

Risk and Decision-Making in Medicine: Just Reasoning or Also Feeling?

Riesgo y decisiones en medicina: ¿solo la razón o también el sentimiento?

Feel it the thought, think it the feeling

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INTRODUCTION

In ancient times, risk was evaluated and decisions were taken instinctively by a deep and almost visceral sensation; rapidly and with an intuitive feeling, people recognized if it was safe to approach an animal or if the water was safe to drink. But apart from the strong emotions as fear, other emotions softer as a whisper, called affects, denote the specific quality of goodness or badness, experienced as a feeling state (with or without consciousness) and demarcating the positive or negative quality of a stimulus.

As life became more complex, analytical procedures and rational thinking emerged, and probability theory, risk assessment and decision analysis were developed. Subsequently, analytical thinking was placed on a pedestal and portrayed as the epitome of rationality. Affects and emotions were seen as interfering with reason.

Therefore, recognizing diagnosis and risk is perceived and acted on in two fundamental ways. Diagnosis and risk as analysis brings logic, reason, and scientific deliberation as help; it is slower and implies time to consider management of diagnosis and risk. Diagnosis and risk as feeling refers to an individual fast, instinctive, and intuitive reaction to the patient and danger.

Some authors argue that reliance on such feelings can be characterized as “the affect heuristic”, using as information the feelings experienced in the process of diagnosis or risk assessment. (1)

Representations of objects and events in people's minds are tagged to varying degrees with “affect”. An “affective pool” exists containing all the positive and negative tags consciously or unconsciously associated with representations. The intensity of the “affect” tag varies with the representation.

Inevitably, people consult the affective pool, or perceive it unconsciously, in the process of making judgment. Just as imaginability serves as a cue for probability judgments, (e.g. the availability and representativeness heuristics), affect may serve as a cue for many important judgments (including probability judgments). Using an overall, readily available affective impression can be far easier and more efficient

than weighing the pros and cons or retrieving from memory many relevant examples, especially when the required judgment or decision is complex or mental resources are limited. This characterization of a mental short-cut leads us to label the use of affect as a heuristic. (2)

How do people make judgments of an activity or a technology? People base their judgments not only on what they think about it, but also on how they feel about it. If their feelings toward an activity are positive, then people are more likely to judge the risk as low and the benefits as high. On the other hand, if their feelings toward an activity are negative, they are more likely to perceive the risk as high and benefits as low.

Experimentally, Finucane et al. (2) found that after providing manipulated information about the high benefit or the low risk of, for example, nuclear power, people felt a positive affection and perceived low risk or high benefit. Conversely, providing information about a low benefit or a high risk induces a negative affection.

A group of clinicians were asked if they would discharge a hospitalized mental patient. When clinicians were told that “20 out of every 100 patients similar to this patient are estimated to commit an act of violence,” 41% refused to discharge him. But when the risk was expressed to another group of clinicians as “patients similar to this patient are estimated to have a 20% chance of committing an act of violence,” only 21% refused to discharge him. (3)

Other studies showed that representations of risk in the form of individual probabilities of 10% or 20% led to relatively benign images of a person as being unlikely to harm anyone, whereas the equivalent relative-frequency representations created frightening images of violent patients because these affect-laden images induced greater perceptions of risk (e.g., ‘some guy going crazy and killing someone’). The way the information is presented to patients may have a great impact in the way they respond to their respective risks and benefits.

DO WE DECIDE ACCORDING TO THE PROBABILITY OR DO WE CONSIDER THE LIKELIHOOD AND THE FRAME?

What happens when consequences carry sharp and strong affective meaning, as would be the case of winning a lottery jackpot or suffering from cancer?

As Loewenstein et al. observed, (4) the images and feelings toward winning the lottery are likely to be similar whether the probability of winning is one in 10 million or one in 10,000. They noted that responses to uncertain situations appear to have an all or none characteristic that is sensitive to the possibility rather than the probability of strong positive or negative consequences, causing very small probabilities to carry great weight.

