

1 Introduction: toward an applied metacognition

Bennett L. Schwartz and Timothy J. Perfect

Metacognition is traditionally defined as the experiences and knowledge we have about our own cognitive processes (e.g. Flavell, 1979). Although ripe for philosophers and cognitive psychologists (e.g. Nelson, 1996), this topic may not appear at a first glance to be one immediately applicable to everyday human life. However, we hope to show in this book that metacognition has broad applications across a number of different settings. Furthermore, we contend that, unlike some laboratory research, metacognitive data from the lab have parallels to real-world phenomena and therefore can be applied. The nature of metacognition is such that, in order to study it effectively in the lab, one must devise situations that mimic real life. The current volume will also attest to the ease with which metacognition research moves back and forth from theoretical questions to applied concerns, a situation we consider most desirable in any scientific endeavor.

Let us begin with examples from everyday life in which metacognition is important. Imagine a student studying for an exam. It is well past midnight, she has been studying for hours, and is exhausted. The decision that this student must make is whether she has studied the material for the exam sufficiently and can go to sleep, or whether she must brew another pot of coffee and keep studying. The student must decide whether the material is generally well-learned, and if not, what information necessitates further study. These decisions influence not only the student's caffeine intake but also her studying behavior and, ultimately, her test performance (see Nelson, 1993). In the lab, this situation has been modeled with judgments of learning and the control of study time (see Dunlosky, Rawson, and McDonald, this volume; Son and Schwartz, this volume). These studies reveal important and counterintuitive findings which can be applied in educational settings.

Now imagine a lawyer questioning a witness. The lawyer asks if the witness is confident that his memory of the events he saw at the scene of the crime are accurate. The witness replies, "Absolutely, I'll never forget that face as long as I live." We know, from decades of research, that

eyewitness memory is not always accurate. However, it is also important to determine if the witness' confidence in the accuracy of his own memory predicts the actual accuracy of the memory. Indeed, there have been cases in which the witness declares something similar to the sentence above and then points to the lawyer rather than the defendant. Witness confidence is a metacognitive judgment, and recent progress in this area is reviewed in this volume as well (see Perfect, this volume).

In the course of this volume, we will touch on applications of metacognition to children's learning (Schneider and Lockl), to adult education (Carroll and Perfect; Maki and McGuire; Dunlosky et al.; Son and Schwartz), to eyewitness memory (Perfect; Mazzoni and Kirsch), and to neuropsychological patients and older adults (Moulin; Hertzog). Whereas the first two fields of application are already quite advanced, the second two areas are just beginning to gain momentum. In this chapter, we will briefly review the history of metacognition research, introduce the key concepts of monitoring and control, reflect on the importance of metacognition to consciousness, and then entice the reader to read the remaining chapters.

History of metacognition research

Modern research in metacognition has two parallel roots, one in the emerging cognitive psychology of the 1960s (e.g. Hart, 1965) and the other in the post-Piagetian developmental psychology of the 1970s (e.g. Flavell, 1979). To some extent, these two tracks have remained largely separate. Today, there are two parallel fields, each called metacognition (Kuhn, 2000; Schwartz, Benjamin, and Bjork, 1997). Recently, however, there has been a more concerted effort to bring these two tracks in metacognition closer together (e.g. Hacker, Dunlosky, and Graesser, 1998; Hertzog, this volume). It is our belief that each track has something to add to the advancement toward an applied metacognition.

Hart (1965, 1967) was interested in the accuracy of judgments people made about memory. Coming from an adult cognition tradition, Hart assumed that adults have conscious experiences such as "feelings of knowing." What was important to discover was whether they were valid predictors of behavior. He devised a paradigm, dubbed the RJR procedure, to test metamemory judgments. First, he gave people a recall test (R), of either newly learned information or general knowledge. For example, participants might have been asked, "What is the capital city of the Bahamas?" (Nassau). If the participant was unsuccessful at recall, the participant was asked to make a feeling-of-knowing judgment (J),

predicting the answer would be recognized in a multiple-choice format. In Hart's (1965) first study, participants simply indicated yes – they had a feeling of knowing – or no – they did not. In the second experiment, Hart (1965) used a six-point scale for feeling of knowing, although this was dichotomized with points 1–3 corresponding to feeling of knowing, and 4–6 corresponding to feeling of not knowing. Subsequent studies introduced more conventional Likert-scale measurements (see Nelson, 1988). Finally, the participant received the recognition test (R). Hart (1965) showed that feeling-of-knowing judgments did indeed predict the likelihood of correct recognition for general knowledge materials, an observation replicated many times (see Nelson, 1988; Schwartz, 1994). Hart (1967) extended this technique to episodic memory, demonstrating that feeling-of-knowing judgments were above chance in predicting recognition of trigram materials in a paired-associate task. The RJR technique mostly lay dormant until the 1980s when it was revised by Thomas Nelson and his colleagues (e.g. Nelson and Narens, 1980, but see Gruneberg and Monks, 1974 for an exception).

