choosing Timothy Geithner for treasure secretary his instinct was that 'Tim had a basic integrity, a steadfastness of temperament, and an ability to problem-solve unsullied by ego or political considerations.' Obama quickly realized that formal processes and mathematical probabilities can only take a president so far. The same is true of a CEO. The problems that make it to the president's, or CEO's, desk are by their nature complex and messy. If this was not so, then someone lower down the chain of command would have solved them already or could be delegated to do so. But Obama also recognized a conundrum: the pursuit of the perfect could can lead to paralysis-by-analysis, whilst 'going with your gut too often meant letting preconceived notions or the path of least political resistance guide a decision—with

cherry picked facts used to justify it.'[21] The president's dilemma illustrates perfectly the challenge that sooner or later confronts many decision-makers who have to take consequential decisions under uncertainty: decisions often have to be taken under significant constraints which sometimes severely limit how rational they can actually be even when they aspire, or claim, to be fully rational.

Managers, as well as presidents, often find themselves in situations that are highly uncertain. This might be where no further data are available, not enough time or resources are available to gather more data, first-mover advantage has to be secured, there is little previous precedent to go on, the territory is uncharted and there are no maps, or there are a number of equally compelling solutions that cannot be discriminated between using analytics. In such situations, making a gut call may be the only way to move the situation forward. In describing how his company responded to the challenges of doing business in the radically uncertain and uncharted territory of the aftermath of the 2008 financial crisis, the CEO of one of the world's largest engineering professional services firms remarked that: 'In a recession, you don't necessarily know what you're up against, but you still have to be decisive, which means you'll find yourself making decisions based on gut feel rather than just the facts and accepting that sometimes you'll get it wrong.'[22]

Rationality Is Bounded

The psychological processes that are at work in decision-making under uncertainty were the focus of attention for one of management's most original and influential thinkers: the 1978 Nobel Laureate Herbert Simon (1916 to 2001) of Carnegie-Mellon University. Simon's work is pre-eminent in intuition research in business and management; it is on his shoulders that subsequent generations of decision-making researchers have stood, so much so that someone once commented, not disparagingly, that much of intuition research in business is a footnote to Simon.[23] Three of the theories of intuition discussed in this book ('heuristics-and-biases' in Chapter 2, 'fast-and-frugal' heuristics in Chapter 3 and 'recognition-primed decision-making' in Chapter 4) are so strongly influenced by Simon's work that they can be thought of as extensions and elaborations of his original theory of 'bounded rationality'.

Simon described management as the 'art of getting things done' by 'insuring incisive [penetrating and insightful] action'. He also reminded us that incisive action must be preceded by making sense of a situation in order to decide what needs to be done before doing it. However, incisive and decisive action in business as well as in any other walk of life often has to be taken under constraints of information and time, a lack of knowledge of the consequences of one's actions, and using an information processing system (the human brain) that has limited processing capacity. For these reasons Simon described rationality as 'bounded'. This is also why Simon considered the idealized 'classical' rational model of decision-making favoured by many economists a somewhat 'dubious way of describing human choice'.[24]

The classical/rational model of decision-making typically involves the identification of various options and attributes—for example their 'pros' and 'cons'—and assigning values to them in order to compute a utility analysis. However, as Simon realized, managers' rational and analytical decision-making capabilities are bounded not only by their knowledge of the available alternatives and the consequences of their actions—which are intrinsically uncertain—but also by the human mind's inherent computational limitations.[25] The challenge is compounded when decisions have to be taken under time pressure. The classical/rational model assumes that managers have a knowledge of the future that is quite different from that which they, as human beings, are actually able to possess. These are some of the reasons why Simon considered managers to be boundedly rational actors and management to be an 'art' that is inherently intuitive and judgemental.[26] We will return to a more detailed analysis and appreciation of Simon's theory of bounded rationality in Chapter 2.

The models of decision-making that managers are taught typically in business schools are based on the economic principles of logic and rationality. It is these principles that managers are expected to follow. We also tend to live our lives more generally as though the world is rational. When this turns out not to be the case, we find it unsettling. In these circumstances intuition is one way of making sense of and taking action in an uncertain world that is not as rational as we may have been led or might like to believe that it is. This endows intuition with an element of strangeness that many people find both alluring and mystifying, and which some even mistake for magic. Unpacking intuition's strangeness, allure, and mystique begins by stripping intuition down to its essentials, and that means defining it.

Unpacking Intuition

History matters. One of the earliest and to this day most insightful analyses of the role of intuition in management decision-making is *The Functions of the Executive* by Chester Barnard published in 1938. Barnard (1886 to 1961) was not only an intellectually curious business executive of a major US corporation (president of New Jersey Bell Telephone Company, now part of Verizon) he was also a pioneering and perceptive writer on the subject of management.[27] *The Functions*, which is still in print, is Barnard's magnum opus. It is one of the most thought-provoking books on organization and management ever written by a practising executive.[28] Barnard's work has made an enormous, if not always explicitly acknowledged, 'impact on both the academic and business community'.[29]

The roots of modern intuition research are to be found not in the main body of *The Functions* but in its appendix entitled 'The Mind in Everyday Affairs'.[30] Barnard's cogent and concise exposition, which runs to just over twenty pages, is foundational not least because of the influence it had on intuition researchers who followed in his footsteps, most notably Herbert Simon. In 'The Mind in Everyday Affairs', Barnard drew a straightforward distinction between 'logical mental processes' and 'non-logical mental processes'. Logical processes are those thoughts 'that can be

'expressed in words or other symbols'.[31] On the other hand, non-logical processes are those mental processes 'not capable of being expressed in words or as reasoning, which are only made known by a judgement, decision or action'. Non-logical processes are 'unconscious' and so 'complex' and 'rapid, often approaching instantaneous', that they 'could not be analysed by the person within whose brain they take place'. Barnard attributed them to factors in the physical and social environment 'mostly impressed upon us unconsciously or without conscious effort on our part' in addition to the 'mass of facts, patterns, concepts, techniques and abstractions' which are 'impressed on our minds … by 'conscious effort and study'.[32] Based on this clear and common-sense way of thinking, Barnard defined intuition as:

