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What do we really understand about how managers make important decisions?

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Our motivation in writing this article is twofold. We want to give a state-of-the-art update for readers of *Organizational Dynamics* on management intuition research, but equally pay tribute to the foundational contribution made by Dr. Weston H. Agor in the pages of this journal almost three decades ago. Agor, considered by many to be the pioneer of intuition research in management, claimed in his *Organizational Dynamics*' (1986) article entitled "The Logic of Intuition: How Top Executives Make Important Decisions" that the 1980s may well be a "benchmark in management history when intuition finally gained acceptance as a powerful tool in guiding executive decision making." Against a backdrop of the preeminence of rationality in management and management education, the picture Agor painted in 1986 was a radical one. He exhorted managers and executives not only to be more attuned to the potential of intuition but to hone their intuitive skills so that they could manage and lead more productively.

Agor's research was driven empirically and theoretically. He based it on available theories of human information processing and brain functioning and on results from his own study of over 2000 managers in the U.S. from a wide variety and levels of business. One of his most important, and often-replicated, findings was that managers at the top of organizations score higher on use of intuition than middle or lower level managers. Proof, if it was needed, that senior managers use intuition. In a follow-up study of the top 10 percent intuitives, Agor found that the vast majority acknowledged using intuition when making important decisions, including strategic decisions, and when surrounded by high levels of uncertainty, little previous precedent, limited facts, and time pressure. Wisely, Agor did not just look for intuitive "hits" but also asked these executives to come up with instances where they followed their intuition and it missed. The intuitive "misses" were characterized by self-deception and pretense, wishful thinking, attachment to a person or object, letting the ego take control, emotional pressures, and psychological stress. Even so, some executives still attributed lack of success in decision making to failure to follow their intuition in the first place.

Agor was interested in developing managers' "brain skills". He wrote a book called *Intuitive Management: Integrating*

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Left and Right Brain Management Skills. With one eye on the management classroom, Agor offered techniques and exercises that executives could use to activate their intuition, including mental exercises (such as guided imagery, tolerating ambiguity), analytical approaches (such as immersion, identifying pros and cons, reflection) and relaxation techniques (such as meditation, "sleeping on it") to complement and counterbalance intuition. Interestingly, this was over a quarter of a century before Daniel Goleman tuned-in to mindfulness meditation in *Focus: The Hidden Driver of Excellence* (2013). Agor concluded that more research was required especially in light of the increased knowledge of how the human brain functions and that even among intuitive executives opportunities existed for honing and further developing intuition.

Since Agor's classic contribution, it is clear that intuition has enduring appeal to generalist and specialist audiences alike. The popular business press, such as a 2013 *Fast Company* article by John Coleman, has highlighted intuitive components in historic decisions that appeared to defy logic, from the Cuban Missile Crisis to the creation of the iPod. We have also witnessed the popularity of Malcolm Gladwell's international best seller *Blink* (2006) and more recently Daniel Kahneman's *Thinking Fast, and Slow* (2011). In the research literature, there has similarly been a steady rise in the number of published articles on intuition in top journals, but how much meaningful progress has really been made since 1986? And what challenges and opportunities in the contemporary business reality confront any significant evolution of the science and practice of intuition in management? Next, we look back and recap where the genre of intuition research has been, then digest where the practice and science of intuition is presently, and finally attempt to frame where and how the field should progress.

WHERE WERE WE THEN?

Long ago, Albert Einstein claimed eloquently that "the intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honors the servant and has forgotten the gift." Thus, not surprisingly, one reason that the study of intuition began to exercise an allure for managers and researchers was the acknowledgment that rational approaches, invaluable though they are, are less powerful and realistically viable than classical economic and decision theories might lead us to believe.

This observation was expanded upon famously in the management literature by Nobel laureate Herbert Simon with his concept of 'bounded rationality', based on the precepts that in real world decision making the number of alternatives to be explored and the amount of information required is often very large, while the human brain's information processing capacity, by comparison, is limited. Consequently managers satisfice, optimize, and intuit. Like Agor, Simon was part of a longer intellectual tradition that stretches back at least as far as Chester Barnard and his 1938 book *The Functions of the Executive* (and more specifically its appendix "The Mind in Everyday Affairs"). In this work Barnard, who himself was a practicing executive at the New Jersey Bell Telephone Company, conceptualized intuition as a "non-logical mental process":

