

Metacognition

for every clinician



Dr Uttam Shiralkar FRCS MRCPsych

This is an abridged chapter from the book ‘Surgical Metacognition’. Although the book is primarily aimed at surgeons, the principles are applicable to any speciality.

Just prior to his retirement, the renowned neurosurgeon Henry Marsh decided to look back on the forty years of his surgical career, considering whether his mistakes had been negligent carelessness or acceptable ‘errors of clinical judgement’:

*“To my distress... I could not deny that many of the mistakes I was remembering fell into the first category – I had been careless. They were also the mistakes I found most difficult to remember and I suspect that some of my worst mistakes remain buried in my subconscious or have been completely erased. It was also striking that the great majority of the mistakes had been mistakes in decision-making... And yet, like most doctors, I like to think that I am a good doctor”.*¹

Although his career is over, and he will no longer benefit professionally from his reflections at this point, he offers lesson for those of us that can. These few lines give many lessons. Despite his internationally acclaimed status, Mr Marsh voluntarily admits to having committed serious errors in his career. And he is candid about having been in denial about these mistakes for a long time.

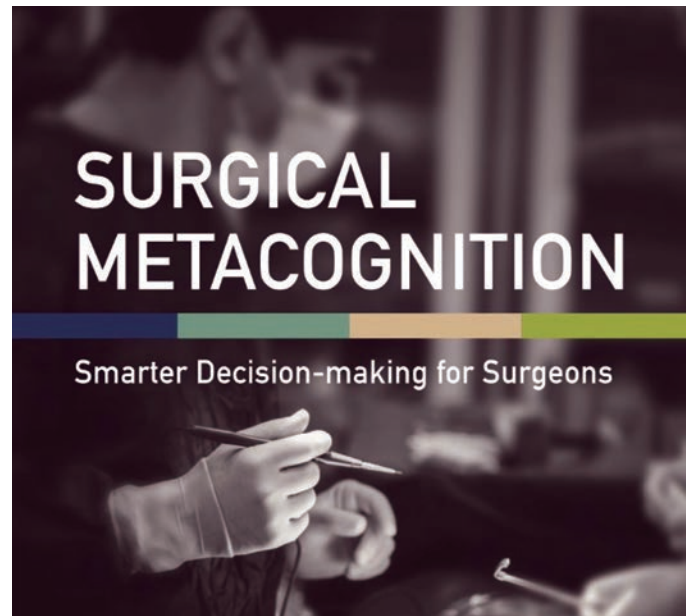
The first lesson to take from this is the tendency to deny limitations and problems in decision-making, thinking ‘I am a good doctor.’ The second lesson is that you don’t need to wait until retirement to take remedial measures.

The third lesson is to understand a type of thinking called metacognition; it is the ability to understand and reflect on both decisions and your underlying thinking processes. Using these skills, Mr Marsh dove deep into his memory, brought forgotten cases to his consciousness, and analysed his core thinking process. This isn’t the mere recollection of what happened; it is an important attribute of a good decision maker: an exploration of thoughts. This is metacognition in action.

The fourth lesson to take from this is that anyone desiring to be an expert should proactively develop such metacognitive skills, as these are seen almost universally among experts across a range of fields.

Unfortunately, the stereotypical image of a surgeon, compared to other medical specialities, is of an actor rather than thinker. There are two reasons this is unfortunate. Firstly, it is a misperception and secondly, some surgeons buy into it.

This perception is inaccurate as surgeons don’t think any less than other clinicians. In fact, it could be said that due to the gravity of many of their decisions, surgeons think more than most clinicians. They may appear to think less because their thoughts are not necessarily



analytical or verbalised. Although a significant amount of surgical thinking is non-analytical and non-verbal, and is instead visual, tactile, or kinaesthetic; it is still ‘thinking.’

