

UNDERSTANDING UNCONSCIOUS INTELLIGENCE AND INTUITION

"Blink" and beyond

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ABSTRACT The importance of unconscious intelligence and intuition is increasingly acknowledged by the scientific community. This essay examines and assesses the varied views on the topic presented in three books that bridge the scientific world and reading public: *Blink* by Malcolm Gladwell (2005), *Gut Feelings* by Gerd Gigerenzer (2008), and *How Doctors Think* by Jerome Groopman (2007). The analysis differentiates among kinds of unconscious intelligence and points towards a more complete understanding of the higher cognitive potential of the unconscious mind.

THE IMPORTANCE OF UNCONSCIOUS COGNITION is seeping into popular consciousness. A number of recent books bridging the academic world and the reading public stress that at least a portion of decision-making depends not on conscious reasoning, but instead on cognition that occurs below awareness. However, these books provide a limited perspective on how the unconscious mind works and the potential power of intuition.

This essay is an effort to expand the picture. It is structured around the book that has garnered the most attention, Malcolm Gladwell's *Blink* (2005), but it also considers *Gut Feelings* by Gerd Gigerenzer (2007) and *How Doctors Think* by Jerome Groopman (2007). These books help deepen the discussion even as they highlight some widely held limiting perceptions of the intelligence of the unconscious and intuition.

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Perspectives in Biology and Medicine, volume 56, number 1 (winter 2013):148–66
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UNCONSCIOUS INTELLIGENCE

According to Gladwell (2005), the key to understanding unconscious intelligence is the notion of *thin-slicing* (Rosenthal and Ambady 2002). Gladwell defines thin-slicing as “the ability of our unconscious to find patterns in situations and behavior based on very narrow slices of experience” (p. 23). In his hands, thin-slicing takes on many different meanings, which often do not function together. Sometimes it refers to using only a small slice of the available information for decision-making and ignoring the rest. At other times it implies compressing a great deal of information into a simple underlying pattern to be used in snap decision-making. The term is also used to refer to the simple underlying pattern itself and sometimes to the thin slice of time in which rapid cognition occurs.

This broad view of thin-slicing allows Gladwell to conflate a number of different categories of unconscious mental activity: (1) unconscious prejudice; (2) using heuristics, simple algorithms, or rules of thumb—what I will call the “less is more” perspective; and (3) parallel interactive processing, or intuition-like processing, and intuition—what I will call the “more is sometimes more” view.

As the above hints, the unconscious aspects of intelligence depend on a number of different mechanisms. These include many aspects of the emotional/motivational system, as Damasio’s (1994) well-known work demonstrated. Damasio has also shown that the emotional/motivational system can direct cognition that does not necessarily come to awareness. This nexus between unconscious motivation and unconscious cognition allows us to speak of a purposeful entity called the *unconscious mind* (although not all non-conscious cognitive mechanisms need act together). It is responsible for the rapid cognition Gladwell emphasizes, but in my view its cognitive reach extends considerably beyond.

To begin to understand the higher cognitive potential power of the unconscious mind, it is helpful to unpack some of what Gladwell has lumped together under the thin-slicing banner. My focus will be on differentiating the second and third kinds of unconscious mental activities mentioned above. I will also consider several further distinctions that can be made within the last kind, intuition-like processing and intuition. To supplement the notion of thin-slicing I offer the ideas of *adequate-slicing* and *fat-slicing*.

Less Is More: Heuristics, Algorithms, and Rules of Thumb

Gladwell’s exposition of thin-slicing rests in large part on a number of examples that illustrate the use of intensive computer as well as human analysis to compress a large amount of information into a simple pattern or signature. He puts these examples to work in a number of different but not necessarily consistent ways. These include his conviction that: (1) most situations can be reduced to a simple underlying pattern or signature, so that much of the time one can throw away all but one or a few critical pieces of information from the begin-

ning; (2) these patterns can often be translated into rules of thumb or algorithms that support rapid cognition; and (3) such examples demonstrate what the unconscious mind is doing when it finds novel patterns rapidly.

Perhaps the most developed example in *Blink* of the use of simple signatures in snap decision-making is the work of John Gottman on marriages and the critical factors that doom them (Gottman and Levenson 2002). He and his colleagues videotaped the interactions of large numbers of couples. After a great deal of number crunching to correlate various aspects of the interactions to the 14-year success or failure of the relationships, they concluded that most of the information was irrelevant to the prognosis. Eventually they found they were able to reduce the amount of videotape they had to watch to make an accurate prediction to a thinner and thinner slice. Ultimately, they found that just 15 seconds contained the essential information. The deal breaker turned out to be even very subtle signs of contempt from one or both partners towards the other. Gladwell writes: “John Gottman took a complex problem and reduced it to its simplest elements: even the most complicated of relationships and problems, he showed, have an identifiable underlying pattern” (p. 141).

Another study Gladwell writes about showed that faulty medical judgment was not the critical determinant of whether a doctor would get sued (Ambady et al. 2002). Rather, “if the voice sounded less dominant and more concerned, the surgeon tended to be in the non-suit group.” Gladwell continues: “Could there be a thinner slice? Malpractice sounds like one of those infinitely complicated and multi-dimensional problems. It all comes down to a matter of respect” (p. 43).