...mostly impressed upon us unconsciously or without conscious effort on our part. Because they are so complex and so rapid, often approaching the instantaneous, these processes cannot be analyzed by the person within whose brain they take place consisting, as they do, of a mass of patterns, concepts, techniques, and abstractions that increase in number and complexity with directed experience, study and education. (p. 302)

There is continuity between the work of Barnard and Simon. Not only did Barnard write the preface to the original 1945 edition of Simon's most famous work *Administrative Behavior*, Simon himself later acknowledged Barnard as providing a "persuasive account" of executives' decision processes. Simon's own thinking on the subject drew on research of expert performance and in particular De Groot's studies of chess players, as well as the famous maxim that to acquire high-level expertise in chess requires an investment of approximately 10,000 h of playing and practice. Simon's thinking on the subject became refined to the point that in the late 1980s he famously characterized intuition as "analyses frozen into habit and the capacity for rapid response through recognition." (p. 63)

Although in the popular view intuition is often taken to be synonymous with "gut feel," Simon's account of intuition is a mostly cognitive one. Managers' responses to familiar situations become automated on the basis of pattern recognition. If there is a weakness in Simon's theory of intuition it is the lack of a detailed explanation of intuitive affect (i.e., gut feelings, hunches, vibes, etc.). As we shall see, progress has been made to the extent that brain scientists are now able to offer insights into the neuroanatomical systems that may drive or underlie gut feel.

Earlier attempts at brain-based explanations of intuition might now be considered premature. For example, in the 1970s, Henry Mintzberg wrote his famous *Harvard Business Review* article entitled "Planning on the Left, Managing on the Right," in which he adopted and adapted ideas from neurobiology and applied them to management. The essence of Mintzberg's argument was that planning and administration were left-brain activities, whereas managing was a right-brain activity. It was not long before management scholars coupled the left-brain/right-brain concept with debates about rationality and came up with the idea that "intuition was in the right-brain" and "analysis was in the left." These kinds of attributions are over simplifications and best treated as metaphors for different types of thinking.

Researchers such as Bill Taggart devised 'brain dominance' models and outlined the implications for management education. Taggart argued that business schools should not favor the left brain, as they traditionally have done, but must give equal attention to both hemispheres. The management consultant Ned Hermann went so far as to design and develop an inventory he claimed could assess which quadrant of one's brain was the most dominant. These proposals now seem farfetched and ambitious, and even at the time there were sceptics such as Hines' 1987 *Academy of Management Review* article that poured cold water on the idea, dismissing it as "hemisphere mythology."

The '80s offered a fertile environment for speculations and conjectures about human cognition and the role that intuition plays in management decision making. As well as

Organizational Dynamics, other top management journals were publishing on the subject, including Herbert Simon in *Academy of Management Executive*, Thomas Isaack in *Academy of Management Review*, and Daniel Isenberg in *Harvard Business Review*. As far as the implications for management practice were concerned, intuition was offered as a timely antidote to the acknowledged limits of rationality and was depicted in a largely positive light.

However, a glance sideways from management towards the scientific disciplines that studied the behavioral aspects of decision making and judgment in a systematic manner revealed a somewhat different interpretation of intuition. Intuition had long fascinated psychologists, including William James and Carl Jung. In the 1980s, important advances were made in psychological science to understand the limits of intuitive judgment. The fallibility of human intuition provided one of the guiding precepts of the heuristics and biases (H&B) program of research instigated and led by Daniel Kahneman and Amos Tversky. As an illustration of this, the following is a well-known judgment task that exposes the potency and perils of intuitive first responses in arithmetical problem solving: a bat and a ball together cost \$1.10; the bat costs \$1 more than the ball; how much does each item cost? The most common intuitive response to this question is invariably wrong (i.e., the answer is not: \$1 for the bat, 10 cents for the ball).

The H&B researchers used the results of a series of ingenious experimental tasks like this one to demonstrate how reflexive intuitive mental processes can make complex problems more manageable, but they are also dangerously flawed. In Kahneman and Tversky's lab studies, intuition has been shown to have at most a rough-and-ready usefulness. Most important, intuition often comes badly unstuck when dealing with probabilities or computation, probably because these are tasks that intuitive processing did not evolve to solve in the first place (a point that often goes unnoticed). In recognition of the work he did with Tversky (who died in 1996), Kahneman was awarded the 2002 Nobel Prize in economics for "having integrated insights from psychological research into the study of human judgment and decision making under uncertainty."