> *A complex and rapid mental process not capable of being expressed in words or as reasoning or analysed by the person within whose brain it takes place and manifesting in judgement, decision and action.*[33] (Definition 1)

Barnard's is the first of three definitions of intuition which are cornerstones of intuition research in business. Barnard pointed out that the logical and non-logical mental processes are characteristic of different types of work, for example, logical characterizes the work of accountants and non-logical characterizes that of '"high pressure" trading', 'salesmanship', and 'in much of the work of business men [*sic*] or executives'.[34] He also argued that logical reasoning—that source of the 'incessant din of reasons'[35] that can sometimes obscure intuitions—does not necessarily denote a higher order of intellect than the non-logical processes that underlie quick judgements (i.e. 'handling of a mass of experience or complex of abstractions in a flash'). His unequivocal position is that without this capacity, which is so 'unexplainable that we call it "intuition"', managers 'could not do *any* work'.[36]

Barnard's use of accountancy as an example may be somewhat surprising and contradictory given what he said about the suitability of logical and non-logical processes for different business functions. But he argued that experienced accountants can take a complex balance sheet and within minutes or even seconds 'get a significant set of facts from it' which do not 'leap from the paper and strike the eye [of the novice]' but which 'lie between the figures in the part filled by the mind out of years of experience and technical knowledge'. The intuitable aspects of a complex balance sheet provide 'something to which then reason can usefully be applied'.[37] With impressive foresight (given later discoveries about human cognition, see Chapters 5 and 6) Barnard hints at the complementarity of the two processes: the function of the non-logical processes is 'sensing' those things which do not leap out at the eye, whilst the logical processes 'solve' through the application of reason.

Ultimately, Barnard's choice of accountancy as an example need not be problematic since it highlights the important idea that logical (analytical) and the non-logical (intuitive) processes are complementary and both are required by most if not all management functions, no matter how quantitative (or qualitative) the demands of a specific task might be. It has taken some time for management educators and researchers to accept that intuition has a vital role to play in managerial work, even

though most managers would accept this as self-evident.[38] Intuition has tended to be denigrated in the social sciences more generally, which is in contrast to its status in the arts and physical sciences where it is lauded. For example, Einstein is reputed to have said: 'The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honours the servant and has forgotten the gift.' Intuition and analysis are qualitatively different ways of thinking, deciding, and problem-solving. Each is more or less appropriate depending on the task, person, and context. The most successful managers and business people have perfected the art of amalgamating, balancing, and reconciling Barnard's logical and non-logical processes, for example, 'business viability data' and 'person perception', as in the case of the business angels discussed earlier.[39]

Following Barnard's groundbreaking work in the 1930s, a further milestone in the study of intuition came several decades later in Simon's work. This culminated in his 1978 Nobel Prize in economic sciences awarded for 'his pioneering research into the decision-making process within economic organizations'.[40] It is ironic that Simon's Nobel Prize was in economics (since there is no prize in psychology) given that his theory of bounded rationality was a direct assault on classical economic models of decision-making. It marked the inception of the field of behavioural decision theory (BDT). Incidentally, but not unimportantly, the Foreword to the first edition of Simon's magnum opus, *Administrative Behaviour: A Study of Decision-Making Processes in Organizations* (first published by Macmillan in 1947 and still in print), was written by Chester Barnard. This is a testament to the influence that Barnard's writing had on Simon. Simon was impressed greatly by Barnard's account. But he was also 'troubled' by it as an explanation of intuition because it did not give any clues as to how the subconscious processes themselves operate in the lead-up to an intuitive judgement.

Simon, in his own estimation, arrived at a 'solid understanding' of what those processes are via his research on expertise in chess, most notably with his colleague William Chase. This groundbreaking work was based on the proposal that a chess grand masters' memories hold two vital pieces of information which helps them to judge whether a particular move is better executed or avoided: the first is a set of meaningful patterns that represent the arrangement of the pieces on the board; the second is information about each pattern in terms of the opportunities and threats posed. Simon's theory offered an explanation as to why chess grand masters can play several games simultaneously and make significant moves intuitively often in 'only a few seconds'.[41] He estimated that a chess master's long-term memory contains in the order of 50,000 'familiar patterns' built up over many years of learning and experience. Simon's interpretation was corroborated by World Chess Champion Garry Kasparov, who claims to be able to think up to fifteen moves ahead. Kasparov remarked that 'the total number of possible different moves in a single game of chess is more than the number of seconds that have elapsed since the big bang' and that in the chess universe 'intuition is the defining quality of a great chess player.'[42]

Simon extrapolated from research in chess to the practice of management. He argued that the intuitive skills of experienced managers depend on 'the same kinds

of mechanisms as the intuitive skills of chess masters or physicians'.[43] Moreover, he remarked that it would be 'surprising if it were otherwise'[44] on the basis that the underlying processes of pattern recognition are widely applicable to judgement and decision-making (i.e. they are 'domain general' rather than being confined purely to chess).[45] Simon defined intuitions succinctly as:

> *Analyses frozen into habit and into the capacity for rapid response through recognition.*[46] (Definition 2)

In this view, despite appearing 'spontaneous and non-deliberative', intuition is essentially a rational rather than an irrational process. As such it 'needs no veil of mystery'.[47] Simon described intuition's best effect as being when it is 'backed up by whole volumes of knowledge … preserved in a frozen state in long-term memory until thawed by the act of recognition'.[48]

Contrary to the Swiss psychoanalyst Carl Jung's theory of psychological types,[49] Simon doubted that people, including managers, fall into stereotypical intuitive or analytical types. He thought it much more likely that managers, or at least effective managers, do 'not have the luxury of choosing between "analytic" and "intuitive" approaches to problems'.[50] Good management—indeed the 'art' of management[51]—involves an 'intimate combination'[52] of intuitive sensing and analytical solving. In the same way that Simon was troubled by Barnard's work,[i] Simon's work is also troubling in that it tends to gloss over the more affective (i.e., feelings-based) aspects of intuition—gut feelings, hunches, and vibes[53]—which Barnard himself referred to as 'this feeling in our "marrow"'.[54] This is important because intuition is unique in that it exists at the nexus of cognition (thinking) and affect (feeling).[55]