The problem is that only certain types of situations can dependably be reduced to simple underlying signatures. They are those in which one or a few pieces of information have an overwhelming role in determining the outcome. For instance, as the above examples highlight, in interpersonal interactions certain emotions can play a determining role in certain outcomes—in one example, contempt, and in the other, not being listened to. Yet unconscious cognition is not limited to situations in which one or even a few pieces of information or factors have an overwhelming role in determining the outcome. Equating unconscious intelligence with the ability to reduce situations to a simple cause or to a simple underlying pattern is at very best incomplete.

Another problem is that Gladwell uses many of these examples to blur the important distinction between, on the one hand, the intensive computer information-processing and deliberate human analysis that often goes into the acquisition of simple signatures like these, and on the other hand, their possible unconscious application in snap decision-making once they are acquired. Only the latter is conceivably thin-slicing. For example, he includes a story about the development of an algorithmic tree with four choice points to help emergency room doctors determine when chest pain indicates a heart attack (Goldman and Kittane 2003). Its adaptation considerably increased survival rates. Although

these simple criteria certainly can be applied rapidly when needed, no one could develop such an algorithm from only a thin slice of experience or information.

Moreover, with respect to Gottman's work we eventually learn that not every 15 seconds of a couple's interaction is predictive of the long-term stability of their marriage. Instead, only a 15-second period when they are arguing—and thus likely to be demonstrating the already determined crucial behavior—is predictive. Determining the crucial factor, which in this case also determines when to look, was a time- and computation-intensive activity. Yet Gladwell writes:

when our unconscious mind engages in thin-slicing, what we are doing is an automated, accelerated unconscious version of what Gottman does with his videotapes and equations. Can marriage really be understood in one sitting? Yes it can, and so can lots of other seemingly complex situations. What Gottman has done is show us how. (p. 23)

The notion that the brain can regularly extract simple underlying patterns from complex novel situations, and moreover can do so in a snap by throwing out most of the information, is deeply misleading. Indeed, much of *Blink* itself stresses the importance of expertise in enabling snap decision-making. I do not mean to rule out the possibility of completely novel understanding forming in a flash. However, there is an alternative explanation that can account much better for the capacity of the unconscious mind to understand many complex novel situations—sometimes in an instant—than *Blink* suggests. First, however, I would like to offer another more compelling view of thin-slicing's role in unconscious intelligence.

Gigerenzer and "Fast and Frugal" Cognition

Researcher Gerd Gigerenzer's *Gut Feelings: The Intelligence of the Unconscious* (2007) gives a number of examples where in the absence of awareness the human mind can both discover and depend on a thin slice of information or experience to serve as a rule of thumb for rapid decision-making. One is the way good ballplayers follow the trajectory of a fly ball already in the air. They maintain a constant angle between their eye and the ball as they run, and they do so for the most part without awareness of the rule. Gigerenzer in fact coined the phrase "fast and frugal" for unconscious decision-making, which *Blink* often touts (Huttcenson and Gigerenzer 2005).

Such rules of thumb are often called *heuristics*, which means mental shortcut, or substituting something relatively simple for something complicated (Kahneman and Tversky 1973). The fly-ball rule is an aspect of the *gaze heuristic*, and the ability to infer intention by following another's gaze is an additional example of this heuristic.

Another heuristic is called the *recognition heuristic*. Gigerenzer showed that German students were better than American students at deciding whether

Detroit or Minneapolis has a larger population. Since they had not heard of Minneapolis, they realized it was likely to be a smaller, less populous city. Likewise, he points out that choosing well-known brands can be an effective strategy, since it can save a lot of research time.

Gigerenzer argues convincingly these heuristics depend on basic elements in an adaptive toolbox that is part of the human evolutionary heritage. Thus, the recognition heuristic keeps animals eating the food they are meant to. A variant of the gaze heuristic allows them to intercept their prey. For Gigerenzer, intuition is nothing but the ability of the unconscious in some cases to discover these rules of thumb, in some cases to apply them without awareness, but in all cases to come up with the appropriate rule for the occasion. He recognizes they are often applied consciously. Nonetheless, he considers their use examples of intuition because they are a shortcut strategy and because the rule used is chosen by the unconscious. He argues that the flexibility of the mind in choosing the rule and evaluating whether it is right for the job depends on the intelligence of the unconscious.

I think his argument an important one. It implies that all thought is intuitive in the sense that it is grounded in unconscious intelligence. (For example, it means that in certain situations even the decision that it is necessary to consider all the pros and cons carefully at a conscious level is grounded in unconscious intelligence.) Notwithstanding the possible unconscious grounding of all thought, some “thinking” depends on unconscious yet flexible information processing at other levels of description as well, as I argue below.

Gigerenzer feels that unconscious intelligence works especially well when information is scant. Even when information is plentiful, he argues, the human mind ignores much of the information. It automatically considers the available data in order of its importance, and once it finds one good reason to choose a certain option it ignores the rest.