From the late 1970s onward, psychologists also revisited the long-standing notion of conscious and unconscious cognition. They attempted to understand mental processes that on one hand are automatic and inaccessible to conscious awareness but on the other hand are able to influence judgment, feeling, and behavior in powerful and profound ways. In the 1980s and 1990s these ideas coalesced around the theory that there are two separate but complementary information-processing systems that underlie thinking and reasoning. A motoring analogy may suffice: if the body is the "car" and the brain is the "engine," the mind is the "driver." However, the key point in the analogy is that this "car" has two drivers, not one. The theory has come to be known as dual process or dual system theory. The two systems complement each other and are referred to variously as automatic/controlled, implicit/explicit, or more generically as System 1/System 2. Dual process theory (i.e., the "two minds model") has moved center stage in managerial cognition research and provides a coherent and compelling theoretical framework offering new insights as to how managers think, decide, and problem solve.

In summary, the 1980s witnessed a radical proposal by Agor that intuition be placed on an equal footing with rationality in management decision making. Management researchers in the 1980s made attempts to explain intuition by using concepts from neurobiology (as cognitive neuroscience had yet to emerge), and consultants zealously devised "whole brain" training programs. While management scholars were extolling intuition's practical benefits, psychologists were simultaneously alerting us to its perils, but also beginning to uncover the existence of an "intuitive mind." Next, we examine the current state of intuition research to better understand where the field is presently.

WHERE ARE WE NOW?

What are the important developments that have taken place in intuition research in the decades since Agor conducted and published his pioneering work? In this section we discuss key scientific advances in the research domain – including defining and measuring intuition, the significance of intuitive expertise, the possibility that there are different types of intuition, understanding when intuition works and when it doesn't, the difference between insight and intuition, and finally the emerging "neural geography" of intuition.

Defining and Measuring Intuition

Intuition used to be hard to pin down. It was often defined in ways that were of little practical or scientific value, such as "knowing without knowing." Chester Barnard described it as a "feeling in our marrow" and attributed it to "previous experience that has not yet emerged into articulate thought." In the 1980s Roy Rowan's book *The Intuitive Manager* defined intuition as "knowledge gained without rational thought. It comes from some stratum of awareness just below the conscious level and is slippery and elusive. Intuition comes with a feeling of almost, but not quite knowing." (p. 96)

These early efforts got partway there, but captured it incompletely. Fortunately, recent opinion has coalesced around several key attributes of intuition. These have enabled researchers to offer a much tighter definition: Intuitions are involuntary, affectively charged judgments arising through rapid, non-conscious and holistic associations (Dane and Pratt, 2007: 33). See Table 1 for this definition and other selected definitions various researchers have contributed to the evolving intuition literature and the progression of conceptualizations over time. As seen there, each definition incrementally builds in important ways to arrive at the Dane and Pratt definition much used in research and practice today.

As far as measuring intuition was concerned, Agor used the *MBTI* in his initial research and his own *Agor Intuitive Manager (AIM)* survey in his follow-up work to measure intuition. Not surprisingly, the world of psychometrics has moved on since the mid-1980s and much better tools are now available that enable managers' preferences for intuition and analysis to be measured reliably (for example, Epstein and colleagues' *Rational Experiential Inventory*) and plotted on a two-by-two, four-quadrant intuition/analysis matrix. This format opens up the interesting possibility of a manager being high on intuition and analysis simultaneously.

Table 1 Selected definitions of intuition, arranged chronologically.

Definition	Source
"This feeling 'in our marrow' is probably an outcome of previous experience that has not yet emerged into articulate thought"	Barnard, 1938: 302
"... simply analyses frozen into habit and into the capacity. for rapid response through recognition"	Simon, 1987: 63
"Intuition is knowledge gained without rational thought. It comes from some stratum of awareness just below the conscious level and is slippery and elusive. Intuition comes with a feeling of 'almost, but not quite knowing'"	Rowan, 1989: 96
"A feeling of knowing with certitude on the basis of inadequate information and without conscious awareness of rational thinking""cognitive conclusion based upon the culmination of a decision maker's previous experiences and emotional inputs"	Shirley and Langan-Fox, 1996: 564 Burke and Miller, 1999: 92
"Intuition is a capacity for attaining direct knowledge or understanding without the apparent intrusion of rational thought or logical inference"	Sadler-Smith and Shefy, 2004: 77
"A non-sequential information processing mode, which encompasses both cognitive and affective elements and results in direct knowing without any use of conscious reasoning"	Sinclair and Ashkanasy, 2005: 357
"Affectively charged judgments that arise through rapid, non-conscious and holistic associations"	Dane and Pratt, 2007: 33