Two decades after Simon's seminal article in 1987 on the role of intuition in management decisions,[56] American management researchers Erik Dane and Michael G Pratt identified three blockages to a productive discourse on intuition in business. Firstly, considerable confusion about what intuition is. Secondly, failure to distinguish between the process of intuiting and the outcome of that process, intuition. Thirdly, a lack of understanding of the conditions that foster the effective use of intuition, and hence disagreements about if and when it can be trusted.[57] They described the process of intuiting as 'nonconscious' (i.e. outside of conscious awareness), involving 'holistic associations' (meaning that cues in the environment are matched with patterns in long-term memory), and 'rapid' (or comparatively so compared with the operations of the rational system). The outcome of intuiting—the intuitive judgement itself—is 'affectively charged' (involves cognitive feelings, gut feelings, gut instincts, etc.) which give rise to feelings of knowing, even though the knower may not know exactly how they have come to know. In the words of the philosopher Michael Polanyi they 'know more than they can tell'. Dane and Pratt produced what has become for many intuition researchers the consensus definition:

[i] Because it failed to offer any explanation for the underlying cognitive mechanisms for non-logical processes.

> *Intuitions are affectively charged judgments that arise through rapid, nonconscious, and holistic associations*.[58] (Definition 3)

In formulating this description, they successfully addressed two of their three barriers, i.e. confusion about what intuition is and the failure to distinguish between intuiting and intuition. The third barrier—lack of understanding of the conditions that foster the effective use of intuition—is one of the focal points of intuition research. The question of not 'if' but 'when does intuition work best?' is the subject of ongoing inquiry and of much of this book.

The seminal contributions of Barnard, Simon, and Dane and Pratt provide an answer to the question 'what is intuition?'

> *Intuition is an involuntary, difficult-to-articulate, affect-laden recognition or judgement, based on prior learning and experiences and arrived at rapidly without deliberate or conscious rational thought.*[59]

A shortish answer to the question of 'when does intuition work best?' is that intuition works best when it is exercised by the right person, at the right time, under the right circumstances. A useful starting point in trying to understand why this is the case is to try to get closer to the subjective experience of intuition itself.

The 'Sixth Sense'?

In terms of its proximity to consciousness,[60] the unconscious process of intuiting leads to a conscious outcome, intuition. This outcome manifests as bodily sensations referred to variously as gut feelings, hunches, vibes, etc. Intuiting is both 'embrained' (in that there are cognitive processes—albeit unconscious—which lead to the outcome) and 'embodied' (in that awareness of it is experienced as a 'felt-sense').[61] Evidence for intuition as a universal and embodied phenomenon is to be found in the words used to describe it across human languages and cultures. 'Gut feeling' in Greek is 'éntero' (έντερο), in Chinese it is 'Zhíjué' (直觉), in Hindi it is 'saahasee bhaavana' (साहसी भावना), and in Korean it is 'jiggam' (직감).[62]

Although the person experiencing the intuition (the intuitor) cannot comprehend fully where their gut feelings emanate from, they are nonetheless aware of the outcome in the form of an intuitive felt-sense.[63] That said, as we shall see in Chapter 6, there are certain circumstances in which our decisions can be influenced by our intuitions without us necessarily being aware that our 'gut', and not our head, appears to be the one that is in charge.[64] Irrespective of how the process operates (and more of that in the subsequent chapters) the result is that the person experiencing the intuition feels or thinks, via a gut feeling or a hunch, that they 'know without knowing how or why they know'.[65]

But what does it feel like to know without knowing how or why you know, or to put it another way 'what happens when you intuit?' In my own research I asked a

sample of 127 human resource (HR) managers to answer the question 'what happens when you intuit?' As far as the process of intuiting itself was concerned, HR managers' prior experiences (for example, 'elements of my experience come together to shape my thoughts and actions) and perception of cues ('I recognize cues') resulted in a process that was automatic ('I feel something to be true without analysing it'), fast ('I make a decision quickly'), and subconscious ('it feels as though an answer appears from nowhere'). In terms of outcomes, the HR managers distinguished between bodily awarenesses as feelings ('a whole body feeling') and gut reactions ('I get feelings in my stomach'), and cognitive awarenesses, for example, as mental imagery (an aural image 'I listen to that small voice in my head'). The outcomes manifested as insights ('connections between previous unconnected or apparently unrelated ideas') and as both positive signals ('something clicks inside that I recognize as clearly right') and negative signals ('I know something is wrong'). Managers used these signals for anticipating ('I sense that someone is going to say something'), deciding ('guides me towards concrete direction, decision or action'), judging ('I cannot rationalize an absolute decision so I make a casting vote based on intuition'), and questioning ('I ask myself what's really going on here').[66]

The aim of this research was to try and get close up to managers' subjective experiences of intuition; it illustrates a number of important general points about intuition as a 'sense'. Intuition is sometimes referred to metaphorically as a 'sixth sense'; this is not a wholly inappropriate way of thinking about it given that intuition works by interpreting information provided by the other five sense perceptions. For example, wine experts use taste and smell to intuitively identify the year, the grape, and sometimes even the exact vineyard where a particular wine was produced. Expert firefighters are able to use the sound of the blaze and the sponginess of a surface to judge whether a burning building is about to collapse. Art experts are able to judge instantaneously from the merest glimpse whether a work of art is a fake. The five sense perceptions work from outside to inside; cues from the outside world are perceived and processed. Intuition, on the other hand, works from the inside to outside; signals from the inside world (in the form of an intuitive felt-sense) are presented to us from within and inform our thoughts, actions, and behaviours. But even as a metaphorical 'sixth sense', no paranormal explanation of intuition is necessary.