However, although it is not true that surgeons use less cognition, it may be the case that they tend to use less metacognition. Therefore, we come across surgeons who are unable to improve their decision-making. It is not because they cannot or do not want to improve, but rather because they are less able to appreciate the differences between their own thinking and that of those who perform better. Fortunately, it is now well established that metacognition can be taught and learned, allowing a great potential to improve our decision-making abilities.²

What is metacognition?

In simple terms, metacognition is ‘thinking about thinking.’ It involves understanding how you think and how you regulate the way that you think. The regulation of thinking is done by monitoring and evaluating the thought process and planning of thoughts (figure 1).³ Thus, metacognition is a person’s ability to manage their thinking.

Although the word itself may be new to you, metacognitive actions are common. Consider the following two questions.

- When was the last time you failed to recall someone's name but were sure that you knew it? These frustrating ‘tip-of-the-tongue’ events are common and may increase as we age. They are metacognitive because you have a thought, “I am sure I know the persons name”, about the cognitive action of memory; of remembering a name.
- How often do you use a shopping list or see others do so? Lists indicate an awareness that we are at risk of forgetting, and so we use an external aid.

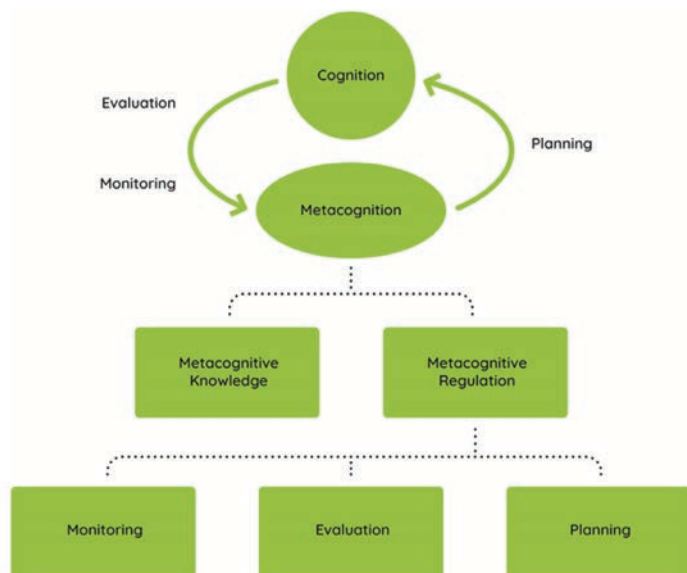


Figure 1 The roles of cognition and metacognition.

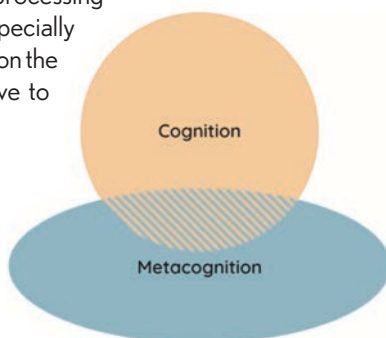
Understanding the limits of your own memory is a form of metacognition because it is based on your awareness of your memory and the limitations of your thinking. These examples also make it clear that metacognition is not a single concept but is multifaceted in nature.

An analogy from management is that cognition is like a clerk whose role is to process and action the decisions taken by the manager, whose metacognitive role is to oversee and supervise the clerk's activities. Just as a manager is supposed to keep an eye on the clerk's performance and take managerial decisions, metacognition regulates thinking and the planning of decisions.

Clinical metacognition includes checking clinical reasoning for possible errors and assessing what one needs to know about a treatment option.⁴ Surgeons are expected to be self-directed learners throughout their careers, and metacognitive skills are critical to this in addressing what, when, and how to learn.

Cognition and metacognition overlap (figure 2). Just as a manager may need to get involved in processing and actioning a decision, especially when the clerk is not around, on the other hand, a clerk may have to make managerial decisions.

Figure 2: The overlap of cognition and metacognition.