Gigerenzer (2008) acknowledges that this strategy, called “take the best,” is most effective when the importance of each piece of information is much greater than the next most important one. But he also proposes that unconscious intelligence has ecological validity, which means it is shaped by evolution to match the environment in which the species functions. Most environments contemporary humans encounter, he claims, are conducive to take the best—a view that resonates with *Blink’s* claim that most situations can be reduced to simple underlying causes.

Gigerenzer’s work represents an important departure from the traditional views of judgment and decision-making, in which all options are considered and evaluated consciously. However, it is not the only alternative. Moreover even when take the best would work, it is not necessarily used by the unconscious mind (Glöckner 2007; Glöckner and Hodges 2011).

Simplifying heuristics sometimes play a role in snap decision-making, and

choosing the right rule of thumb, whether it is applied consciously or unconsciously, often reflects an aspect of unconscious intelligence. The same thing is true about take the best. Yet in many circumstances, no one piece of information captures an underlying cause, nor can the whole be captured in a simple pattern. Instead, the whole may be distributed among any number of pieces of information and, just as importantly, among their interactions. The unconscious mind appears especially well equipped to deal with just such complex patterns.

More Can Be More: Intuition-Like Cognition and the Unconscious Mind

The conscious mind can maintain in an active state and process only four to seven pieces of information at the same time (Miller 1956). It is at its limit when recalling a phone number just heard. However, the unconscious mind does not have the same limitations.

Considerable support exists for an alternative mechanism to thin-slicing for unconscious intelligence, in which all the relevant information is processed very rapidly below awareness in an interactive manner (Churchland 1992; French and Cleeremans 2002; Glöckner and Betsch 2008; McClelland, McNaughton and O'Reilly 1995). Neural network information processing, sometimes called *connectionism*, *parallel distributed*, or *parallel interactive* information processing, is modeled on the basic architecture of neural tissue, in which each neuron interacts simultaneously with many others. Parallel interactive processing is at the core of pattern recognition because it automatically registers complex co-occurrences and interacting regularities.

Early attempts at artificial intelligence were based on the logical, sequential way the conscious mind processes information at its most rigorous (Bechtel and Abrahamsen 1991). Because of this, it could not reproduce many of the most basic perceptual skills regularly performed by the unconscious mind. It could not read handwriting, recognize Aunt Sally with a new haircut, or tell melon from squash. The ability to reproduce such tasks was greatly enhanced when connectionism or neural network computing with its pattern recognition skill was incorporated.

Gladwell is right that pattern recognition is central to unconscious intelligence. However, the patterns detected by the unconscious are often quite complex. Arthur Reber (1993), a pioneer in the field of implicit, or unconscious, learning, showed that people can learn complicated patterns, such as the artificial grammar shown in Figure 1, without awareness of doing so. Simply from memorizing a list of letter strings derived from the grammar (Table 1, left), subjects can judge subsequent test strings as consistent or not with it at better than chance level (Table 1, bottom center and right), even though they have no conscious sense of why. Moreover, knowing beforehand that the letter strings to be memorized have come from an underlying grammar decreases their performance. Computer simulations using parallel interactive information processing

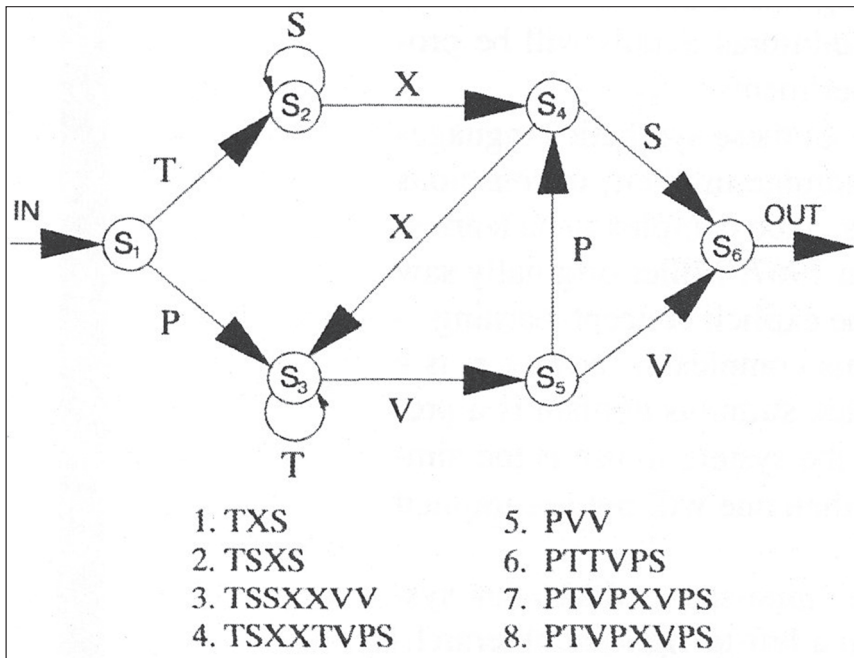


FIGURE 1

A simple artificial grammar and some letter strings derived from it. To generate strings, one starts at IN on the left of the grammar and follows the arrows, sometimes choosing one path, sometimes another, to get to OUT on the right.