If and how this information is interpreted and whether it leads to an accurate judgement depends on the person's prior knowledge and experiences (some people have much more experience than others on which to base their intuitions) as well as on the situation (some situations are more amenable to being judged intuitively than others). This means that not everybody will arrive at the same intuition even though they experience the same cues; for example, a novice who tastes and smells a vintage wine or sees a genuine work of art is likely to come to a quite different, less informed, and more hit-or-miss interpretation compared to that of an expert, even though they will be drinking the same drink and looking at the same image. Experts, whether it be in wine or art connoisseurship, chess, firefighting, or management, see and interpret the world quite differently from non-experts. Experts, by dint of their know-how, are able to come up with gist-based interpretations which help

them to navigate their world intuitively.[67] Intuitive expertise may be marvellous in terms of what it can achieve, but it does not require mystical, magical, or paranormal explanations to account for how it works.

Incidentally, the question of whether intuition operates at the level of a 'supra-consciousness' was alluded to by intuition researchers Marta Sinclair and Neal Ashkanasy. They speculated that in future it might be necessary to depart from conventional psychology to explain intuition, for example by reference to transpersonal psychology and other spiritual and transcendental perspectives that acknowledge the possibilities for 'alternate realities'.[68] A 'spiritual intuition' has been mooted which offers holistic perception of reality that transcends rational, dualistic ways of knowing and gives the individual a 'direct transpersonal experience of the underlying oneness of life'.[69]

Intuition Makes Sense

Police work is a demanding business. Police officers often have to make sense of situations that initially do not make sense in order to take sometimes urgent and often consequential decisions in uncertain, ambiguous, complex, and fast-moving environments. Much police work involves situations in which officers are required to use their experience to take actions spontaneously to resolve a situation, for example, a person who is in the precarious position of having fallen into a fast-flowing river and has to be rescued immediately. Other aspects of police work cannot be resolved so instinctively, for example, when a mother calls to make a complaint of a domestic dispute involving a child but when the officers arrive the mother claims that everything is now okay, despite the fact that her partner is nowhere to be seen and the child appears to be brooding and withdrawn.

In the first example of the river rescue, it is clear what the circumstances are and what needs to be done: officers have to see and respond. In the second example of the domestic dispute, the circumstances are ambiguous and perplexing; what needs to be done next is not clear, and officers have to sense, inquire, interpret, and respond. Skilled police officers make sense of such situations by interpreting the observable cues in terms of their previous experiences so as to develop a plausible meaning that can be used as a basis for action. Their intuition tells them that the situation does not look right and therefore they need to find out why and then act accordingly. They intuit their way into sense.[70]

Sense-making is the act of developing ideas that make the explanation of ambiguous, equivocal, or confusing events possible.[71] People use sense-making when they are initially confused and cannot choose between different interpretations of an ambiguous situation and decide what the best course of action is likely to be.[72] In intuitive sense-making, someone notices something as surprising because the cues do not fit with an established pattern which makes it 'out of kilter' with their experiences and expectations. The initial intuitive response is likely to be experienced bodily through gut feelings and hunches and intellectually through puzzlement and perplexity. Intuitions are activated as a result of cues, such as a person's verbal

and non-verbal behaviours, violating expectations and causing surprise. Things not making sense prompts the making of sense. In such situations it is necessary to come up with a plausible explanation in order to respond with a reasonable and justified action; moreover, it is not possible to simply edit intuition out of the decision-maker's lived experience.[73]

In the domestic dispute example above, officers engaged in a process of sense-making by the rational process of inquiring (see Chapter 4). The officers were 'thrown' via their intuitions into inquiring, rather than into acting, by the uniqueness of the situation.[74] They had to inquire because their initial sense that was personal, partially formed, intuitive, tacit, and complex needed to be turned into something that was simpler, fully formed, more ordered, and could be articulated so as to be usable by other stakeholders (in the police example these were the participants, colleagues, and the judiciary).[75] In the process of sense-making, intuition acquires new properties: it transitions from being tacit, ineffable, and nebulous to explicit, detectable, and solid. As the eminent organization theorist Karl Weick commented: 'Intuiting, rather than intuitions, is what moves an initial tacit, intimate, and complex sense into a public, simpler, ordered sense.'[76]

In acquiring new properties, for example by becoming more solidified, intuitions can become not only explanatory (explaining ambiguous events), but they can also become generative (creating new ideas). As such they assist in the process of foreseeing. Innovation and new product development (NPD) is the life blood of growth in high-tech firms but the front end of the process is typically fuzzy, and effort and resources can go to waste. One of the reasons for this is that the critical success factors (CSFs) which influence idea screening at the NPD front end and help to weed out unpromising ideas can often be tacit, ineffable, and nebulous. Managers may know the CSFs when they see them and take them for granted. Carnegie Mellon University Software Engineering Institute's 'CSF Method' taps into managers' intuitions by making their 'sixth sense' explicit so that the organization can use it.[77] The CSF method is based on the idea that every organization already has a set of CSFs, but these are often tacit, hence it may not 'know that it knows'. The former CEO of Hewlett Packard (HP), Lew Platt, is reputed to have said that 'If HP knew what HP knows, we'd be three times more productive.'[78] In the medical device industry, which thrives on NPD, the CSF method has been used to glean a set of simple and seemingly obvious rules of thumb that are sometimes taken for granted but when harvested and articulated can be used to make the NPD process far smarter, for example: 'resource requirements are clearly documented', 'the project has the ability to meet customer needs', 'the right people are active in the right place at the right time', 'criteria are established to promote or kill the project', 'competitive advantage from the project is clear', etc. Identifying CSFs makes explicit those things that the skilled manager knows intuitively but which must be interpreted, integrated, and institutionalized in order to guide and direct the process of organizing. Making sense of CSFs that experienced managers rely on intuitively makes the fuzzy front end of the NPD process more efficient by reducing the time taken, having fewer failures, being less wasteful of resources, and, ultimately, increasing the chances of success.[79]

Sharing individual managers' intuitions, for example by encoding them as simple rules, is one way to build what have become known as 'collective intuitions'.[80] Strategic management researchers Christopher Bingham and Kathleen Eisenhardt documented numerous simple rules based on collective intuitions that were a source of competitive advantage for technology-based ventures that were seeking to internationalize, for example 'enter one continent at a time', 'sell through partners first, then build direct channels', 'place greatest emphasis on government accounts', etc. Once captured, these rules seem like common sense, but only once they are distilled from the experiences and intuitions of individual managers.[81]

Instinct or Intuition?