A clinical example of the difference in their roles is shown when performing a diagnostic procedure or an investigation. Cognition is knowledge of the technique and test results. Metacognition is the capacity to review the result, determine if it is clinically consistent, and repeat the test if required or to plan the next step.

An example of different facets of metacognition used in studying include recognizing where your weakness in a topic are; using mnemonics as memory aids and following up on your weak points by focusing study on them or reaching out to colleagues for help. These are all aspects of metacognition: metacognitive knowledge, metacognitive monitoring and metacognitive control, respectively.

Metacognitive abilities exist on a spectrum, from someone who is unaware of their thinking process, to disorganised awareness, organised thinking that can be verbalised, and finally, the reflective

learner who can quickly adapt their thinking as the situation requires

Metacognition is necessary for lifelong learning and is essential in the development of professionalism.⁵ An interesting difference between cognition and metacognition is that, while cognitive abilities decline at varying rates after a certain age,⁶ metacognitive capabilities seem to remain.⁷ Thus, senior surgeons with changing cognitive abilities would be expected to maintain and use metacognitive abilities to improve their performance in practice.

Lack of insight and metacognition

Some surgeons are poor at self-assessment and overconfident in their own levels of ability. Their ability may also be limited by distractions, fatigue or competing interests. Such a combination is often compounded by a lack of awareness (or acceptance) that there is a problem. In short, they lack insight. They don't know that they don't know; they are ignorant of their ignorance, making their decision-making error prone.

Sometimes the inability of a surgeon to learn how to make clinical decisions is not because they cannot learn, but because they are less able to appreciate the differences between their own performance and that of others. Fortunately, there is good evidence that increasing metacognitive capacity, their ability to understand and reflect on both the context of decision-making, and the underlying thinking processes they are employing, can improve their overall performance.⁸

Improving metacognition in surgery

To achieve unconscious competence, you need to go to the next stage: knowing what you don't know. The fact is that most surgeons are not familiar with metacognition and may not be aware of how complex, overarching, and crucial surgical decision-making is. Even if they are aware of the complexity, most are unaware of how we process complex decisions. As a profession, we have not thoroughly tried to really understand how surgeons make or should make difficult decisions, why they sometimes go wrong and how experts sometimes make exceptionally smart decisions. Moreover, the efforts that the profession has so far taken to optimise surgical decision-making have not yielded results.

Despite this, some surgeons may still question the value of metacognition and improving decision-making. Surgeons make hundreds of decisions every day; it is a continual and deep-rooted aspect of the profession. Most are automatic and the vast majority do not result in problems. And even when there are problems, there are various factors other than the surgeon's thinking that are usually held responsible. So, there are strong reasons why the decision-making process is not examined more closely, just as we don't pay much attention to other 'automatic' functions like breathing.

However, there is stark evidence that we do indeed need to improve both our individual and collective clinical decision-making:

- Clinical error is one of the **leading causes of death** in the developed world.⁹
- Clinical decision-making can be considered a **significant threat to the patient safety**.¹⁰
- More than 30% of healthcare **costs are wasted** on inappropriate care, and suboptimal care is increasingly connected to the quality of clinical decisions. Approximately 80% of healthcare expenditure results from clinicians' decisions. Therefore, improving healthcare necessitates improving clinical decisions.¹¹

- Analysis of clinical decisions has revealed that a **significant number of errors** occur because of inappropriate thinking.¹²
- Surgical **adverse events** are linked to failures in cognitive skills such as situational awareness and decision-making.¹³
- Following guidelines for surgical interventions has been shown to improve patient outcomes and reduce costs, but **the degree of guideline implementation is variable**. For example, with hernia repair it has been found to be as low as 32% and an average of 65% of procedures.¹⁴

These studies make it clear that there is significant room for improvement when it comes to decision-making.

Surgical training and professional development

Those who are responsible for surgical training are often not aware of recent developments in decision-making and how best to improve it.