Support for these arguments comes from Rottenstreich and Hsee, (5) who showed that, if the potential outcome of a gamble is emotionally powerful, its attractiveness or unattractiveness is relatively insensitive to changes in probability ranging from 0.99 to 0.01.

In the decision to start smoking, the adolescents seldom use their conscious thinking (the “informed rational choice” of the experts). Instead, they are driven by the affective impulses of the moment, enjoying smoking as something new and exciting, a way to share complicity and have fun with their friends. Most of them begin to think of risk only after starting to smoke.

In the responses to a survey question that asked smokers, “If you had it to do all over again, would you start smoking?”, more than 85% of adult smokers and about 80% of young smokers (aged 14–22 years) answered NO.

However, we know that only a small proportion of smokers really quit smoking, despite multiple attempts, due to addiction to nicotine.

Tobacco corporations spend USD 10 billion in the United States to investigate “smoker psychology” and to learn to promote campaigns using image and affect to manipulate the behaviors of the current target audience, the new young generation.

Related implications are that anti-tobacco messages should be designed with the same skill and appreciation of affect that pro-tobacco messages have exhibited for years.

Some authors (6) state that integral affect (experienced feelings about a stimulus) and incidental affect (feelings such as mood states that are independent of a stimulus but can be misattributed to it or can influence decision processes) have been used to predict and explain a wide variety of judgments and decisions.

In their pioneering study, Kahneman and Tversky defied the axiom which states that human decisions are neutral descriptions that are not modified by affects, and they described for the first time the shift of rational decision making, in what they called “frame effect”, a key aspect of the prospect theory. (7)

De Martino et al. designed a study with university students who received 50 pounds and had to choose between a “sure” option and a “gamble” option. (8) The participants were randomly divided into two groups: “gain” frame (keep 20 of the initial 50 pounds) and “loss” frame (lose 30 of the 50 initial pounds). In both groups, the participants could choose between

the “sure” option (gain or loss) and the “gamble” option, in which they could win or lose everything.

Although the student retained 20 pounds in both “sure” options, the framing manipulation showed a marked difference in choices between the two frames. In accordance with predictions arising from prospect theory, subjects were risk-averse in the “Gain” frame, and 42.9% tended to choose the “sure” option over the “gamble” option. On the contrary, subjects were risk-seeking in the “Loss” frame, preferring the gamble option 61.6%; both choices were significantly different ($p < 0.05$) from neutrality of 50%. This effect was consistently expressed across different probabilities and starting amounts of money. However, the majority of subjects seemed unaware of any biasing effect when specifically questioned in a debriefing session that followed the experiment.

WHICH NEURAL PATHWAYS PARTICIPATE IN ANALYTICAL OR AFFECTIVE DECISIONS?

Subjects performed the behavioral task while a functional magnetic resonance imaging scan was performed. Amygdala activation was significantly greater when subjects decided to choose the “sure” option in the “Gain” frame or the “gamble” option in the “Loss” frame. A different pattern of brain activation was identified when subjects made decisions that ran counter to their general behavioral tendency. In this reverse interaction, they observed enhanced activity in the anterior cingulate cortex (ACC), and to a lesser extent in the bilateral dorsolateral prefrontal cortex (DLPFC).

They also found a significant correlation between decreased susceptibility to the “framing effect” and enhanced activity in the orbital and medial prefrontal cortex (OMPFC), specifically in the right orbitofrontal cortex. In summary, those subjects who acted more rationally exhibited greater activation in OMPFC associated with the “frame effect”.

These data provide a neurobiological account of the framing effect. Increased activation in the amygdala associated with the “frame effect” supports the hypothesis that the framing effect is driven by an affect heuristic underwritten by an emotional system. In humans, the amygdala is implicated in the detection of emotionally relevant contextual information. The observation that the frame has such a pervasive impact on complex decision-making supports an emerging role for the amygdala in decision-making.

These authors (8) suggest opponency between two neural systems, with ACC activation consistent with the detection of conflict between predominantly “analytic” response tendencies in OMPFC and a more “emotional” amygdala-based system.

