From Emergency Rooms to Boardrooms

How doctors think can improve business decision-making.

by Lim Tow Keang

More than two decades ago, the landmark report by the Institute of Medicine (US) Committee on Quality of Health Care in America *To Err is Human: Building a Safer Health System* highlighted the issue of patient safety in healthcare.[1] Since then, doctors and healthcare systems have implemented a wide range of interventions to reduce medical errors and mitigate patient harm. The most effective and popular solutions have involved quality improvements and systemic changes. In these two domains, the medical community has learnt from, adopted, adapted, and applied many lessons and tools from the business world. Particularly, the disciplines of behavioural economics or 'nudges' and high-reliability organisations are seen as exemplars.[2]

Now, let's take an inverse perspective by asking, "Can business decision-makers learn from clinicians?" Important decisions made in the boardroom and at the bedside occur under very similar conditions. They involve judgments in uncertain situations, are time-sensitive, and carry high stakes. These decisions also engage the same human cognitive processes, both as individuals and as a group.[3]

I organise this article using two phases of clinical thinking–diagnosis and treatment. It is in making the correct diagnosis that a clinician can then decide on the appropriate treatment plan. I will show how higher-order thinking can be deployed to optimise decision-making under clinical or medical settings. During my discussion, I will highlight the role of human cognition which is based on the idea of the predictive brain (PB) and active inference. This is an advanced theory of how the brain works that has been developed recently by leading neuroscientists, where it considers the brain as a highly evolved, proactive, and predictive machine.

DIAGNOSIS: AN EPISTEMIC PROCESS

Clinical diagnosis is fundamentally an epistemic process. This means that the steps involve various aspects of knowledge–from understanding, belief, justification, and methods used to acquire and evaluate such knowledge to arriving at judgements, decisions, and actions. Expressed in another way, the epistemic process encompasses how we ascertain our knowledge, the dependability of our understanding, and the methodologies we employ to gather and appraise information. It is most apparent when we try to make sense of mistakes–not only what went wrong but also how it has gone wrong, i.e., the causal mechanism underlying the illness and its manifestations.

Following the PB perspective, this process involves abduction and inference to the best explanation (IBE). Abduction is how we generate possible explanations or hypotheses to account for observed phenomena when there is limited or incomplete evidence. This cognitive process focuses on proposing various explanations and selecting the most likely one based on available information. For example, a patient who presents with a one-day history of fever, runny nose, and cough would most likely have an acute respiratory tract infection. The specific cause however could be any one of many respiratory pathogens which may present with very similar features. Abduction is also often used to generate initial ideas or hypotheses that can guide further investigation.

On the other hand, IBE involves evaluating multiple explanations or hypotheses for a given set of evidence and selecting the one that provides the most comprehensive and coherent account of the data. It aims to choose the explanation that best fits the available evidence while considering simplicity, explanatory power, and coherence. IBE is more about selecting the most compelling explanation among competing options. Thus, in the case of our patient with an acute respiratory tract infection, the coronavirus obviously becomes the most likely suspect in the COVID-19 pandemic setting.

This approach is also applicable when investigating problems in the business world. Take the situation where market trends are to be assessed before launching a new product in business. Instead of relying solely on intuition, an epistemic approach would involve gathering data from a range of sources, conducting rigorous market analysis, and critically evaluating the reliability of each piece of information. This process enhances the accuracy of predictions, and acknowledges the dynamic and uncertain nature of markets. Hence by incorporating such epistemic principles, business leaders will be able to make more informed decisions.

The fictional detective Sherlock Holmes simply referred to this whole process as "thinking backwards", contrasting it with rational-logical deduction or "thinking forwards".[4] The PB efficiently performs this "backward thinking" by proactively matching new bottom-up sensory information with prior top-down case memories and experiences of similar situations in the past, quickly identifying predictive errors when the two streams of information do not match.[5]

In clinical practice, this is manifested in familiar cases as making a 'spot diagnosis' based on pattern recognition, while in more difficult cases, it involves carefully comparing and contrasting the presenting features before arriving at a diagnosis. Similarly, in business, we try to make sense of emerging problems by matching them with similar situations from past experiences. This process involves recalling representative cases encoded as grid maps in long-term memory.[6] An efficient approach to quick decision-making involves using the 'gist' or a small number of key features that differentiate among different conditions.