In the last few years surgical training has moved away from immersion learning towards more formal, structured programs. Work schedules are regulated with a resulting reduction in clinical exposure. This loss of decision-making experience needs to be compensated by alternative methods. Also, reduced working hours means that trainees and trainers more frequently miss seeing the consequences of decisions they have taken. These factors make the need to actively teach decision-making even more important.

Despite their career-spanning importance, decision-making skills are also largely ignored in professional development, often only covered in an ad hoc and unstructured manner. Although surgeons are assumed to have learnt metacognitive skills through their career and how to learn via self-directed learning, there is ample evidence that this may not be the case.¹⁵

Studies also show that metacognitive skills vary among surgeons, and unfortunately some find it very difficult to improve their skills.¹⁶

Undoubtedly, there have been efforts to address the issue. Articles and books have been written on this subject. In the epilogue of one of those books, *Surgical Decision-making: Beyond the Evidence Based Surgery* by Rifat Latifi, the author writes:

If you thought that by the end of the book, you would understand entirely how surgeons make decisions, I'm afraid that you may not be fully satisfied. While we have explained several aspects of this complex issue, much remains unknown, and further work is required. This work should be done by surgeons in collaboration with those trained to understand the mind, how the brain works and how the brain can be directed or trained.¹⁷

In a sense, what the author raises only at the end of his book – psychological factors – are the focus of this book: what can “those trained to understand the mind, how the brain works and how the brain can be directed or trained,” tell us about surgical decision-making?

The lateness of our profession to acknowledge the importance of psychological factors has parallels with the history of aviation safety, where ‘human factors’ were only identified as key contributors to aviation accidents after decades of focusing predominantly on technological improvements. But once they were recognised as a key cause of accidents, aviation safety improved significantly with the

implementation of training and protocols that addressed human factors, such as checklists.¹⁹

Although we are in serious need of a similar ‘human factor’ revolution in understanding and reducing surgical error, we also require solutions that address ‘intra-human’ factors, i.e., cognitive factors. As the author suggests, to optimise decisions, we need to understand what and how surgeons think while decisions are made. Other professions have made significantly more headway in this direction, including marketing and the financial sector, and a new discipline of ‘decision science’ has developed.

Decision Science

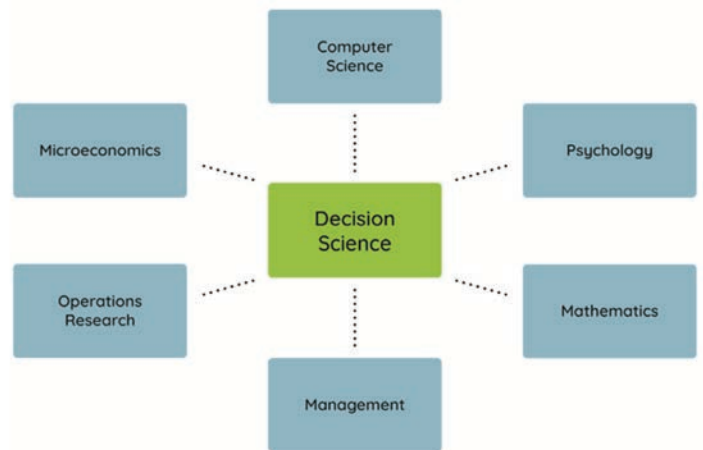


Fig 3-Contributing faculties of decision science.

Decision science has helped to unravel how decision-making works using a multidisciplinary approach incorporating information technology, mathematics, economics, and psychology (figure 3).

It has provided new evidence for how decisions are made, how they can be improved, and it has demonstrated that decision-making is a skill that can and needs to be honed. Much of this new understanding is directly applicable to surgical decision-making, with exciting potentials for improving surgical performance.

Popular metacognition

Before we look at metacognition in a surgical context, let's consider an example of its use in popular culture.