Indeed, "cognitive versatility" is claimed to be desirable. It enables managers to switch 'cognitive gears' in response to the demands of the situation and deploy both processing modes in parallel. While cognitive versatility might be a characteristic of certain managers, it also opens up the potential of developing other managers to use their less preferred mode and become more versatile. It is also possible for a manager to be low on intuition and low on analysis. This is not a desirable condition; managers in this quadrant are likely to need intensive development.

Intuitive Expertise

The phenomenon of "deep smarts" is founded in an expertise-based view of intuition. Informed intuitive judgments arise from a decision maker's complex, domain relevant mental representations. Based on work by Leonard and Swap, deep smarts enable individuals to quickly comprehend intricate, interactive situations by invoking tacitly held expertise harvested from multifarious life experiences – thus lending credence to the concept of intuitive expertise. These authors argue that deep smarts have been observed in many work situations, ranging from highly-foresighted strategic planning decisions (known to permeate firms such as Intuit Inc.) and opportunity recognition skills exercised by various wealthy venture capitalists (such as Peter Thiel, Reid Hoffman, and Jim Breyer). Intuitive expertise enables decision makers to frame problems swiftly and to identify a suitable course of action long before they are able to express their rationale for why that chosen course of action is even appropriate. Popular business press contributors, such as Tomas Chamorro-Premuzic in a 2014 *Forbes* blog, highlighted contemporary CEOs espousing such abilities – for example, Steve Jobs had the capacity to translate information into knowledge in the absence of clear guidelines, unlike his successor, Tim Cook, who allegedly exhibits less "intuitive capacity to transcend the data." In the present age of "big data," Tim

Lebrecht, writing in *Fortune Magazine* in 2013, observed that although data can give us information quickly it can only serve to make us "smarter not wiser" and that for "quick but profound decisions" intuition is much better.

Some supporters of scenario planning and other related forecasting techniques hold that expertise-based intuition (informed by processes similar to the concept of deep smarts) is a vital ingredient in developing plausible alternative frames for managing in times of uncertainty. Viewed from this perspective, the quick and unconscious pattern recognition associated with deep smarts has a propagative function, enabling experienced decision makers to aggregate information, which would appear fragmented to a novice, into meaningful patterns that not only facilitate recognition, but also allow projection into unclear futures. Thus, in the simplest terms intuitive expertise is sophisticated pattern matching born out of intensive experience, practice, and feedback.

More recently, Dane, Rockmann, and Pratt in their experiment-based research reported in the *Journal of Organizational Behavior and Human Decision Processes* that individuals can better rely on intuition when making a broad evaluation (i.e., one that doesn't include a subset of additional decisions) in a domain area where they have in-depth knowledge of the subject, or amassed intuitive expertise. Dane and colleagues suggest therefore that intuition is likely more reliably used by managers who have risen up through the ranks of an industry or a firm accumulating extensive experience as well as domain expertise versus someone who has jumped around different industries.

Indeed, ignoring expertise in the intuition equation can lead to failure. Ponder the example of the Finnish soccer club, Pallokerho-35, as re-capped by Eric Bonabeau in his 2009 *Sloan Management Review* piece, "Decisions 2.0." Several years ago, the coach of this soccer club invited the fans to vote, using their cell phones, on everything from game tactics to recruiting to training. However, the season ended in disaster and – not surprisingly – this coach was fired. Needless to say the fan-driven decision making methods were also thrown out the window.