It is noteworthy that there are strong reciprocal connections between the amygdala and the OMPFC, although each may contribute to distinct functional roles in decision-making.

These findings would support a model in which the

OMPFC evaluates and integrates emotional and cognitive information, thus underpinning more rational behavior.

This study suggests a model in which the framing bias reflects an affect heuristic by which individuals incorporate a potentially broad range of additional emotional information into the decision process. In evolutionary terms, this mechanism may confer a strong advantage, because such contextual cues may carry useful, if not critical, information. Neglecting such information may ignore the subtle social cues that communicate elements of (possibly unconscious) knowledge allowing optimal decisions to be made in a variety of environments.

Brain lesions disrupt complex decision-making processes when emotions are “eliminated”. Patients who have sustained damage in the ventromedial prefrontal cortex (VMPFC) reveal a generally flat affect and an inability to react to emotional situations, in addition to repeatedly making decisions that are detrimental to their well-being, despite perfectly functioning intellectual capacities. It seems as if they did not learn from previous experiences.

Consequences of behavior processed in the sensory cortex induce the amygdala to elicit emotional bodily responses via effector nuclei in the brain stem. Through a learning process, these responses (somatic markers) become linked to mental representations of this specific behavior in the VMPFC, which are stored in the DLPFC. (9)

In decision-making, therefore, the same emotional response is elicited when experiencing or envisioning the behavior that brought them about in the past. Subsequently, they are processed either at the cortical level, evoking conscious “gut feelings” of positive or negative affect, or at the subcortical level, influencing decision-making in a unconscious way. At the cortical level, functional imaging studies suggest that the insular cortex is involved in representing awareness of subjective feelings and has a role in guiding mental and physical behavior.

DOES PREMONITION (GUT FEELING) EXIST IN PROGNOSTIC ASSESSMENT AND DECISION-MAKING?

Recent research into the role of intuition in general practice found that many general practitioners experience the so-called gut feeling in their diagnostic reasoning about patients. This gut feeling can be regarded as a specific kind of intuitive feeling since it is usually confined to prognostic assessments of the patient's situation and is often accompanied by bodily sensations.

Two types of gut feelings can be discerned: a “sense of alarm” and a “sense of reassurance”.

The “sense of alarm” implies the sense of “there's something wrong here.” It means that the general practitioner needs to initiate specific management to prevent serious health problems.

The “sense of reassurance” means that general

practitioners feel secure about the further management and course of a patient's problem, even though they may not be certain about the diagnosis: “everything fits in”.

Although the role of gut feeling in general practitioner's diagnostic reasoning has been described, a scientific explanation for the phenomenon is still lacking.

However, as we have seen, the use of analytical methods does not always seem to warrant objective results to “affect heuristic” or “frame effect”.

Scientific knowledge alone is not a sufficient guide, as based on their expertise and skills clinicians need to acquire and integrate information on the condition of the individual patient, his or her preferences, and the best evidence. We may conclude that in medical decision-making practitioners have to find a balance between analytical reasoning and a kind of intuitive assessment.

With increasing experience, clinical reasoning becomes more automatic and non-analytical, allowing fast and efficient diagnosis and treatment, while the rich knowledge base can be accessed, if necessary, in a more deliberate and analytical way.

A lot of medical thinking is situated somewhere in the continuum between cognitive analysis and intuition. The appropriate mode of thinking depends on the specific task characteristics.

A doctor's personal knowledge is built on a wealth of experience that is not verbalizable, that which we know but cannot tell. It is tied to the practices from which it is acquired, and often results from informal and implicit learning.

Intuition can thus be explained as the outcome of highly personalized knowledge-based non-analytical processes that may help physicians deal with the complexity of the tasks they face.

Psychological dual-process theories contrast analytical reasoning and non-analytical reasoning as two modes of knowing and thinking.