Gathering new information through diagnostic tests to either exclude unlikely diseases or confirm likely ones is a critical step in this process. The prescriptive method for interpreting diagnostic test results is known as Bayesian inference, a statistical method that involves updating beliefs or probabilities about a hypothesis as new evidence or information becomes available. It is based on the principles of Bayesian probability theory, developed by Thomas Bayes, an English mathematician/philosopher in the 18th century. In fact, in everyday practice, we are already performing an approximation of Bayesian inferences intuitively without relying on formal calculations.[7]

Of course, diagnostic tests are never perfectly accurate. Thus, a crucial factor to consider when conducting diagnostic testing is the careful assessment of the projected risks and their costs relative to the potential benefits of the test. There are scenarios in which pursuing additional diagnostic tests might not be in the best interests of the patient and therefore should be steered clear of. This concept is elucidated through the lens of decision analysis, referred to as the 'threshold approach', where a pivotal juncture balancing risk against benefits guides the selection of suitable tests.[8]

For example, if a severe bacterial bloodstream infection is suspected, an antibiotic should be administered as soon as possible instead of waiting for testing to locate possible sources of this infection. Likewise, in business, senior executives do not and should not wait to act only when they have gathered perfect information. When expanding into new markets, they rely on strategies that involve understanding market characteristics, choosing the right partners, and dealing with regulatory issues, among others. All these involve careful observation and constant probes for feedback as to whether the decisions require timely adjustments based on changing conditions or new information.

I suggest that business decision-making may also be improved by applying the principles of Bayesian inference and the threshold approach heuristically or as rules of thumb. When Netflix expanded its streaming service globally and subsequently started creating original content from 2015, it took calculated risks by tailoring its content and strategy to different markets, while recognising that it did not enjoy complete understanding of local content preferences and the media regulatory environments. The company had to adapt and learn quickly from the new markets as it went along, which, in a nutshell, follows a Bayesian approach to responsive and adaptive decision-making. In two years, the once DVD-by-mail movie rental provider had operations in more than 190 countries where close to 50 percent of its 130 million subscribers were outside the US, its country of origin.[9]

In the medical field, there is also significant interest in understanding and preventing diagnostic errors. Biased thinking is recognised as a common cause of diagnostic errors. However, attempts to improve diagnostic accuracy by recognising and avoiding biased thinking (de-biasing interventions) have proven unsuccessful.[10] The main reason for this failure is that biased thinking is simply part of our default intuitive problem-solving process. And thus, it is only in hindsight, when the outcomes are clear, that we can go back and say that one decision was right, i.e., a 'heuristic' versus another one that was wrong and so label it a 'bias'. Going forward, in real time, it is impossible to tell a bias from a heuristic, so we do not have the agency to prevent or avoid it. As highlighted by Daniel Kahneman in his most recent book *Noise: A Flaw in Human Judgment*, the Nobel Economics Prize laureate recommends that we work on identifying and reducing 'noise' or variations in our work.[11] This search for better reliability and consistency, he thinks, may be more do-able than trying to reduce bias.

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An effective way to reduce variability in clinical decision-making is to adhere to management protocols based on clinical guidelines and gather consensus from independent experts. Likewise, in business, just as in medicine, decision-making can vary greatly among individuals which may lead to inconsistency and inefficiency. To minimise such variability, companies often adopt established protocols and guidelines within their domains, such as best practices or standard operating procedures, especially for routine decision-making. By following these, managers are more likely to make decisions that are aligned with the organisation's goals, values, and past successful strategies. In the same vein, businesses have practised gathering consensus from external advisors with relevant knowledge and expertise. Apple's position at the top of the consumer electronics market owes as much to protocols and guidelines that ensures aesthetic consistency as it does to sparks of innovation and design genius. While creativity can be cultivated in-house, the Cupertino-based tech giant ensures it stays abreast of market trends by working with external consultants such as Accenture and IBM.

THE PREDICTIVE BRAIN

The PB concept in neuroscience suggests that the brain primarily functions as a prediction-making machine that is constantly generating and updating its hypotheses about the world based on incoming sensory information and past experience. Take driving as an example. The PB concept emphasises how a driver anticipates potential hazards. The driver's brain continuously predicts and prepares for various scenarios, like a car in front suddenly braking or a pedestrian stepping off the pavement and into its drive path. This notion differs from previous concepts of the brain that have only highlighted the brain's reactive processing as simply responding to stimuli. Using the same example, when the driver brakes after seeing the brake lights of the vehicle ahead, it is not because the individual is scanning for hazards (as suggested under the PB theory), but it is simply a stimulus-response action only.

TREATMENT: PRACTICAL DECISIONS AND ACTIONS

Similar to diagnostic testing, the process of making treatment decisions necessitates a meticulous equilibrium between weighing risks and benefits prospectively in predictive error processing.[12] This delicate balance of top-down expectations or predictions based on *a priori* experience and bottom-up new information as the case evolves is instrumental in selecting the optimal course of treatment within the framework of the 'threshold approach'.[13] For example, a low threshold might apply in cases of proven therapies for the critically ill, but a higher threshold would be more appropriate when considering invasive or potentially harmful treatments such as chemotherapy.