SOURCE: REPRINTED FROM REBER 1993, FIG. 2.1 (P. 28), BY PERMISSION OF OXFORD UNIVERSITY PRESS, USA.

architecture have been shown to mimic many of the implicit learning results—even with very noisy or imperfect data (Cleeremans and McClelland 1991; Dienes 1992; French and Cleeremans 2002).

Implicit learning experiments suggest that as the underlying pattern gets more complicated, contrary to Gladwell’s formulation, the unconscious mind tends to have the advantage (Fletcher et al. 2005; Lewicki, Czyzewska, and Hoffman 1987; Reber 1993). Several studies have shown that asking subjects to actively look for complex patterns interferes with their ability to learn the material at an implicit level (Fletcher et al. 2005; Reber 1993). Recent experiments also show that high motivation can increase the speed of implicit learning—and its coming to awareness (Damasio 1994; Fu, Fu, and Dienes 2008).

Another study illuminated the potential power of unconscious information processing to deal with multiple interactive variables in more practical matters. Subjects were told to form a general impression before they read 12 different positive and negative attributes of four cars (Dijksterhuis and Meurs 2006; Usher et al. 2011). Those who were distracted by having to solve an anagram for four minutes before deciding which car was best made better decisions than those asked to think carefully about the solution for four minutes. However with only

Learning Stimuli	Testing Stimuli	
1. PVPXVPS	*1. PTTTVPS	*26. SVPXTVV
2. TSSXXVPS	*2. PVTVV	27. PVPXTTVV
3. TSXS	*3. TSSXXVSS	28. PTTVPXVV
4. PVV	*4. TTVV	29. TSXXTVPS
5. TSSSXXVV	5. PTTTVPS	30. TXXTVV
6. PTVPXVV	6. PVV	31. TSSSSXS
7. TXXVPXVV	*7. PTTPS	*32. TSXXPV
8. PTTVV	8. TXXTTVPS	33. TPVV
9. TSXXTVPS	9. TSXTTVV	*34. TXPV
10. TXXTVPS	*10. PVXPVXPX	*35. TPTXS
11. PTVPS	*11. XXSVT	36. PVPXTVPS
12. TSX	12. TSSXTVV	*37. PTVPXVSP
13. TSXTVV	13. TXS	38. PVPXVV
14. PVPXTVPS	*14. TXXVX	39. PTVPXVPS
15. TXXTTVV	*15. PTTTVT	*40. SXXVPS
16. PTTTVPS	16. TSXXVPS	41. TXXVV
17. TSSSXS	17. PTTTVV	*42. PVTTVV
18. TSSSXXVV	*18. TXV	43. TSSXXVPS
19. PVPXVV	19. PTTVPS	*44. PTVVVV
20. TXTVPS	20. TXXTTVV	*45. VSTXVVS
	*21. PSXS	46. TSXXVV
	*22. PTVPPPS	*47. TXXTVPT
	23. PTTTTTVV	48. PVPS
	*24. TXVPS	*49. PXPVXVTT
	25. TSSXS	*50. VPXTVV

*Indicates a nongrammatical string

FIGURE 2

Learning and testing strings for an artificial grammar experiment. Without seeing the grammar, subjects memorize a list of strings generated from it (left). When given another list of strings, some of which are grammatical and some not, they are able to distinguish grammatical ones at better than chance levels (center and right). Non-grammatical strings are indicated by an asterisk.

SOURCE: REPRINTED FROM REBER 1993, TABLE 2.1 (P. 36), BY PERMISSION OF OXFORD UNIVERSITY PRESS, USA.

four attributes, the two groups were equally successful. Other studies show that subjects make better decisions immediately after reading all 12 characteristics than after four minutes of conscious consideration (Waroquier et al. 2010). Because it cannot hold all the information at once, the conscious mind has a tendency to focus only on certain salient details, or sometimes only on the last details it hears.

Simple artificial networks can convey some of the power of parallel interactive information processing to detect complex patterns. They consist of units that are analogous to neurons, and the connections between them that are analogous to the synapses between neurons. The connections, or weights, are strengthening between units that fire at the same time in response to a stimulus. In the future, activation can flow more strongly between these units. This experienced-based coupling allows neural networks to encode patterns in the environment by the

flow of activation through the network. Part of their power is their ability to make extremely difficult discriminations and to do so rapidly.

For example, underwater mines are a great danger to submarines, yet they have highly overlapping sonar echoes with rocks. Very simple artificial neural networks can distinguish between the two on the ocean floor based on their complex sonar responses (Churchland 1992, Gorman and Sejnowsky 1988). One such network consisted of 13 input units, one for each of the sonar frequency responses recorded; seven so-called hidden units; and two output units, one for rocks and one for mines. Each unit was connected to all units in the next higher level. Once activation from a sample spread throughout the network, certain of the network's weights were adjusted a little bit towards the desired output. When the weights were made permanent after extensive training with thousands of samples, the network was roughly 94% successful at distinguishing samples it had not seen before. Ultimately, the discriminations depended on the patterns of activation across the hidden unit layer. These patterns depended on which hidden units were activated and to what degree: some patterns corresponded to rocks, and others to mines.