Although gut feeling as such does not feature in any psychological dual-process theory, this sense of reassurance and a sense of alarm (gut feeling) also originates in the knowledge and experience gained over time, and may therefore contribute to the assessment of the prognosis and diagnostic process.

In research on judgment and choice, affect is defined as a feeling of “goodness” or “badness” that is elicited by the positive or negative quality attached by experience to the object of thought. This response depends on the interaction between an individual and a specific context. Reliance on such feelings is characterized as the “affect heuristic”, a mental shortcut preceding deliberate, analytical thinking that helps people navigate in a more efficient way in complex, uncertain and sometimes dangerous situations. This function of affect and emotions is the hallmark of the experience-based system in Epstein's dual process theory. (10)

Of particular interest for the sense of alarm are emotions invoked by stimuli like signs and symptoms that do not fit into a familiar pattern of a disease or a patient. These unusual stimuli arouse curiosity and explorative behavior, but also keen expectation and fear.

This means that gut feeling needs to be taken seriously. When general practitioners recognize a sense of alarm, they should be alerted to slow down the velocity of prognostic or diagnostic processes and switch to analytical reasoning. Being aware of gut feeling may help general practitioners to learn when to be sure or alarmed when something does not fit.

Reflection-in-action by medical practitioners during the diagnostic process contributes to awareness of their feelings of certainty or uncertainty, assessing the limitations of their knowledge, and stimulating them to search for feedback and follow-up.

A typical gut feeling: diagnosing pulmonary embolism in primary care

Pulmonary Embolism (PE) is a serious condition which has to be identified quickly: the mortality rate is high, with 18% of patients dying within 3 months, but is clinically suspected in fewer than half of all fatal cases.

Uncertainty is an inherent part of primary care as signs and symptoms are often vague. Dyspnea and thoracic pain are signs indicating from benign to life-threatening conditions.

A Wells score <4 combined with a negative point of care D-dimer test have been proven safe and efficient for the exclusion of PE diagnosis in primary care.

In fact, before using any predictive rule oriented towards this particular diagnosis, the general practitioner should have some suspicion of PE and it is precisely this initial stage which is unclear.

A qualitative approach was performed using individual structured interviews (range, 5-40 minutes) with two groups of family practitioners (FPs): 14 FPs who had referred a patient to the emergency unit of the local hospital within the past 6 months and where a PE was ultimately diagnosed, and a second group of FPs was chosen from a general sample with different perspectives and experiences. The interview was performed a couple of days after the diagnosis. (11)

A thematic analysis was conducted, originating from grounded theory: 10/14 FPs in the first group referred their patient with suspicion of PE. Clinical signs were polymorphic.

All the FPs interviewed stated they did not use the PE prediction rules (Wells score) or the D-dimer test: The result of the score was seen as disconnected with the real patient and they stated that it would have had no influence on their decision-making process in the office. They insisted on the global view they had of the situation based on their examination and knowledge of the patient.

The FPs talked about the use of their perception in diagnosis: they sensed when something was wrong, although they were unable to underpin this feeling with objective arguments. The perception of a serious prognosis decided if the patient would be sent for assessment as the FPs needed further investigation because of the sense of alarm they experienced. This feeling was described in different ways: having a “noise”, “a sense”, “an intuition”. Eighteen FPs from both sampling groups commented about this feeling.

The suspicion of PE arose out of four considerations: the absence of indicative clinical signs for diagnoses other than PE, a sudden change in the condition of the patient, a gut feeling that something was wrong and an FP's experience of previously failing to diagnose PE.

In this description of real practice in France, FPs based the initial stages of the diagnostic process on a feeling of alarm; yet, the usefulness of rules, as the Wells score, for clinical decision-making, should not be excluded. On the contrary, gut feelings should trigger the next clinical process, particularly the use rules, such as the Wells score.

Knowing the patient, his/her risk factors and being sensitive to a discrepancy in the patient's behavior seemed to be decisive for FPs when clinical signs were vague but serious conditions were suspected.