Multiple Types of Intuition

Many researchers no longer consider intuition to be a single type. Specifically, several researchers in the behavioral sciences and management have identified four 'primary types' of intuition:

- (1) *Expert intuition*. As discussed, this type of intuition represents an expertise-based response driven by involuntary, non-conscious processing of information. Expert intuition (also referred to as "problem solving intuition" or "intuitive expertise") is activated automatically and elicits matching of complex patterns of multiple cues against previously acquired prototypes and scripts held in long-term memory. It enables experienced practitioners to solve specific types of problems with low cognitive effort. However, intuition for firefighting, for example, does not translate to intuition for predicting the value of company stocks or investment prospects; the vital point is that expert intuition is domain specific.
- (2) *Social intuition*. This type of intuition refers to the rapid and automatic evaluation of another person's cognitive and/or affective state through the perception and non-conscious processing of verbal and/or non-verbal indicators, akin to a form of "mind-reading." Social intuitions may enable us to infer and interpret others' motivations and intentions. They are often based on thin slices of others persons' verbal and non-verbal behaviors, sometimes amounting to the decoding of little more than several seconds of interaction. Gladwell based much of his best-selling *Blink* largely on this idea. Social intuitions are difficult to consciously control. For example, while it may be possible to consciously manipulate the content of the verbal channel, states such as anxiety are communicated implicitly and effortlessly through tone, pitch, and gesture and ultimately evaluated intuitively. That said, this is something skilled liars and sociopaths can often do with consummate ease. Like all intuitions, social intuitions are judgments and not necessarily accurate. It is also important to remember that social intuitions may be contaminated by fears, biases, prejudices, and wishful thinking. For example, in recruitment and selection scenarios we are often drawn automatically to candidates who we see as being similar to ourselves. Psychology professor Scott Highhouse refers disparagingly to this as a "stubborn reliance on intuition" among employers in hiring decisions in spite of the advances made in the science of selection.
- (3) *Moral intuition*. For many decades moral philosophers, in common with decision researchers, adhered almost religiously to rational models of human moral judgment and ethical decision making. However, many behavioral scientists no longer accept that moral judgments are arrived at purely via rational processing. Some researchers, such as Jonathan Haidt, Joshua Greene, and Jesse Graham have suggested that intuitive processing may represent an 'innately prepared' default setting for moral judgments, especially those that involve the suffering of others, hierarchy, reciprocity, and purity. An implication of this so-called Moral Foundations Theory is that human beings arrive at moral evaluations quickly

and automatically, and they then search for confirmatory evidence to rationalize their gut moral reactions. As well as being automatic and rapid, a person's moral intuitions are relatively resistant to disconfirmation. That is, in common with social intuitions, they tend to be "sticky." Intuition can provide managers with a moral compass, provided their intuitions have been learned in an ethical environment.

- (4) *Creative intuition*. Decades ago, the highly influential philosopher Karl Popper contended that the creation of new ideas is a non-rational process. Like creativity, intuition is non-rational (not to be confused with irrational). In their *Academy of Management Review* article, Dane and Pratt suggested that "creative intuition" is accompanied by an incubation period, and it is during this fermentation phase where creative processes flourish. While there is a paucity of empirical research exploring creative intuition, from a conceptual perspective many authors such as Langer, Poincaré, and Burke and Miller have positioned intuition as a precursor to creativity and invention. For example, the British billionaire inventor and industrial designer Sir James Dyson trusted his intuition over market research when opting for a clear bin on his dual cyclone, bag-less vacuum cleaner, as relayed in a recent press interview: "I couldn't prove that people would buy it. The research showed the opposite. But you have to be brave, you have to risk a lot of money, you have to go into the unknown. It's risky." Intuition, it seems, precedes creativity, invention, and innovation – not vice versa. And given the importance of innovation in the contemporary business reality, more research on the conceptual intertwining of these related constructs is needed, particularly how the conditions can be created in the workplace for generating, deploying, and testing intuitions in the management of innovation and new product development.

When Intuition Works and When it does not?

As well as being domain-specific, there are certain classes of situations where it would be imprudent and unwise to trust your intuition. Nobel laureate Daniel Kahneman in *Thinking Fast, and Slow*, puts it more bluntly: "claims for correct intuitions in an unpredictable situation are self-delusional at best" and "in the absence of valid cues, intuitive hits are due either to luck or lies." Kahneman is referring to a useful and specific meaning of 'validity' that he and naturalistic decision researcher (and pioneer of field-based intuition research) Gary Klein came up with to explain intuitive "hits" and "misses."