Humans can sometimes approach the success of artificial network in discriminating the sonar echoes of rocks and mines. The underlying patterns, or signatures, on which discriminations such as these depend, are complex and diffuse as well as hidden. This is true of many discriminations we make without knowing why. Like artificial neural networks, part of the power of unconscious intelligence is its ability to record multiple different pieces of information simultaneously—and, importantly, their interconnections. This allows the unconscious mind, in conjunction with the emotional/motivational system that below awareness helps to direct attention, to generate meaningful as well as flexible knowledge of the world.

Thin-slicing—in the sense of ignoring most of the information—and pattern recognition might be the same thing when only one or a few variables or pieces of information turn out to be significant to making the required discrimination or judgment. But is it still thin-slicing if five turn out to be critical—or 10 or 13? The claim becomes progressively less tenable as the number of critical interactive variables increases.

At one point, Gladwell comes close to acknowledging the importance of parallel interactive information processing to unconscious intelligence. When talking about bird recognition, quoting an ornithologist, he says: "Most of bird identification is based on a sort of subjective impression—the way a bird moves and little instantaneous appearances at different angles and sequences of different appearances, and as it turns its head and as it flies and as it turns around, you see sequences of different shapes and angles" (p. 44). However, Gladwell characterizes this as a "flurry of thin-slicing." When described from the perspective of the conscious mind, this can be understood as a string of contiguous instantaneous impressions. Yet from the perspective of the unconscious mind, which does the

encoding and learning, it represents continuous—in the sense of ongoing or cumulative parallel interactive—information processing.

Moreover, the unconscious patterns that result over time can be exceedingly complex, encoding multiple simultaneous dimensions of description. As Gladwell himself says: “all that combines to create a unique impression of the bird that can’t really be taken apart and described in words. . . . After a lot of practice, you look at the bird and it triggers little switches in your brain . . . you know what it is at a glance” (pp. 44–45). This example has a pivotal role in *Blink*. It allows the thin-slicing *modus operandi* of unconscious intelligence to expand from recognizing patterns with a simple underlying signature to recognizing multidimensional patterns that come to awareness quickly. Thus thin-slicing becomes a unified mechanism for unconscious intelligence.

Certainly it is true that with increasing exposure to a category of object or event, the extraneous details drop out, and only the essential pattern required to tell, for example, one small brown bird from another remains. Sometimes it is possible to distinguish one from another even if we see it in low light, or if we see part of it. But only if the unconscious mind has adequate information to make the discrimination.

Instead of thin-slicing, this aspect of unconscious activity could be called *adequate-slicing*. The sensory discrimination potential must be adequate to capture the relevant distinctions; adequate information is needed over time to train the brain’s networks; and adequate current information is needed to make the on-the-spot discrimination. In some situations, a single piece of information may be enough for the unconscious mind to make the discrimination, but often many clues and their interactions are required.

The special ability of the unconscious mind appears to be its facility for dealing with complex or messy patterns that do not depend on a thin slice of information and do not necessarily reduce to a simple underlying pattern. It is special in the sense that it cannot readily be duplicated by the unaided conscious mind. This capacity of the unconscious mind to integrate multiple strands of information simultaneously—including different kinds of information—is what I call *intuitive processing* (Isenman 1997). Intuitive processing is most often the kind of information processing involved in intuition. However, it is not necessarily the same thing. I prefer to reserve the word *intuition* for the novel pattern formation or creation, discussed below, that has the potential to influence thought or action in significant and often radical ways.

Intuitive processing can be understood as analogous to visual perception. Just as visual experience is composed below awareness from multiple simultaneous cues, the unconscious mind constructs a coherent and meaningful world from the integration of multiple simultaneous cues and hands it to the conscious mind. Coming to a coherent and meaningful interpretation sometimes requires that the unconscious mind give certain clues more weight than others. Thus one knows it is Aunt Sally even though she has a new and very different hairstyle.

Arriving at the best interpretation often requires back-and-forth processing between several alternatives below awareness—for instance, in the above situation perhaps between Aunt Sally and her sister.

Heuristics, such as choosing the most familiar option or throwing out most of the information, also probably has a role in unconscious understanding. However, using parallel interactive processing becomes increasingly important in information-rich situations that require complex and subtle discriminations. Moreover, deciding which heuristic to use in many circumstances, such as identifying one good reason to take the best or determining the critical piece of information in some versions of thin-slicing, all likely depend on the mind taking multiple simultaneous clues or strands of information into account at another less accessible level below awareness.

INTUITION

Most readers consider *Blink* to be about intuition, although the word *intuition* does not appear in the book. Some of its vignettes clearly do showcase intuition. I will use three of Gladwell's stories to help expand *Blink*'s thin-slicing framework for unconscious intelligence. Seen in a different light, each helps illuminate additional aspects of unconscious intelligence and its relevance to intuition. At the same time, Gladwell's interpretations highlight a number of different kinds of potential misunderstanding that can occur when thinking about unconscious intelligence and intuition. In this same context, I also discuss Jerome Groopman's 2007 book, *How Doctor's Think*.