Developmentalists were also interested in metacognition, but chose a different avenue of exploration. Flavell (1979) was interested in finding out if the improvement in children's memory abilities was a function of greater conscious understanding of the rules that govern memory and cognition (see Kuhn, 2000). Thus, his studies trace the development of metacognitive thinking, that is, the ability to reflect on one's cognitive processes. Unfortunately, not yet fully armed with the ideas of monitoring and control (Nelson and Narens, 1990), Flavell's research agenda did not show any strong correlations between metacognitive thinking and improvements in memory. Indeed, many developmentalists from this camp abandoned metacognition for the greener pastures of theory of mind (Wimmer and Perner, 1983). Nonetheless, Flavell's approach has had a strong influence on the development of metamemory in a number of domains (Hacker, 1998).

In recent years, there has been an impressive confluence of the two "schools" of metacognition. Developmentalists have begun to borrow the tools developed by Hart, Nelson, and others to investigate the questions that Flavell originally set out to answer. In this volume, Schneider and Lockl offer a more extensive history of this interaction and the many fruits it is now bearing. They focus on how this has led to new understanding of how metacognition develops in children. Also in this volume, Hertzog focuses on how metacognition changes in later adulthood.

In mainstream cognitive psychology, metacognition still lingered at the fringes. Indeed, at most conferences, metacognition researchers presented

their papers in memory sessions not metacognition sessions. At the American Psychonomic Society meeting, a session on metacognition did not emerge until 1997. Metacognition did receive a significant boost from its endorsement by the “everyday memory” movement (e.g. Neisser, 1978). Early pioneers in the everyday memory movement studied meta-memory phenomena, particularly the feeling of knowing (e.g. Gruneberg and Monks, 1974). In 2002, although not quite as “hot” or “fashionable” an area as false memories or theories of word recognition, metacognition has emerged as an important sub-field of cognitive psychology. Perhaps in part, the emergence of metacognition into the mainstream reflects the greater focus of cognitive psychologists on the experiential aspects of memory (Tulving, 1985). The concept of a false memory brings with it the notions of *beliefs* in memory and *judgments* about the source, and veracity of memories. Thus, cognitive researchers focusing on false memory are led inevitably towards a consideration of metacognitive aspects of remembering (see Mazzoni and Kirsch, this volume).

Monitoring and control

Metacognition came into the “modern” era with the publication of Nelson and Narens’ (1990; see Nelson, 1996) theory of monitoring and control. This theory was able to organize and integrate almost all of the extant research on metacognition. As the chapters in this volume show, it has also served as an effective model for applications of metacognition (see Son and Schwartz, this volume). The theory concentrates on the interaction between two metacognitive processes, monitoring and control.

Metacognitive monitoring is those processes that allow the individual to observe, reflect on, or experience his or her own cognitive processes. Thus, one may know that one has mastered his or her arithmetic tables, or one may feel that they have understood a text they have just read. In the laboratory, metacognitive monitoring is revealed by asking participants to make feeling-of-knowing judgments, judgments of learning, ease-of-learning judgments, warmth judgments, judgments of comprehension, etc. Monitoring informs the person of the state of their cognition relative to their current goal.

Metacognitive control is the conscious and non-conscious *decisions* that we make based on the output of our monitoring processes. Control processes are revealed by the behaviors a person engages in as a function of monitoring. Thus, if a person feels that an item is not adequately encoded, they may choose to continue studying that item. If a person feels that they have not understood a passage of text, they may re-read it. In the laboratory, we can observe control processes through such measures as response

latency, allocation of study time, and decisions about which items to study (e.g. Son and Metcalfe, 2000; Thiede and Dunlosky, 1999).