Writing in *American Psychologist*, Kahneman and Klein distinguished between high validity decision environments and low validity decision environments. High validity environments have stable relationships between objectively identifiable cues and subsequent events/outcomes of possible actions (and hence are conducive to the use of intuition), whereas low validity environments have no such stable or predictable relationships (and thus are hostile to the use of intuition). They offer the example of games such as bridge or poker where the ability to identify favorable bets on the basis of relevant cues improves with practice but without

guaranteeing that every attempt will succeed. In contrast, they warn against relying upon intuition in turbulent (i.e., low validity) environments, such as relying upon the judgment of stockbrokers to pick individual stocks. The second condition for the development of skilled intuition is adequate opportunities to learn the relevant cues, as in the case of the skilled pediatric nurse Klein and colleagues studied who has seen enough sick infants to recognize subtle signs of disease, or the fire ground commander who has seen enough fires to recognize how a fast-moving emergency situation is likely to develop. The third condition for the development of skilled intuition is timely, detailed, and unequivocal feedback on the outcomes of one's intuitive judgments rather than delayed, sparse, or ambiguous feedback.

Intuition is not the Same as Insight

Contrary to popular belief, intuition is not the same as insight. Insight refers to an abrupt and unexpected solution that occurs in a problem space, arrived at after an impasse has been encountered and the incubation period passes. The point at which the solution arises is often referred to as a "Eureka!" moment, as talked about in various scientific achievements, such as the apocryphal story of Archimedes' problem-solving insight, Einstein's theory of relativity, Tesla's discovery of alternating current, or Descartes' coordinate geometry. An incubation period is often necessary for insight to occur because it relaxingly enables non-conscious processes to operate more freely, contrary to the binding constraints imposed by rational analyses.

That said, insights and intuitions are conceptually and practically related. An intuition may precede an insight as a "feeling of knowing" or an inkling of a potential solution, as with Nobel Laureate Michael S. Brown's experiences in discovering the mechanism for cholesterol regulation: "As we did our work, I think, we almost felt at times that 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." However, not all intuitions become insights. Many intuitions remain unverified hypotheses, while some in due course become the subject of empirical substantiation or refutation. Creating the conditions for insight to occur (such as mental time outs and sleeping on it) and capturing them (e.g., via sticky notes kept by the bedside) are thus as vital as intuition in the competency profile of skilled decision makers, particularly as it relates to creativity and innovation. Roger Martin, former Dean of the Rotman School of Business, in *The Design of Business: Why Design Thinking is the Next Competitive Advantage*, argued that too much analytical thinking can inadvertently suppress innovation and creativity; thus organizations need to counterbalance analytical thinking, which *exploits* existing knowledge, with intuitive thinking, which *explores* to create new knowledge.

Neural Bases of Intuition

The development of brain imaging techniques, such as Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI), has been likened to the discovery of the telescope in the Renaissance. The telescope allowed

astronomers like Galileo to observe the craters of our Moon and the moons of Jupiter. Without the use of the telescope these phenomena existed but lay undiscovered. Brain imaging techniques now allow us the amazing possibility to gaze inwards at the constellations of our own cognition and see things that we previously never knew existed.

For example, Social Cognitive Neuroscience (SCN), a sub-field of neuroscience pioneered by Matthew Lieberman and colleagues, has identified multiple interacting brain regions that support "reflexive" (including intuitive) information processing and that are distinct from the systems that support reflective processing (referred to as the "X-system" vs. the "C-system"). Other research by Antonio Damasio and colleagues has uncovered the important role played by part of the cortex called the ventromedial pre-frontal cortex (VMPC) in infusing "gut feelings" into decision making. This research has also found that individuals who are unfortunate enough to have incurred damage to this region can be afflicted by "analysis paralysis." They are unable to experience or perceive body signals that can help them decide, and the result is they get bogged-down in minutiae and are unable to intuitively select between even the most trivial of options.

For example, in a 2014 *Fast Company* article, author Drake Baer relays Damasio's account of a former patient who had developed a brain tumor that had to be extracted surgically from the ventromedial frontal lobe. Afterwards, this formerly highly successful businessman and husband became what Damasio describes as an "uninvolved spectator" in his own life, i.e., his marriage ended, his once successful business folded, yet the man remain controlled, lacking any real emotion. Even after speaking for hours with this patient, Damasio never evidenced a display of impatience, frustration, or even sadness. The neuroscientist stated the man lacked baseline decisiveness; for example, even small, inconsequential decisions, such as what pen to use or what eatery to choose, would leave the man in "circling deliberations."

WHERE DO WE NEED TO GO?