A no-nonsense perspective on intuition in business is to be found in the autobiography of Jack Welch (1935 to 2020 and former CEO and Chairman of General Electric from 1981 to 2001) which is entitled *Straight from the Gut* (2001). For Welch a 'tin gut' (analogous to the metaphorical 'tin ear') can incapacitate managers; on the other hand strong and effective leaders have 'an instinct for business—a "gut" that guides them well'.[82] Likewise, Bill Gates in articulating his 'grudging respect' for Steve Jobs, commented that although 'He [Jobs] never really knew much about technology … he had an amazing instinct for what works.'[83] Sir Richard Branson in his autobiography *Losing my Virginity* commented that he relies 'far more on gut instinct that researching huge amounts of statistics'.[84]

Sometimes following your instinct means going out on a limb and against the grain. There are plenty of examples in the popular business press of executives who did so and it paid off. Henry Ford is reputed to have used his business instinct in 1914 to meet the challenge of falling demand for his vehicles and high employee turnover. His instinct was to double his employees' wages. Many in the industry thought he had made a grave error, however, within a year employee turnover had fallen by 20 per cent, productivity doubled, and demand for Ford motor vehicles doubled partly because employees could now afford the cars they were making.[85] Boeing CEO Bill Allen's instinctive decision in the 1950s to expand out of the military aircraft market and into commercial airliners in the project to develop the Boeing 707, which could hold up to 190 passengers, was met with howls of derision, but it ended-up transforming both his own company and the business of air travel.[86] Chrysler CEO Bob Lutz's decision to go with his gut to develop a 'muscular, outrageous sports car that would turn heads and stop traffic' was opposed vehemently by the 'naysayers' and 'bean counters'. The Dodge Viper was a product of Lutz's executive instinct, in his own words 'a visceral feeling [that] just felt right' which turned out to be a commercial success.[87]

'Gut instinct', 'business instinct', or 'executive instinct' are often endorsed by business biographers and the popular press as desirable management and leadership attributes. But whilst instinct might be an appealing and catchy metaphor for how senior managers, usually male, take decisive actions, it is potentially unhelpful in

arriving at a scientific understanding of intuition in business decision-making. In its proper sense, instinct is a biological term that is best confined to behaviours and responses that are pre-programmed genetically into an organism. Such behaviours include a baby's grasping reflex and other hardwired behaviours such as the homing instinct in pigeons. Instinct in the context of intuition in business is a metaphor. How expert executives and managers come to be able to intuitively, and on the face of it 'instinctively', navigate the risky and uncertain world of business world is much more likely to be a product of their experiences and their situation than any hardwired instinct or genetic predisposition. For these reasons gut instinct is a term that is perhaps best avoided. The seemingly related term 'insight' is, likewise, not the same thing as intuition even though intuition and insight are sometimes used interchangeably. The differences between them are explored in Chapter 10.

The Science of Intuition in Business

The business of intuitive judgement—and whether intuition should be trusted or not—is a complex and contested matter. Behavioural and brain scientists have expended a great deal of effort both in the laboratory and in the field in order to understand the conditions under which intuition helps or hinders decision-making. Common sense tells us that it is less a question of *if* intuition can be trusted, and more a question of *when* intuition can be trusted.[88] Is there a key ingredient that separates good from bad intuitions?

Research into expert performers in areas as diverse as chess, firefighting, policing, medicine, and management conducted over the best part of half a century consistently shows that being able to make sense of and respond intuitively and effectively in complex and uncertain situations is very much a matter of not only the quantity but also the *quality* of one's experiences.[89] Extensive high-quality learning and experience helps mind *and* body adapt to what is required in a specific situation[90] and builds the capacity for rapid response through recognition.[91] Experienced decision-makers know without necessarily knowing how or why they know; their intuitive knowledge is hard to articulate or 'tacit' (from the Latin *tacēre* meaning 'to be silent').[92]

In the early years of this century only a small handful of scientific works existed on the subject of intuition in business decision-making. By contrast, there was a plethora of popular self-help books by advocates of intuition, for example *Intuition and Beyond*[93] claims benefits of 'more abundance' and 'greater financial freedom', *Awakening Intuition*[94] promises to help readers use their 'mind-body network for insight and healing', and *Intuition by Design* is based on 'subtle energy geometrics'. Managers who wondered whether intuition could add value to business decision-making could be excused for being confused. There was little in the way of hard evidence for where and how intuition worked over and above general discussions of the benefits of using intuition (for example, it expedites and improves decision-making)[95] and suggestions for how to use intuition (for example, 'getting a feel for your intuitive batting average' and 'getting good feedback' on your intuitive decisions).[96] This early

work, whilst doing much to raise the profile of intuition in business, was based more on conjecture than on substantive research evidence. To move the scientific study of intuition in business forward, more was needed than anecdotes and advice. Fortunately, a considerable body of empirical evidence has accumulated over the past two decades. This work, rather than being mere advocacy for intuition, takes an objective view and shows that intuition works well, but only under certain conditions, and consequently has the potential to both be the managers' friend and a foe in the complex and uncertain business environment of the twenty-first century.[97]

One of the groundbreaking studies of intuition in business was conducted by Naresh Khatri and Alvin Ng in the early 2000s. They set out to explore if there were particular conditions under which strategic intuitive decisions are more likely to work well. They looked at how the interaction between intuitive decision-making and the stability of a firm's business environment affected financial performance (for example, profits and growth) and non-financial performance (for example, operational efficiency). Did intuition work best in stable or unstable conditions? Khatri and Ng's proposition was that in fast-moving, unstable environments boundedly rational managers must combine real-time information about their environment gleaned from multiple sources (for example, markets, finance, competition, technology, policy, etc.) and integrate this into a holistic, intuitive assessment of how to act. They surveyed managers in three contrasting industries that varied in terms of competition, technology, and government regulation: the computer industry characterized by high instability; banking, moderate instability; public utilities, low instability.