Judith Keppel was a contestant on the show ‘*Who Wants to Be a Millionaire?*’ In case you are unfamiliar with the show; for each question, contestants are asked if they are sure they know the right answer and want to risk their existing winnings on the chance of a higher prize, or if they'd prefer to walk away with whatever they have already won. The stakes are high: being wrong means losing everything you have earned. In Keppel's case, she faced this decision with £500,000 on the line. The million-pound question was: “*Which king was married to Eleanor of Aquitaine?*”

After a brief discussion with the show's host, Chris Tarrant, she settled on the answer of Henry II. Then Tarrant asked his killer question, the moment when contestants typically agonise the most: “Is that your final answer?” Success again rests on metacognition. You want to know if you're likely to be right before accepting the risk. Keppel stuck to her guns and became the show's first winner of the top prize.

In Judith's case, we can identify two types of metacognitive situations: She may have known the answer but thought she did not, and therefore would have missed out on the opportunity to become a millionaire. Or she may have been overconfident, choosing to gamble on a wrong answer and losing everything.

If we are overconfident, or think we have more reliable information than we do, we run the risk of not changing our minds when we should to make the right decision.¹⁹ On the other hand, if we are underconfident, we may remain indecisive even when the way forward is clear. More generally, poor metacognition can leave us stuck with decisions that we should have reversed or discarded long ago. Indeed, studies have demonstrated a direct link between metacognition and more careful, considered decision-making.²⁰

Expert metacognition

It is not a chance observation that experts exhibit better metacognitive skills than nonexperts. What we don't know so far is if having metacognitive skills makes someone expert or if one gains such skills after becoming an expert; a 'chicken or egg' conundrum! Regardless, although some may have this ability naturally, most people need to nurture it to become an expert.

By consciously understanding and improving our professional metacognitive skills, as all experts do, we are more able to identify our strengths and limitations precisely, find the most appropriate information and method needed to become an expert, thereby reducing the stress and time involved in achieving expertise. Moreover, metacognitive skills help to maintain the expertise. Indeed, some experts opine that maintaining expertise is more difficult than achieving it, as you are expected to handle more and more difficult cases as your reputation, and the stakes, increase.

Metacognition is also good for you, not just your patients!

So far, we have discussed the need for metacognition in decision-making in terms of patient outcomes. But there is another aspect that is even more important and underrecognised: the relationship between metacognition and a clinician's well-being.

In over a decade working professionally with the mental well-being of surgeons and other specialist, I have seen serious consequences of poor metacognitive skills on doctor's health. Not only have patients lost their lives because of a suboptimal metacognition; doctors have also lost their own lives, too. No doubt these occurrences are rare but the stress around making decisions is certainly commonplace, in particular, the stress of dealing with the consequences of decisions. The increased professional stress and burnout among doctors can be partly attributed to difficulties in decision-making and suboptimal metacognitive skills.

It is not all a dark picture, of course. The satisfaction, relief and pride one experiences after making a difficult but successful decision is a joy that is difficult to describe, and one can really only understand by experiencing it. Again, metacognition plays a role in both negative and positive situations.

Take-away points: An introduction to surgical metacognition

There is concrete evidence that there are problems with clinical decision-making that contribute to poor outcomes.

- Experts are known to have superior metacognitive skills.
- Metacognition is a skill that needs to be developed like any other skill.
- Metacognition plays an important role in decision-making as well as mental well-being.

About the author

Uttam Shiralkar

FRCS, MRCPsych.

Uttam worked as a surgeon for 15 years in the UK, India, and the US before moving to psychiatry. This transition was the result of the medical problems he faced after a car accident. While working in psychiatry, it became clear to him the profound impact that a surgeon's psychology has on performance and surgical outcomes. This revelation inspired him to bring psychological research into surgical practice and training.

For more than a decade Uttam has helped many surgeons at various levels of their careers on a range of issues, providing mentorship, conducting research, speaking at meetings, and running workshops.

Uttam's newest book, Surgical Metacognition: Smarter Decision-making for Surgeons, focuses on the key tool that underlies surgical expertise – metacognition, i.e., 'thinking about thinking.'

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