The view that anecdotal or experiential material has no role in scientific endeavor is widespread. Yet the conscious and unconscious minds lie on a complex continuum. In addition to experimental investigation, full understanding of the elusive capacity we call intuition requires entering the experience as much as possible. Considering both kinds of material together is especially helpful.

Content versus Process

Blink begins with a vignette about a few art historians who recognized that a costly and celebrated statue authenticated by scientific experiment as well as its purported history was likely a fake. One found himself staring at the figure's fingernails, which seemed wrong in a way he could not characterize; another had a wordless hunch; another found that the word *fresh* popped into mind; another experienced a feeling of intuitive repulsion; and yet another felt as if there were a glass between himself and the work. *Blink* offers these as examples of thin-slicing by the unconscious mind in the sense of throwing out most of the information: they “brushed aside a thousand other considerations about the way the sculpture looked and zeroed in on a specific feature that told them everything they needed to know” (p. 142).

Certainly from the perspective of the conscious mind, these judgments ap-

peared to depend on a thin slice of information and occurred in a very thin slice of time; also the conclusion that the statue was a fake just popped into mind. But these conscious reflections reveal little about what was going in the art historians' unconscious minds. The expert who found himself staring at the statue's fingernails and the expert who judged it too fresh likely blended below awareness a large amount of physical or stylistic information to conclude the statue was a forgery. The inarticulateness of the judgments of most of the experts, on the one hand, and the credence they gave these inarticulate judgments, on the other, argues even more clearly for the complexity of the underlying patterns behind their conclusions.

At another level as well, these judgments likely depended not on a thin slice of experience, but on a great deal of cumulative training and experience, which supports quick judgments in certain situations. One of the thrusts of *Blink* taken as a whole is that snap decision-making in any specific area is best left to those with training and experience. This popular view is often referred to as the *learning perspective* on intuition.

Yet trying to account for the potential power of unconscious intelligence only by training and experience is also incomplete. Breakthrough intuition can depend on expertise in a field, training in another discipline (Kuhn 1962), or even having a relatively fresh and untrained mind. Indeed, expertise can sometimes get in the way of having the kind of breakthrough intuition needed to solve a seemingly intractable problem or move a field forward.

Another way to account for unconscious intelligence and intuition's potential power, the one I favor, readily incorporates the learning perspective but is not limited by it. It instead stresses the kind of underlying information processing or integration involved (Glöckner and Witteman 2010). I emphasize parallel interactive integration—which is not bound by past understanding, especially at higher levels of processing—as crucial to most unconscious intelligence and intuition.

Thin-Slicing versus Holism

Another vignette Gladwell recounts features the work of Gary Klein, who studies expert decision-making. Klein found that experts who have to make split-second decisions in emergency situations have great difficulty saying what informed their judgment. In one case, firefighters entered a burning home and attacked what seemed to be a kitchen fire in the usual way. All the water sprayed at the flames had no effect. Recognizing that something was wrong, the lieutenant regrouped his men outside of the kitchen and then ordered them to leave immediately. Moments later the floor where they had been standing collapsed. The fire was in the basement. The lieutenant thought his order reflected ESP.

Years after the incident, Klein led the lieutenant to relive his experience again and again. Eventually the lieutenant recalled having noticed certain anomalies that did not fit with a kitchen fire, but were instead consistent with a fire in the

basement. For example, the fire was hotter and quieter than a kitchen fire. No doubt these anomalies were important to the lieutenant's decision. Yet as Reber (1993) pointed out many years ago, what the conscious mind can remember and reconstruct after the fact is not necessarily the only or the same information that went into a judgment made below awareness. Multiple clues were likely processed at an unconscious level—which helps account for the lieutenant's feeling it was ESP—although how many is unknowable.

It is instructive to look at this situation again from a rather different perspective in order to contrast it with other cases. Each of the anomalies isolated by Klein, as well as all of them together, pointed to a basement fire. Theoretically at least, focusing logically on any one alone at a conscious level might eventually have pointed to the correct solution—although it would have been too slow. Yet in many other situations the individual clues can only possibly make sense in the context of each other. The meaning is distributed between multiple clues. When the distributed clues are integrated together, they may sometimes converge to a simple pattern or signature. But instead they may come together into a much more complex pattern. The resulting pattern may be too multidimensional and interwoven for the conscious mind, with its ability to hold a very limited amount of information at the same time, to comprehend, never mind articulate.

The possibility of information condensing into a multidimensional rather than a simple pattern helps underscore one of the fundamental tensions in *Blink*. Gladwell often talks of the importance of holism to unconscious intelligence, meaning that it considers the situation as a whole. At the same time, he stresses that unconscious intelligence relies on finding simple underlying patterns. However, only when a situation is overwhelmingly determined by one or a few interacting factors is holism consistent with a simple underlying signature. In many situations, holism and simple underlying signatures pull in different directions.