Khatri and Ng found that the use of intuition in strategic decision-making was positively related to organizational performance in an unstable environment (i.e. the computing industry) whereas intuition was negatively related to performance in a stable environment (i.e. the public utilities industry). Their results showed that intuition is advantageous in fast-moving sectors and markets which tend to be more unstable and where creativity, innovation, and first-mover advantage are important. However, they also concluded that intuition needs to be used cautiously and much less often in stable and moderately unstable environments.

I extended this work a few years later in a longitudinal study of decision-making in the fast-moving entrepreneurial environment of small business management in the UK. I found that intuitive decision-making was associated with superior financial performance (sales growth, objectively measured) and non-financial performance (efficiency, reputation, and product and service quality) both over the shorter and longer terms.[98] In the years since Khatri and Ng conducted their groundbreaking study, the business environment in general has become more unstable. It is not unreasonable to assume, therefore, that across businesses the ability to sense intuitively as well as solve analytically are likely to be key ingredients of organizational resilience and sustainability.[99]

By the end of the first decade of the twenty-first century, management researchers had built a solid framework which offered empirical evidence for intuition's role in business decision-making, especially in fast-moving environments. A study by

Mark Fenton-O'Creevy and colleagues of the use of intuition by traders in four leading investment banks in the City of London found that higher-performing traders reported that they often relied on their intuition. Unsurprisingly, given what has already been said, higher-performing traders did not just 'go with their gut'. Instead they tended to weigh their gut feelings critically alongside other evidence and to introspect about the whys and wherefores of their gut feelings in order to pin down what their instincts were telling them.[100] One experienced higher performing trader remarked that 'there are very good traders that say they're trading off gut feel … but perhaps they're not analysing what they're actually thinking … they're seeing a lot of customer flow and a lot of buyers and they probably don't necessarily realize the reasons why they want to buy.' The knowledge that these experienced high-performing traders were using was acquired experientially and used intuitively. In contrast with the intelligent use of intuition by experienced high-performing traders, lower-performing traders tended to rely exclusively on gut feelings and were less disposed towards thinking critically about their hunches. Somewhat worryingly, one low-performing trader remarked, 'It's almost like a sixth sense. Something comes over you and you feel like—yes I know they're going to be looking to buy these later on or looking to sell these later on.'

Fenton-O'Creevy's research suggests that there is more to making effective use of intuition than simply having a quantity of experience. He and his team found that use of intuition increases quantitatively with traders' experience (i.e. they became more intuitive over the years), however, the way that experienced traders used their intuition varied qualitatively between the higher and lower performers. High-performing traders consciously tried to make sense of their intuitions before acting on them, this involved the skill of engaging with intuitions 'meta-cognitively', i.e. they thought critically about their intuitive thinking processes.[ii] Managers, such as the traders in this study, must be able to make sense not only of the problems they have to solve and the decisions they are required to take but also make sense of their intuitions in order to be able to determine if and when they are to be trusted.

Caveat Emptor

Because our 'intuitive mind' works automatically and effortlessly, we typically do not have to ask it what it 'thinks'—it tells us, whether we want it to or not. 'Intuitive hits' such as those of Jack Welch at General Electric or Bob Lutz at Chrysler are highly visible. They get promulgated and perpetuated in the business press and CEO biographies, end up being part of business folklore, and perpetuate a macho 'go-with-your-gut' myth. What are less well known are the 'intuitive misses' and the potential that intuition has for getting it wrong. In areas of business, from strategic planning through human resources to finance and accounting, managers regularly have to

[ii] Meta-cognition is 'thinking about thinking'. Hence engaging with one's intuitions 'metacognitively' means thinking about one's intuitive thinking processes.

decide whether not they should trust their intuitions when they take important, and potentially career- and business-changing, decisions. It is tempting to 'go with your gut' when time and information are scarce. However, problems are likely to follow when an intuitive sense of 'feeling good' about something is conflated with accuracy of judgement. Obviously, simply because a decision *feels* right does not mean that it *is* right. For example, a popular mantra in many intuition self-help books is that intuition 'always shows the best route'.[101] Decades of research in the behavioural sciences into the biases that bedevil human judgement tell us that this statement cannot possibly be true (more of this in Chapter 2). Therefore, following your intuition indiscriminately could be the first step on the slippery slope of an undiscerning, uninformed, and ultimately unintelligent, use of intuition. It is worth reiterating: the conditional statement '*if* I simply feel good about a judgement, *then* I must be right about it' does not hold true.[102] Simply feeling right about a business decision can be a short cut to errors and biases and opens the door to naïve and wishful thinking and false hopes. It can, more perniciously, lead to prejudice and discrimination. One of intuition's more perilous features is that it is sometimes wrong but rarely in doubt.

A case in point is employee selection decisions. HR practitioners have been criticized for a 'stubborn' over-reliance on intuitive judgements despite the availability of rigorously researched scientific approaches to decisions about hiring.[103] Nonetheless many managers will testify, quite genuinely and sincerely, that going with their gut has served them well in making new hires.[104] However, one of the problems of going with your gut in such situations is that as human beings we engage automatically in intuitive categorizations based on stereotypes in a fast, automatic process of impression formation.[105] For example, it has been long established that we intuitively like and are attracted to people who we perceive to be like us and hence are more likely to hire them. Unfortunately, the fact that we may be doing so, and reasons for it, may not be known immediately to us or open to introspection—the result can be an unconscious bias.[106] The intuitive mind operates on the basis of implicit categorization processes[107] and when intuition is used indiscriminately, for example in hiring decisions, managers run the risk of violating principles of fairness, justice, and equity as well as their own professional standards. They may also create an echo chamber of their own making which reproduces and replicates their own beliefs and values.[108]