As we just outlined, intuition research has certainly come a long way since Agor's pioneering *Organizational Dynamics* article. However, we are only at the beginning of the journey, important questions still need to be resolved, and in learning more about intuition new questions undoubtedly arise. For reflective managers and practical researchers, we highlight some of these intriguing research questions next.

Brain Science Limits

One of the problems with intuition research in Agor's time was that management researchers and managers appeared to be seduced by brain science. It has been over 20 years since the first fMRI study appeared in *Science*, and today the allure of neuroscience is stronger and potentially more seductive, given the powerful pull that vivid images of brain activations have on our imagination. It seems like each day neuroscience posts a new insight into the workings of the human mind. This is exciting and alluring, but as management scholars and practitioners we might do well to bear in what Herbert Simon said in 1987: the important questions in the management

field are “what is intuition and how is it accomplished?” – not a preoccupation with in which cubic centimeters of the brain tissue it takes place. To answer Simon’s important question we need more lab studies, but it is in the field where the deepest insights into the lived reality of intuitive decision making in organizations are likely to be made.

More Fieldwork

Intuition researchers have at their disposal brain scans, psychometrically validated self-report instruments, and descriptive surveys that can be used to document where, when, why, and how intuition occurs. Yet, what is needed at this point in the evolution of the domain is more field work. In vivo analysis and field study are needed to uncover more about this non-conscious, cognitive, affect laden process. As well as Klein’s pioneering naturalistic decision research with the military, firefighters, neonatal nurses, and other high stakes decision makers, useful work has been done in the field looking at film directors and bankers.

This is a good start, but many more field studies are needed of intuition-in-use. Realistically, challenges abound in conducting field investigations of intuitive decision making. As Dane and Pratt articulated in 2009, intuition researchers face the challenge of accessing, viewing, and demonstrating intuition processes and outcomes as they occur or have occurred. Given this, a particular trial that researchers face is how to maintain the distinction between the processes (i.e. intuiting) and the outcomes (i.e. intuitions). Disentangling these is likely problematic in the frenetic reality of business decision making. Innovative methods are needed to document intuition as it happens, for example using retrospective reports via diary methods, ethnographic studies, and even mobile technologies to document intuition as it happens, using audio and video capture.

Strategic Link to Performance

Macro management research focuses on the organizational level of analysis. It is concerned with the explanatory prediction of firm performance and other organizational and employee outcomes across larger samples. For example, research in strategic human resource by leading authors such as Dave Ulrich, Brian Becker, and Mark Huselid has documented a positive relationship between various human resource practices and organizational performance. However, we are not aware of many recent published studies that have empirically investigated and documented the intuitive decision making relationship with actual (as opposed to self-reported) firm performance. Given the increasing emphasis on

measuring the impact of management practices, interventions, and initiatives on bottom line company metrics, we need more research on how intuition impacts firm performance.

Management Education Curriculum

As espoused by Henry Mintzberg, traditional management curricula in mainstream business schools have much room for improvement. Mintzberg has long held that the practice of management is as much an art based on vision and intuition as it is a science. Managers, educators, and researchers cannot and do not expect a diploma to solely produce the intuitive expertise many executives possess. As stated earlier, intuitive expertise is a byproduct of intensive practice, feedback, as well as reflection in and about our decisions.

It is our contention that intuitive expertise be developed using strong conceptual foundations obtained through formal management education coupled closely with rigorous and rich experiences, on-going professional development, and appropriate feedback and reflection. By blending conceptual and analytical knowledge grounded in evidence based science, along with experiential knowledge gained through years of workplace problem solving, intuitive expertise may be developed and honed continuously. Ultimately, it is this combination of conceptual and experience based development that makes for a well-rounded manager, a person capable of genuine and critical reflexivity, or the ability to keenly seek, accept, and incorporate candid feedback into his/her workplace behavior.

CONCLUSION: THE SCIENCE OF INTUITION AND THE ART OF INTUITIVE MANAGEMENT

In this article we have provided a relevant summary for managers and researchers as a “state of the industry” review on the science of intuition by articulating where research has been, where it is presently, and where it needs to go. As we know and have discussed throughout this article, intuitive decision making is fallible; however, just as Popper intimated decades ago, *all* of human nature is fallible – it is simply the nature of humankind. As such, researchers should shun efforts “to make intuition more rational.” Intuition is a non-rational process, neither irrational nor rational, and it is in this space where the *art* of intuitive management lies.



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