The reductive strategy that reduces situations to simple underlying causes or simple patterns is more the *modus operandi* of the conscious mind, since it can deal with only a limited amount of information at any one time. Yet through chunking information together, logic, and reflection, this strategy can lead to simple underlying laws that encompass great complexity. The heuristic aspect of unconscious intelligence seems to share some of the reductive intent of the conscious mind, but it tends to reduce the complexity of situations by throwing out most of the information. In contrast, holism, which entails dealing directly with multiple simultaneous levels of information and their interconnections in order to understand the whole, is more dependent on the capacity of the unconscious mind for intricate parallel interactive integration.

Frugality and Holism

One of the most exciting vignettes in *Blink* is about a military war games exercise. Purportedly about the frugality of unconscious information processing, it is open to a more complete and potentially illuminating explanation. The blue

team used intensive technology geared to providing as close to total central information awareness and dissemination as possible. The red team was led by a Vietnam-seasoned maverick and brilliant strategist Lieutenant General Paul Van Ripper. It was low tech and organized to minimize top-down control. Once soldiers were given overall guidance by Van Ripper, they were left on their own.

Of course, the story is only interesting if the more agile, low-tech organization won. Gladwell correctly sees this as a contest between analysis and holism. However he also views it as support for his thin-slicing thesis, claiming that finding the underlying signature is easier if there is less information: “if you are forced to consider much more than your unconscious is comfortable with, you get paralyzed. Snap judgments can be made in a snap because they are frugal, and if we want to protect our snap judgments, we have to take steps to protect that frugality” (p. 143). The problem is that holism and this type of frugality, just like holism and simple underlying signatures, tend to pull in different directions. At the core of holism is inclusive parallel interactive integration. Although unconscious cognition can occur very quickly, it is not necessarily frugal with respect to the information it uses, as a number of studies mentioned before indicated.

Unconscious cognition is, however, frugal in its use of conscious resources. Parallel interactive processing can integrate multiple simultaneous clues automatically below awareness, without the involvement of the conscious mind. Gladwell is right that the unconscious mind is fragile in certain situations and has to be protected. But the problem is not too much information—rather, it is too much information of the kind that encourages conscious analysis and conscious problem-solving. As I noted earlier, instructing subjects to look carefully for complex patterns can decrease the unconscious integration of information.

Parallel interactive processing below awareness is likely to be particularly important in the fog of war. Only vague clues may be available, there is little time to deliberate, and the motivation to integrate correctly is high. Heuristics may also have a role in such situations—although not always for the better.

The guerilla-like techniques of the red team invoke another related aspect of intuition that often goes unrecognized. Because of its inherent holism, or capacity to integrate simultaneously multiple levels of information, intuitive integration is extremely sensitive to current context. One of the things this means is that it tends to update automatically with new information and changing conditions. As new information recontextualizes old, it can sometimes generate novel patterns unique to the immediate situation.

The Unconscious Mind and the Big Picture

Under the banner of thin-slicing, Gladwell tries to unite heuristics and holism. In contrast, in his thought-provoking book *How Doctors Think*, Groopman helps emphasize their distinction, albeit in a roundabout way. He describes some of the heuristics doctors use in diagnosing patients, such as the availability heuristic, or judging the “likelihood of an event by the ease with which relevant

examples come to mind” (p. 64), which often depends on recent experience. His emphasis, in contrast to either Gladwell’s or Gigerenzer’s, is squarely on the limitations of heuristics and the importance of taking the whole situation in all its complexity into account.

Groopman stresses that heuristics can easily distort diagnosis. For example, the availability heuristic can lead to emphasizing certain symptoms, while discarding others that may be crucial to correct diagnosis. He also points out that clinical algorithms have their limitations. Although useful for routine diagnosis and treatment, “they quickly fall apart . . . when symptoms are vague, or multiple and confusing, or when test results are inexact” (p. 5). These are situations in which intuitive processing excels.

Groopman’s heroes are doctors who instead of using conventional wisdom, cherry-picking data, or jumping to conclusions, take time to wrestle with anomalous findings and find novel and insightful ways to comprehend their patients’ symptoms. Groopman does not highlight this as intuition—although in a previous book he stressed the importance of the doctor and patient’s intuition working together as they struggle with perplexing symptoms towards a diagnosis (Groopman 2000). Here he says: “Much has been made of the power of intuition, and certainly initial impressions formed in a flash can be correct. But as we hear from a range of physicians, relying too heavily on intuition has its perils” (p. 9). Intuition may no longer evoke the kind of wrestling and breakthrough insight Groopman champions after the exclusive emphasis Gladwell, Gigerenzer, and many others have placed on rapid cognition in their understanding of unconscious intelligence.

Groopman proposes that what is needed in addition to initial impressions is deliberate analysis: “Cogent medical judgments meld first impressions—Gestalt—with deliberate analysis. This requires time” (p. 9). Deliberate analysis is certainly important in many situations, yet in others it may not be effective or enough. Fortunately, once doctors and others acknowledge that the easy answers that pop into mind are inadequate, they are thrown back on the more profound aspects of the unconscious mind—in addition to their conscious resources. Deep intuitions frequently begin with not knowing, with the recognition that the conventional wisdom or the first thing that comes to mind does not apply.