Deciding whether to go with your gut is surrounded by tensions, contradictions, and paradoxes. The challenge for managers is not to simply 'feel' right about their intuitions and go with them because they feel good. The challenge is to find ways to build intuitive 'muscle power',[109] develop strategies for integrating and reconciling the sometimes contradictory voices from their intuitive and analytical minds, and ultimately to develop an informed intuitive intelligence. Until relatively recently, the expectation had been that when managers take decisions they leave their intuitions at home or consign them to the closet ('Don't trust your gut'[110]) and exercise choices in ways that are consistent with economic principles such as 'optimization' and 'maximizing utility' (more on these concepts in the next chapter). This is likely to be in line both with societal expectations and with what managers are likely to have been taught

in training courses and business schools. However, the reality of decision-making in a world that is often unknowable and radically uncertain is somewhat different.[111] It is also against our human nature. Intuition does have a place in business decision-making, and intuitive intelligence begins with a solid understanding of the science of intuition and an appreciation of its powers and perils.

Artificial Intuition: The New AI?

In the middle of the last century the psychologist Paul Meehl in his book *Clinical Versus Statistical Prediction* (1954) compared how well the subjective predictions of trained clinicians such as physicians, psychologists, and counsellors fared when compared with predictions based on simple statistical algorithms.[112] To many people's surprise, Meehl found that experts' accuracy of prediction, for example trained counsellors' predictions of college grades, was either matched or exceeded by the algorithm. The decision-making landscape that Meehl studied has been transformed radically by the technological revolutions of the 'Information Age'.[113] Computers have exceeded immeasurably the human brain's computational capacity. Big data, data analytics, machine learning (ML), and artificial intelligence (AI) have been described as 'the new oil'.[114] They have opened up possibilities for outsourcing to machines many of the tasks that were until recently the exclusive preserve of humans.[115] The influence of AI and machine learning is extending beyond relatively routine and sometimes mundane tasks such as cashiering in supermarkets. AI now figures prominently behind the scenes in things as diverse as social media feeds, the design of smart cars, and online advertising. It has extended its reach into complex professional areas such as medical diagnoses, investment banking, and even in scriptwriting for advertisements.[116]

There is nothing new in machines replacing humans: they did so in the mechanizations of agriculture and industry in the agricultural and industrial revolutions and since the 1980s many blue collar jobs are now performed by robots. We now find ourselves in the fourth industrial revolution, but Daniel Suskind, author of *World without Work*, thinks the current technological revolution is different. The power with which robots and computers are able to perform tasks at high speed, with high accuracy, at scale using computational capabilities are orders of magnitude greater than those of any human or previous technology. This is one reason why this revolution is different and why it has been referred to as nothing less than the 'biggest event in human history' by Stuart Russell, founder of the Centre for Human-Compatible Artificial Intelligence at the University of California, Berkeley.[117]

The widespread availability of data, along with cheap, scalable computational power, and rapid and ongoing developments of new AI techniques such as machine learning and deep learning have meant that AI has become a powerful tool in business management.[118] Examples include Amazon's Prime Air, which delivers packages using autonomous, small drones; McDonald's use of voice-based AI for ordering at drive-throughs; and Macy's On Call personal in-store assistant which gives shoppers

customized answers to the kind of questions they would normally ask a sales associate face to face.[119] The financial services industry deals with high-stakes, complex problems involving large numbers of interacting variables. It has developed AI that can be used to identify cybercrime schemes such as money laundering, fraud, and ATM hacking.[120] By using complex algorithms, 'fourth generation AI' can uncover fraudulent activity that is hidden amongst millions of innocent transactions and alert human analysts with easily digestible, traceable, and logged data to help them to decide whether activity is suspicious or not and take the appropriate action.[121] There are few areas of business which are likely to be exempt from AI's influence.

Creativity is vitally important in many aspects of business management. It is perhaps one area in which we might assume that humans will always have the edge. However, creative industries, such as advertising, are using AI for idea generation. The car manufacturer Lexus used IBM's Watson AI to write the 'world's most intuitive car ad' for a new model, the strapline for which is 'The new Lexus ES. Driven by intuition.'[122] The aim was to write the ad script for what Lexus claimed to be 'the most intuitive car in the world' using a computer. To do so Watson was programmed to analyse fifteen years'-worth of award-winning footage from the prestigious Cannes Lions international award for creativity using its 'visual recognition' (which uses deep learning to analyse images of scenes, objects, faces, and other visual content), 'tone analyser' (which interprets emotions and communication style in text), and 'personality insights' (using data to make inferences about consumers' personalities) applications.[123] Watson AI helped to 're-write car advertising' by identifying the core elements of award-winning content that was both 'emotionally intelligent' and 'entertaining'. The script outline was literally written by Watson. It was then used by the creative agency, producers, and directors to build an emotionally gripping advertisement.

Even though the Lexus-IBM collaboration reflects a breakthrough application of AI in the creative industries, IBM's stated aim is not to attempt to 'recreate the human mind but to inspire creativity and free up time to spend thinking about the creative process'.[124] The question of whether Watson's advertisement is truly creative in the sense of being novel, as well as useful, is open to question given that it was based on human works that were judged to be outstandingly creative by human judges at the Cannes festival. Another example of area in which fourth-generation AI is making inroads is in the emotional and interpersonal domains. The US-based start-up Luka has developed the artificially intelligent journaling chatbot 'Replika', which is designed to encourage people to 'open up and talk about their day'.[125] Whilst Siri and Alexa are emotionally 'cold' digital assistants, Replika is claimed to be more like your 'best friend'. It injects emotion into conversations and learns from the user's questions and answers.[126]

The fact that computers are making inroads into areas that were once considered uniquely human is nothing new. Perhaps intuition is next. The roots of modern intuition research are in chess, an area of human expertise in which grand masters intuit 'the good move straight away'.[127] But in 1997, IBM's Deep Blue beat Russian chess grand master and world champion Garry Kasparov. Does this mean that