The idea of control processes is crucial to the development of applied metacognition. If control processes exist and influence human behavior and cognition, it may be possible to improve or alter control processes in ways which will improve human learning. Consider the work of Thiede and Dunlosky, 1999 (see also Son and Schwartz, this volume). Thiede and Dunlosky asked students to make judgments of learning (JOLs) on paired-associate word pairs, that were either concrete nouns (e.g. dog-spoon) or abstract words (e.g. democracy-gravity). Later, they were given the option to chose items for re-study. When time pressure to learn was high, the students chose those that had been given high JOLs. When time pressure was low, the students chose the harder items to study, that is, those given low JOLs. Thus, depending on the context, the students made different control decisions. Although conducted in a lab under controlled settings, the applied value of this study is obvious: perhaps we can teach students to use adaptive and flexible control strategies. Thus, the introduction of the concept of control radically altered the kinds of questions that could be asked about how to apply metacognitive findings.

Metacognition and awareness

Flavell (1979) made the distinction between metacognitive knowledge and metacognitive awareness (see also Kuhn, 2000). Metacognitive knowledge refers to explicit knowledge about our own cognitive strengths and weaknesses. Thus, the authors of this chapter can confidently assert that they know most of the capitals of the nations of Western Europe, but very few of the capitals of the nations of Africa. This statement requires no conscious retrieval. Similarly, the first author would assert that he knows a great deal about the sport of basketball, but very little about cricket, with the reverse being true for the second author. Metacognitive awareness refers to the feelings and experiences we have when we engage in cognitive processes, such as retrieval. Thus, when asked about what happened during the last series played between the nations of the West Indies and England at cricket, the first author experiences a vague feeling of familiarity without being able to specify the when, the where, and the events associated with this story. He might make a judgment that he might recognize some of this information, but would also judge an inability to recall any specific information. The second author on the other hand recalls the events vividly, can give the exact score of the series, details of each match, and has clear recollections of a day spent pacing in front of the television set during a crucial match in the series.

Traditionally, developmentalists have been more interested in the first aspect of metacognition. Schneider and Lockl (this volume) and Hertzog (this volume) concentrate their chapters on the development of metacognitive knowledge and how it changes over the lifespan. Important here is the concept of memory self-efficacy, that is, how well people think they are going to learn new information. The very young tend to overestimate their self-efficacy, whereas older adults often underestimate theirs. Mazzone and Kirsch (this volume) make some interesting applications about people's beliefs about their own memory to the development of false autobiographical memories. Cognitivists have been more interested in metacognitive experience, as reflected in their attention to feeling-of-knowing judgments, judgments of learning, etc. Of interest here are both the underlying processes and the extent to which these judgments predict actual performance. We see a focus on this issue in the work here of Dunlosky et al., Maki and McGuire, Perfect, and Son and Schwartz. Perfect, for example, examines how people's feelings of confidence for witnessed events predict the likelihood that their memories are indeed accurate.

Domains of application

Our goal in this volume is to establish the importance of metacognition to a variety of applied concerns, and specifically, to demonstrate how metacognition can inform these areas. It is our belief that metacognition has made a good start at being applied, as a number of researchers in the field are actively engaged in applying their results. In addition, many metacognition researchers ask questions that are applied in nature to begin with.

We consider that the following chapters will make important contributions to two applied domains, namely (a) education, specifically applications toward improving learning and training; and (b) legal contexts, specifically in the self-evaluation of eyewitness reports. The chapters here also touch on applications to other domains including counseling (self-evaluation of coping strategies, beliefs in recovered memories), human factors (self-monitoring of job performance), and recovery from brain injuries.

The current volume contains at least one chapter on each of these topics. Educational applications predominate, as most applied metacognition has had some form of learning as its focus. Maki and McGuire (this volume) discuss the growing literature on the monitoring of comprehension. Many studies find that students, even capable college students,

Cambridge University Press
0521801893 - Applied Metacognition
Edited by Timothy J. Perfect and Bennett L. Schwartz
Excerpt
[More information](#)

do not always adequately monitor their understanding of texts that they have read. If they do not know that they do not understand what they have read, they cannot take steps to ensure learning and understanding. Maki and McGuire describe steps that can be taken to improve the accuracy of monitoring of comprehension.

In another chapter with important educational implications, Carroll and Perfect (this volume) discuss the metacognitive bases of unconscious plagiarism. As any professor knows, plagiarism occurs quite regularly among the students we teach. Some of it is largely unintentional and even unconscious. Nonetheless, such plagiarism can still have disastrous consequences for students. The ability to self-identify unconscious plagiarism, and the ability of teachers to distinguish intentional from unconscious plagiarism has the potential for far-reaching impact in our schools and universities.