The absence of clinical signs for diagnoses other than PE, a sudden change in the condition of the patient, a gut feeling that something was wrong and an FP's experience of previously failing to diagnose PE were the main determinants to decide patient referral. They never used a decision rule.

DO COMPLEX DECISIONS BENEFIT FROM THOROUGH CONSCIOUS THINKING OR FROM UNCONSCIOUS THINKING WITHOUT ATTENTION?

Common sense holds that thorough conscious thinking leads to good decisions and satisfactory choices, particularly when we have to choose between products that are complex and expensive, as a car or a house, while we buy simple elements, as a new set of towels or dish cloths without much thought.

Contrary to conventional wisdom and on the basis of recent insights into the characteristics of conscious and unconscious thinking, it is not always advantageous to engage in thorough conscious deliberation before making a complex choice.

This hypothesis, named the “deliberation-without-attention” hypothesis, was confirmed in four studies on consumer choice, both in the laboratory as well as among actual shoppers, indicating that purchases of complex products were viewed more favorably when decisions had been made in the absence of attentive deliberation. (12)

Whereas conscious thinking refers to thought or deliberation while conscious attention is directed at the problem at hand, unconscious thinking can be defined as thought or deliberation in the absence of con-

scious attention directed at the problem.

Let's see the four experiments. In Study 1 participants were subjected to a 2×2 factorial mode of thinking: conscious versus unconscious and at the same time, each one was assigned according to the complexity of choice to: simple versus complex. All participants read information about four hypothetical cars. Depending on the condition, each car was characterized by 4 attributes (simple) or by 12 attributes (complex). The attributes were either positive or negative. One car was characterized by 75% positive attributes, two by 50% positive attributes, and one by 25% positive attributes (supporting on-line text). After reading the information about the four cars, participants were assigned either to a conscious thinking condition or to an unconscious thinking condition. In the conscious thinking condition, participants were asked to think about the cars for 4 min before they chose their favorite one. In the unconscious thinking condition, participants were distracted for 4 min (they solved anagrams) and were told that after the period of distraction they would be asked to choose the best car.

The crucial two-way interaction supporting the deliberation-without-attention hypothesis was significant ($p < 0.04$). Unconscious thinkers fared relatively well and showed no significant differences between simple or complex conditions. Conscious thinkers generally made the proper choice under simple conditions, but performed poorly under complex circumstances ($p < 0.04$).

In Study 2, they used the difference in attitude toward the best car and the worst car as the dependent variable. Again, conscious thinkers were better able to differentiate the quality of the cars under simple conditions, whereas unconscious thinkers were better able to differentiate the quality of the cars under complex conditions ($p < 0.03$).

Study 3 was a pilot study. Students were asked how many aspects of a product they would take into account in the purchase of 40 different products. In this way, they obtained an average "complexity score" for 40 different products. The students answered the list of 40 products and they knew how satisfied they were with the product.

A positive correlation was found between the extent of time employed thinking and satisfaction for simple products ($p < 0.03$); for complex products, the correlation was negative ($p < 0.03$). As expected, satisfaction was greater the more people thought about simple products. Conversely, satisfaction was lower the more people thought about complex products.

Finally, in Study 4 two shops were selected: one where people generally bought complex products (IKEA, which sells mainly furniture) and one where people generally buy simple products (Bijenkorf, a department store like Macy's that sells clothes, clothing accessories, and kitchen accessories). At the exit, shoppers were asked the following questions: What did you buy? How expensive was it? Did you know the

product before you went shopping? How long did you think about the product between seeing it for the first time and buying it? A few weeks later, the shoppers were asked (over the phone) how satisfied they were with their purchases.

Participants ("thinkers") were divided on the basis of a median-split procedure, into those who engaged in much conscious thinking (conscious thinkers) and those who engaged in little conscious thinking (unconscious thinkers). As expected, conscious thinkers reported more post-choice satisfaction than unconscious thinkers for Bijenkorf products (simple products) ($p < 0.02$). The opposite was true for the IKEA customers (complex products), in which unconscious thinkers showed more post-choice satisfaction than conscious thinkers ($p < 0.02$).