Groopman emphasizes elsewhere in the book that clinical judgment depends heavily on pattern recognition and novel clinical judgment on creative pattern formation. Writing about the cognitive process of a pediatric cardiologist as he unpacks the unusual anatomy of the pulmonary circulation of a newborn whose heart was not getting oxygen, Groopman says:

He avoids all biases or preconceptions; he tries to identify the key clinical features—pattern recognition—and frame the situation himself. “In this instance, the shadow just didn’t belong there,” he said, referring to the white line of the umbilical catheter. While everyone was concentrating on what he termed “the

main event”—the blocked pulmonary vessels—he said he was able to see the entire picture it once, integrating each component into a coherent whole. And when one piece does not fit, he seizes on it as the key to unlock the mystery. “It’s like that game Where’s Waldo?” he said. (p. 146)

Although Groopman stresses the need for considering the situation as a whole and for novel pattern recognition, he attributes these abilities to the conscious mind and to conscious analysis. However, especially in complex novel situations, these are abilities at which the unconscious rather than the conscious mind tends to excel. Recognizing that something important doesn’t fit with the most apparent scenario, an aspect of pattern recognition, and then using parallel interactive processing to integrate all of the relevant strands of information into a complex novel pattern that resolves the challenging situation requires that the unconscious mind be given free rein. It also requires an open channel between it and the conscious mind.

Expert troubleshooters appear more open than others to the promptings of their unconscious mind in difficult situations demanding novel responses. Their cognitive flexibility and receptivity can make problem-solving feel a bit like a game for them. Because these mavericks expect their intuition to work for them, they can approach difficult novel situations with a sense of power. But those less confident of their trouble-shooting skills may have a different experience. Another passage Groopman includes—this time from an expert on professional decision-making, writing about thought processes in the limits of logic—helps highlight these feelings: “Because of some puzzling, troubling, interesting phenomenon, a physician expresses uncertainty, takes time to reflect, and allows himself to be vulnerable. Then he restructures the problem. This is the key to the art of dealing with situations of uncertainty, instability, uniqueness, and value conflict” (p. 151).

My only quibble with this incisive quote is it intimates that the novel, successful framing of the problem that occurs after allowing the vulnerability of not knowing is an active, conscious process. A number of studies lend support to the importance of unconscious processes in creative restructuring. One showed the restructuring event can occur as much as eight seconds before the solution comes to consciousness (Sheth, Sandühler, and Bhattacharya 2009). Another showed that central executive processes associated with consciousness have much less role in insight as opposed to non-insight problems (Gilhooly and Fioratou 2011). Several studies support the view that creativity is sparked by directing conscious attention away from, rather than towards, finding the solution (Dijksterhuis and Meurs 2006; Smith and Blankenship 1989; Zhong, Dijksterhuis, and Galinsky 2008). This can activate more remote connections that link the various strands of information or the constraints of the problem. Once restructuring has occurred, consciousness frequently participates in working out the details of the emerging solution.

Novel solutions often require “blinking” in the sense of the standing down of the conscious mind, which goes a long way to account for the vulnerability described in the quote above. This also hints at a deeper meaning of the metaphor “a blink of the eye” for intuition and the intelligence of the unconscious (Isenman 1997). Intentionally putting one’s sense of conscious agency on hold when the needed answer does not pop into mind automatically hands more intellectual control to the unconscious mind. It can continue to work on the problem even when the conscious mind turns its focus elsewhere (Christoff et al. 2009). The solution may only appear with time.

Instead of the thin-slicing of heuristics or even the adequate-slicing of ordinary pattern recognition, the novel pattern formation/creation at the core of intuition often requires what might be called *fat-slicing*. Acknowledging that one does not know encourages unconscious information processing to take into account even more information or activate even more remote associations linking the various strands of information. What I am calling fat-slicing is also described as thinking out of the box or having a sense of the whole or the big picture. Sometimes logic, heuristics, and ordinary parallel interactive integration are inadequate, and some kind of expanded pattern formation/creation is necessary.

Groopman, by limiting intuition to initial impressions and instead championing analysis, misattributes certain strengths more associated with the unconscious mind to consciousness—such as its ability to look at complex situation as a whole and to restructure problems. In contrast to Groopman, Gladwell misattributes certain limitations more associated with consciousness to the unconscious mind. These include his claim that the unconscious prefers simple patterns and is easily overwhelmed by too much information. Both books, as well as Gigerenzer’s, deny the unconscious mind much of its cognitive power.

The cognitive abilities of the unconscious mind are highly integrated with those of the conscious mind. Thus the potential of unconscious intelligence necessarily underwent a considerable upgrade during the evolution of human consciousness. The capacity for sometimes dazzling pattern formation/creation below awareness that resulted and is illuminated in certain experiences of intuition in turn greatly enhanced the potential prowess of the human mind.

The unconscious mind has a pivotal role in complex novel situations, as well as in routine matters. Accepting this deeply over time can help assuage the vulnerability one tends to feel when the badly needed solution to a difficult problem is beyond reach. Eventually, like expert trouble shooters, we may find that in these challenging circumstances we can open more quickly and fully to the potential creativity and power of the more hidden aspects of mind.

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