Dunlosky et al. investigate how practicing can help improve metacognitive monitoring. They argue that encouraging people to take practice tests can improve their ability to predict how they will do on the actual tests. In this way, practice testing may help people to study more effectively. Schneider and Lockl write a review of the development of metacognitive knowledge and its implications for children's learning. Son and Schwartz review the theory of monitoring and control and discuss how this theory may be used to develop better educational techniques.

If we turn our attention to eyewitness memory and the psychology of memory that has become so important in court proceedings, we find that metacognitive issues have been at the forefront of this domain from almost the beginning. The confidence a witness displays in his or her testimony has a strong effect on juries, judges, and the general public. Unfortunately, and surprisingly, much of the research on this topic suggests that confidence and accuracy are very loosely correlated (e.g. Bothwell, Deffenbacher, and Brigham, 1987; Perfect, this volume). Does this research suggest that judges and juries should revise their opinion and attempt to discount variation among witnesses' confidence? Perfect (this volume) argues that it is too early to answer this question. He argues that, because this research examines a correlation between two psychological measures, problems inherent in correlational data, such as restricted range issues, must be addressed first. Instead, he proposes a research agenda that will assess if confidence–accuracy associations are driven by such features as level of performance, the details of interest, across personality types, and across people's metacognitive beliefs about their areas of expertise. Perfect finds that whereas personality types do not predict much about eyewitness accuracy, people who believe they have strong

memories often express overconfidence leading to poor accuracy. These findings have important implications for both theoretical and applied research.

Mazzoni and Kirsch examine the role of metacognitive beliefs in the retrieval of autobiographical memories and discuss the implications in legal and clinical settings. In their model, people use metacognitive criteria to assess the veracity of retrieved memories. Furthermore, metacognitive beliefs are also used to assess if the inability to retrieve a memory implies that person did not witness or participate in an event. Mazzoni and Kirsch then discuss many studies that support this general system. For example, they point to research that suggests that misinformation is more likely to produce a false memory for a plausible than a non-plausible event (Pezdek, Finger, and Hodge, 1997), and that credible information indicating that an event did occur increases the rate that the person believes the event did occur (Mazzoni et al., in press).

For Mazzoni and Kirsch, metacognitive beliefs function similarly to Flavell's (1979) notion of metacognitive knowledge, that is, it is explicit reportable knowledge about how memory functions. As such, it is educable. Thus, the role of metacognitive beliefs in false memories is a correctable one. This has implications for both legal and clinical outcomes.

Hertzog is also concerned with memory beliefs, namely the changing beliefs about the efficacy of one's memory as one ages. Hertzog is concerned that many older adults may have internalized stereotypes of age-related memory declines, even when these beliefs are not necessarily accurate. These stereotypes create a self-fulfilling prophecy because the poor expectations may lead to anxiety and other negative effects. Again, as these beliefs are educable, it is possible that better education can reassure and provide a sense of confidence to older adults.

One of the new exciting areas of application of metacognitive theory is in the area of neuropsychological assessment. Although the role of the brain in metacognition has been occasionally the subject of inquiry (Shimamura and Squire, 1986; Metcalfe, 1993), application to patient groups is a very new area. Moulin (this volume) incorporates concepts of metacognition, particularly that of improved control, as a method for softening the loss of mnemonic ability associated with early Alzheimer's disease. This is based on his studies, which suggest that early Alzheimer's patients can still accurately monitor their memory abilities.

We suspect that metacognition will increasingly be applied in areas of psychology as diverse as educational psychology, neuropsychology, psychological gerontology, as well as other sub-fields. Although not

represented here, Bjork and his colleagues have been applying metacognition research to a variety of training situations from the military to sports teams (see Bjork, 1994; 1999). Nelson and his colleagues have been applying metacognitive research to the learning of foreign language vocabulary (Nelson et al., 1994). Thus, we anticipate a bright future for metacognition research.

Conclusions

Hermann (1998) distinguished between four types of research methodologies, three of which were related to applied research. The first group are theory-based researchers, for whom application is not initially relevant. Rather, their goal is to understand basic processes. The second group of researchers are basic researchers who stress ecological validity, also known as the “everyday memory” movement, in memory research. These researchers are fundamentally interested in basic questions of theory, but wish to address them in a way that has direct validity to everyday life. The important point about “ecologically valid” research is that, although it tells us something about ordinary life, it may not be directly applicable.