Evidence-based medicine (EBM) has sparked a rethink of this therapeutic decision-making process. EBM is the integration of the best available scientific evidence with clinical expertise and the individual patient's values and preferences. It involves systematically reviewing and appraising clinical research studies, clinical trials, and other forms of medical evidence to inform medical decision-making. Essentially, EBM encapsulates the most recent breakthroughs in medical science, which are then transformed into optimal practices. The most powerful tool in the armamentarium of EBM is the randomised controlled trial (RCT). This was experienced personally by all of us during the COVID-19 pandemic in which life-saving vaccines and treatment modalities were rapidly identified and differentiated from ineffective ones by globalised and rapidly publicised RCTs.

In similar ways, business decision-making may also be improved by applying evidence-based, scientific methods to rigorously test potential solutions before large-scale implementation. Thanks to the idea of 'nudge' in behavioural sciences, many are familiar with Google's use of A/B testing, which is a method that allows the tech giant to compare two versions of a web page or app feature to see which performs better. For instance, when Google updates its search algorithm or introduces a new feature in Gmail, it often conducts A/B tests with a small segment of users. This data-driven approach helps it to understand user preferences and behaviours better and more quickly, ensuring changes made are beneficial to the larger user base before they are eventually rolled out globally.

Such science-based practices are not limited to tech or engineering companies. Take Starbucks as an example. By analysing customer data, market trends, and feedback, the coffee giant identifies potential new products or makes modifications to existing ones. Before a new product is launched, Starbucks typically conducts market tests in selected locations to gauge customer response, allowing it to refine the product and its marketing strategy based on real-world feedback, thus improving its success upon wider release.

Despite stringent experimental methodologies and rigorous peer review standards for publication in medical journals, we are unable (and likely never able) to account for all relevant variables and conditionalities in the real world. Thus, uncertainties persist in every aspect of our practice. To better cope with this, we need to go beyond EBM. Fortunately, we are endowed with extended cognitive capabilities to self-appraise and fine-tune our primary thinking processes. We only need to pay more attention to, and practise to improve upon these higher thinking tools, such as our ability to reflect upon our own thinking processes (i.e., metacognition).

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METACOGNITION: UNCERTAINTY AND PRECISION

Metacognition or higher-order thinking about our own thinking is an important cognitive tool for coping with uncertainty. This is the universal capacity to perform continuous, parallel self-appraisal of our own thoughts. At the basic level, it is manifested and described as 'gut feeling'.[14] A better, more reliable way to measure metacognition is by assessing our levels of confidence in making each judgement in relation to its accuracy.[15] In everyday decision-making, it represents the estimated value of new bottom-up information for this task, indicating the level of attention required. Cognitive philosopher Andy Clark dubs this the 'precision-weighting toolkit', the core of fluid intelligence in discussions on the PB.[16] For decision-makers, this means paying careful attention to the feeling of confidence or trust in our own judgement.

There is emerging evidence that better metacognition improves decision-making in cases of confirmation bias.[17] In complex decision-making involving teams, transparent communication of metacognitive representation among individuals in the process of social or distributed metacognition may be an adaptive way of coping with uncertainty.[18] Simply put, this means that team members, whether in a clinical or business setting, need to communicate openly about their uncertainty and confidence clearly and frankly to one another. This may be especially important for the person who is most senior or the one leading the team, in part to signal the significance of being committed to such an open (and vulnerable) process.

As an example, a multinational corporation may have to deal with a crisis due to a major flaw in one of its key products which had already been distributed globally. The leadership team, instead of rushing to a decision, may choose to meet for a quick 'huddle', where team members are encouraged to openly express their initial gut feelings about the best course of action, whether it is a product recall, a public announcement, or a strategic silence. By vocalising these intuitive responses, the team could better understand the diverse perspectives and areas of uncertainty. This collective introspection leads to a more informed and nuanced decision-making process. To be clear, this approach is still considered a novel domain in medical practice and education, and has to be fully evaluated before large-scale implementation (which is in line with the scientific, evidence-based approach to decision-making).

CONCLUSION

I have shown how the PB makes effective and efficient decisions in the clinical diagnostic and management settings. This model incorporates the optimising tools of probability theory, Bayesian inference, EBM, RCTs, and metacognition. This approach may also be relevant in solving complex problems in business decision-making.

We are still actively evaluating recent important technological advances in deep learning from multi-faceted information sources and problem-solving through large language models in the clinical domains. It is certain that this will impact our everyday clinical work in ways that we have yet to fully delineate and understand. AMI

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