Conscious thinkers were better able to make the best choice among simple products, whereas unconscious thinkers were better able to make the best choice among complex products. Among people who knew the product they purchased before they went on a shopping trip, the amount of conscious thinking was positively related to post-choice satisfaction for simple products and negatively related to post-choice satisfaction for complex products.

The authors (12) comment: "Although we investigated choices among consumer products in our studies, there is no a priori reason to assume that the deliberation-without-attention effect does not generalize to other types of choices (political, managerial, or otherwise). In such cases, it should benefit the individual to think consciously about simple matters and to delegate thinking about more complex matters to the unconscious.

Two reasons why conscious deliberation sometimes leads to poor judgments have been identified. First, consciousness has a low capacity, causing choosers to take into account only a subset of the relevant information when they decide. Second, conscious thinking can lead to suboptimal weighting of the importance of attributes as we tend to inflate the importance of some attributes at the expense of others, leading to worse choices.

Conversely, unconscious thinking, or thought without attention, can lead to good choices.

We also know that conscious thinking is rule-based and very precise. Unconscious thinking can conform to rules in that it detects recurring patterns, as the literature on implicit learning shows. This capacity to follow rules makes conscious thinking more precise in decision-making, because it can strictly follow self-generated rules such as not exceeding a maximum price.

As referred earlier, conscious thinking suffers from the low capacity of consciousness, making it less suitable for very complex issues. Unconscious thinking does not suffer from low capacity. It has been shown that during unconscious thinking, large amounts of information can be integrated into a concise evaluative judgment.

These characteristics of conscious and unconscious thinking led the authors (12) to postulate the “deliberation-without-attention” hypothesis, on the relationship between mode of thinking or deliberation (conscious versus unconscious) and the complexity and quality of choice.

CONCLUSIONS

A central tenet of “rational decision-making” is logical consistency across decisions, regardless of the manner in which available choices are presented. This assumption, known as “invariance”, is a fundamental axiom of game theory. (8)

However, the proposition that human decisions are “description-invariant” does not seem to exist. Kahneman and Tversky originally described this deviation from rational decision-making, which they termed the “framing effect”, as a key aspect of prospect theory. (7)

The idea that conscious deliberation is the ideal (if not always attainable) way to approach a decision forms the backbone of classic as well as contemporary perspectives on decision-making. In contrast, the notion that unconscious thinking is fruitful has been hardly developed beyond the status of “folk wisdom” and infrequently postulated or scientifically investigated. The question addressed here is whether this view is justified; the hypothesis developed seems to say that it is not.

Classical models of medical decision-making are interested in diagnostic reasoning using Bayes’ theorem, likelihood ratio, previous and posterior odds ratio, thresholds, schemes and decision trees to reach the best diagnosis and therapeutic decision. Evidence-based medicine constitutes the standard of the best practice; thus, intuitive feelings may be false, and so the use of analytical models is recommended to act as help in decision-making, deal with intuitive ideas and revise its biases before taking any decision.

In the cognitive continuum theory, intuition and analysis are defined as two modes of cognition that can be placed at the ends of a continuum, where intuition refers to rapid, unconscious processing and low control, and analysis refers to slow, conscious and controlled processing.

One of the main characteristics of the experience-formation system is its affective basis. Although analysis is certainly important in some decision-making circumstances, reliance on affect is a quicker, easier, and more efficient way to navigate in a complex, un-

certain, and sometimes dangerous world.

Namely, representations of objects and events in people’s minds are tagged to varying degrees with affect, and the affective pool is consulted to make quick evaluations. Which situations are most influenced by the “affect heuristic” is an empirical question which depends on different contextual factors, including the extent to which stimuli evoke images that are tagged clearly with positive or negative feelings.

Therefore, the reasons that come to mind may be analytic, or tinged with positive and negative affective tags, or both. Thus, the availability heuristic may be working through cognitive or affective processes. The extent to which each process is evoked is still unclear

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