The third type of research is labeled “applicable research” by Hermann (1998). Applicable research implies ecologically valid research, but research for which applications follow naturally. A typical example is that Loftus’ misinformation-effect studies clearly suggest that investigators should avoid leading and misleading questions when questioning a witness or suspect. Finally, Hermann’s fourth type of research is “application research.” This involves research on specific instruments, products, or services which have been designed to work in specific domains. Thus, application research might involve experimenting on whether a specific form of therapy helps amnesic patients remember more of what they have been taught.

The chapters in this book are mostly of the “applicable research” variety. The researchers have not yet designed specific interventions to improve learning, to ameliorate Alzheimer’s, or to assist judges and juries. However, because the research is ecologically valid and application is kept in mind, the potential application of much research on metacognition falls naturally out of the studies used to explore it. Thus, the schoolteacher looking for specific methods to improve metacognitive understanding may find these chapters premature, but the researcher looking to design specific application tools should find these chapters invaluable.

Cambridge University Press

0521801893 - Applied Metacognition

Edited by Timothy J. Perfect and Bennett L. Schwartz

Excerpt

[More information](#)

10 Bennett L. Schwartz and Timothy J. Perfect

REFERENCES

- Bjork, R. A. (1994). Memory and metamemory considerations in the training of human beings. In J. Metcalfe and A. P. Shimamura (eds.), *Metacognition: knowing about knowing*, pp. 185–205. Cambridge, MA: MIT Press.
- (1999). Assessing our own competence: heuristics and illusions. In D. Gopher and A. Koriati (eds.), *Attention and performance XVII. Cognitive regulation of performance: interaction of theory and application*. Cambridge, MA: MIT Press.
- Bothwell, R. K., Deffenbacher, K. A., and Brigham, J. C. (1987). Correlation of eyewitness accuracy and confidence: optimality hypothesis revisited. *Journal of Applied Psychology*, 72, 691–695.
- Flavell, J. H. (1979). Metacognitive and cognitive monitoring: a new area of cognitive developmental inquiry. *American Psychologist*, 34, 906–911.
- Gruneberg, M. M., and Monks, J. (1974). “Feeling of knowing” and cued recall. *Acta Psychologica*, 38, 257–265.
- Hacker, D. J. (1998). Definitions and empirical foundations. In D. J. Hacker, J. Dunlosky, and A. C. Graesser (eds.), *Metacognition in educational theory and practice*, pp. 1–24. New Jersey: Lawrence Erlbaum Associates.
- Hacker, D. J., Dunlosky, J., and Graesser, A. C. (1998). *Metacognition in educational theory and practice*. New Jersey: Lawrence Erlbaum Associates.
- Hart, J. T. (1965). Memory and the feeling-of-knowing experience. *Journal of Educational Psychology*, 56, 208–216.
- (1967). Memory and the memory-monitoring process. *Journal of Verbal Learning and Verbal Behavior*, 6, 685–691.
- Herrmann, D. J. (1998). The relationship between basic research and applied research in memory and cognition. In C. P. Thompson, D. J. Hermann, D. Bruce, J. D. Read, D. G. Payne, and M. P. Toglia (eds.), *Autobiographical memory: theoretical and applied perspectives*, pp. 13–27. New Jersey: Lawrence Erlbaum Associates.
- Kuhn, D. (2000). Metacognitive development. *Current Directions in Psychological Science*, 9, 178–181.
- Metcalfe, J. (1993). Novelty monitoring, metacognition, and control in a composite holographic associative recall model: interpretations for Korsakoff amnesia. *Psychological Review*, 100, 3–22.
- Neisser, U. (1978). Memory: what are the important questions? In M. M. Gruneberg, P. Morris, and R. L. Sykes (eds.), *Practical aspects of memory*, pp. 3–24. London: Academic Press.
- Nelson, T. O. (1988). Predictive accuracy of feeling of knowing across different criterion tasks and across different subject populations and individuals. In M. Gruneberg, P. Morris, and R. Sykes (eds.), *Practical aspects of memory: current research and issues, Volume 1*, pp. 190–196. New York: Wiley.
- (1993). Judgments of learning and the allocation of study time. *Journal of Experimental Psychology: General*, 122, 269–273.
- (1996). Consciousness and metacognition. *American Psychologist*, 51, 102–116.
- Nelson, T. O., Dunlosky, J., Graf, A., and Narens, L. (1994). Utilization of metacognitive judgments in the allocation of study during multitrial learning. *Psychological Science*, 5, 207–213.