IBM's AI is able to out-intuit a human chess master? The strategy that Deep Blue used to beat Kasparov was fundamentally different from how another human being might have attempted to do so. Deep Blue did not beat Kasparov by replicating or mimicking his thinking processes, in Kasparov's own words: 'instead of a computer that thought and played like a chess champion, with human creativity and intuition, they [the "AI crowd"] got one that played like a machine, systematically, evaluating 200 million chess moves [greatly surpassing Simon's 50,000 "familiar patterns"] on the chess board per second and winning with brute number-crunching force.' Nobel laureate in physics, Richard Feynman, commented presciently in 1985 that it will be possible to develop a machine which can surpass nature's abilities but without imitating nature.[128] If a computer ever becomes capable of out-intuiting a human, it is likely that the rules that the computer relies on will be fundamentally different to those used by humans[129] and will use a very different mode of reasoning to that which evolved in the human organism over many hundreds of millennia.

But AI can also be surprisingly dumb. In medical diagnoses, even though the freckle-analysing system developed at Stanford University does not replicate how doctors exercise their intuitive judgement through 'gut feel' for skin diseases, it can nonetheless through its prodigious number-crunching power diagnose skin cancer without knowing anything at all about dermatology.[130] But as Stuart Russell remarked, the deep learning that such AI systems rely on can be quite difficult to get right, for example some of the 'algorithms that have learned to recognise cancerous skin lesions, turn out to completely fail if you rotate the photograph by 45 degrees [which] doesn't instil a lot of confidence in this technology.'[131]

Although nowhere near as humanly consequential as medical diagnoses, the credit rating decisions taken by managers in banks are nonetheless financially significant. The credit risk assessment process begins with compiling data for analysis, which is then inputted to a bank's proprietary model (e.g. a simple logistic regression equation) and which then generates an output of a preliminary rating in the form of a scorecard. The scorecard summarizes the potential borrower's likelihood of defaulting on a loan. This preliminary risk rating is then reviewed in the light of all other information about the borrower. The process of adjustment to give the final rating by the loan officer is called 'notching' and is based on their experience of making loans and their intuitions about the loan applicant. The final credit risk judgement is based on the statistical analysis plus the notching. In practice, the human assessment is typically several notches lower (i.e. judged riskier) than the computer assessment, suggesting that human intuition errs on the side of caution when judging credit worthiness.

Matthew Harding of University of California Irving and Gabriel Vasconcelos of the Brazilian Bank of Communications investigated whether it was possible to replicate this entire process using a machine learning algorithm capable of both the statistical analysis and the subjective assessment. They constructed several different algorithms which incorporated quantitative variables (e.g. company cash flow, total assets, and profit after tax) and qualitative variables (e.g. ratings of management quality, firm's

outlook in the market, and vulnerability to changes in business environment). When they ran the analysis, they found that the best of the machine learning algorithms could match the final risk rating based on the computer's statistical analysis and the manager's subjective assessment with a degree of accuracy of 95 per cent. It seems as though a relatively simple machine learning algorithm can replicate almost perfectly the risk assessment made by highly skilled human judges.[132] They concluded that it could be much quicker and cheaper for banks to process loan applications using a machine instead of a human and that with additional data and computational power the algorithms could be improved even further. However, as some commentators have noted, although analysis is easy to automate, human accountability, with its various social, ethical, and political ramifications, is not and cannot be reduced to an algorithm.[133] For example, how might a machine learning algorithm rate a loan application from a financially robust terrorist group in order to finance the development of a novel, first-to-market weapon of mass destruction?

Is the balance of how we comprehend situations and take business decisions shifting inexorably away from humans and in favour of machines?[134] Is 'artificial intuition' inevitable and will it herald the demise of 'human intuition'? If an artificial intuition is eventually realized that can match that of a human, it will be one of the pivotal outcomes of the fourth industrial revolution—perhaps the ultimate form of AI. More apocalyptically, could the creation of artificial intuition be the 'canary in the coalmine', signalling the emergence of Vernor Vinge's 'technological singularity', wherein large computer networks and their users suddenly 'wake up' as 'superhumanly intelligent entities'.[135] Could such a development turn out to be a Frankenstein's monster with unknown but potentially negative, unintended consequences for its makers? The potential and the pitfalls of AI are firmly in the domain of the radically uncertain.

Making any predictions about what computers will or will not be able to do in the future is a hostage to fortune. For the foreseeable future, most managers will continue to rely on their own rather than a computer's intuitive judgements when taking both day-to-day and strategic decisions. Therefore, until a viable 'artificial intuition' arrives that is capable of out-intuiting a human, the more pressing and practical question is what value does human intuition add in business? The technological advancements of the information age have endowed machines with the hard skill of 'solving' which far outstrips this capability in the human mind. The evolved capacities of the intuitive mind have endowed managers with the arguably hard-to-automate, or perhaps even impossible-to-automate, soft skill of 'sensing'. This is the essence of human intuition.

Summary

1. The main idea of this chapter has been that human beings possess two complementary modes of thinking: intuitive (which 'senses') and analytical (which 'solves').

2. Intuition is an involuntary, difficult-to-articulate, affect-laden recognition or judgement, based on prior learning and experiences and arrived at rapidly without deliberate or conscious rational thought.
3. Human intuition is both powerful and perilous; it may help or hinder managers in making sense of situations, making decisions, and taking action.[136]
4. Naïve intuitive judgements can result in logically flawed short cuts that can lead decision-makers down blind alleys and to biased judgements.
5. Informed intuition can help managers to take quick decisions based on prior experiences (expert intuition), decipher the motives, intentions, and behaviours of others (social intuition), locate their moral compass (moral intuition), and sense novel and useful ways of solving problems (creative intuition).
6. Informed intuitions help managers to make sense of confusing situations; in the sense-making process intuitions themselves transition from being tacit, ineffable, and nebulous to explicit, detectable, and solid.
7. Intuition might also be a window into some of the more intangible and ineffable aspects of human experience.

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