
Metacognitive monitoring and control processes in remembering

Asher Koriat

The recent upsurge of interest in memory accuracy and distortion has brought about a change in the dominant metaphor of memory—from a storehouse metaphor in which memory is assessed primarily in terms of the quantity of information that is retained and remembered (Roediger 1980) to a correspondence metaphor in which memory is evaluated in terms of its fit with past events (Koriat and Goldsmith 1996a). The correspondence conception has been inspired by many real-life phenomena, and is apparent in such varied topics and paradigms as eyewitness testimony, autobiographical memory, spatial memory, memory distortions and fabrications, false memory, memory illusions and schema-based errors (see Koriat *et al.* 2000).

The correspondence conception has spawned a more active view of the rememberer than that implied by the storehouse conception. Remembering is seen as an intentional, goal-directed attempt to reconstruct a memorial representation from a variety of pieces of information that come to mind, negotiating between different considerations in attempting to arrive at a faithful account of previously encountered events (Schacter *et al.* 1998; Koriat 2000). The notion of remembering has been extended to include a variety of *metacognitive processes* that mediate accurate memory performance, including source monitoring, the monitoring of one's own knowledge and performance, and self-controlled decisional processes used to avoid memory errors or to escape illusions of familiarity (Jacoby *et al.* 1989; Koriat and Goldsmith 1996b; Johnson 1997). A consideration of these processes, in turn, engendered a concern with the *phenomenal qualities* of recollective experience (Koriat 2007), qualities which attracted little interest in traditional quantity-oriented memory research. No longer mere epiphenomena, these qualities are seen as an integral component of the process of remembering (e.g. Johnson 1997; Schacter *et al.* 1998) and, in particular, as diagnostic clues for distinguishing genuine from false memories (e.g. Conway *et al.* 1996). Indeed, various subjective qualities of remembering have been examined in connection with

reality and source monitoring, autobiographical memories, false recall, post-event misinformation, flashbulb memories and eyewitness testimony. The assumption is that the quality of phenomenal experience may be critical in leading the rememberer to identify the source of a memory and accept it as true, and hence may play a critical role in mediating memory accuracy.

Monitoring and control processes operate throughout the various phases of remembering. They are involved in deciding whether to initiate a memory search, what type of search and retrieval process to use, when to terminate the retrieval process and whether or not to report the retrieved information, as well as at what level of precision or coarseness to convey it. Such processes are integral components of the overall remembering process, influencing its course and the quality of its products. Traditional memory research generally avoided addressing person-controlled memory processes, perhaps because the operation of these processes was seen to conflict with the desire to achieve strict experimental control.

Consider, for example, a person on the witness stand who has sworn to 'tell the whole truth and nothing but the truth'. To meet this oath, the person must monitor the accuracy of information that comes to mind before deciding whether to report it or not. Performance is generally consistent with a simple model (Koriat and Goldsmith 1996*b*; Goldsmith *et al.* 2002) in which rememberers first assess the probability that a candidate response is correct (monitoring) and then volunteer it only if its assessed probability of being correct passes a pre-set criterion. Otherwise, if there is a coarser grained answer whose assessed-probability-correct passes the criterion, this coarser answer will be provided (*control of grain size*). If not, the item will be withheld entirely (*control of report option*). The dynamics that guides the control processes is an *accuracy-informativeness trade-off*. Assuming that monitoring is relatively accurate, setting a higher report criterion results in a higher proportion of correct answers out of those reported (i.e. *output-bound accuracy*; see Koriat and Goldsmith 1996*b*), but the increase in accuracy generally comes at the cost of reduced informativeness—fewer items of information may be volunteered (*report option*), and those that are volunteered tend to be less precise (*grain size*). Thus, the rememberer must weigh the competing incentives for accuracy and informativeness in order to arrive at the appropriate control policy for a particular memory situation. Several findings support this model. First, participants place complete faith in their subjective feelings (the within-participant correlation between the tendency to report an answer and subjective confidence in its correctness averaged over 0.95!), and do so even when subjective confidence is quite undiagnostic of accuracy (Koriat and Goldsmith 1996*b*). Secondly, participants strategically adapt their control policy to fit

differing priorities for memory accuracy and quantity, adopting a stricter report criterion when accuracy incentives are stronger. Thirdly, the control over memory reporting generally allows participants to boost the accuracy of what they report, and even more so as the incentive for accuracy increases. Finally, the improved accuracy generally comes at the expense of memory quantity performance, but the extent of the quantity–accuracy trade-off depends critically on monitoring effectiveness, i.e. on the extent to which the person’s confidence judgments discriminate between correct and incorrect answers. This implies that eyewitnesses cannot ‘tell the whole truth’ and also ‘tell nothing but the truth’, except in the extreme case when the subjective monitoring of the correctness of their answers is perfect.

In addition to report option, rememberers can boost accuracy by regulating the grain size of their report, for example reporting ‘late in the afternoon’ (which is more likely to be correct) rather than ‘at 16:30’ (Goldsmith *et al.* 2002, 2005). Neisser (1988) observed that in free-narrative memory reporting, participants tend to provide answers at a level of generality at which they are ‘not likely to be mistaken’. Of course, more coarsely grained answers, while more likely to be correct, are also less informative. When participants are allowed to control the grain size of their report, they do so in a strategic manner, sacrificing informativeness (precision) for the sake of accuracy when their subjective confidence in the more precise-informative answer is low, and taking into account the relative payoffs for accuracy and informativeness (Goldsmith *et al.* 2002, 2005).

Of course, whether the remembering occurs in legal settings or in more mundane everyday situations in which people recount their memories to others, there are certainly other functional goals beyond accuracy that guide the remembering process. For example, people may generally strive to recall accurately, but in some cases the desire to make a good impression, to be entertaining or self-consistent may be more important (e.g. Neisser 1996; Conway 2005). Such goals presumably interact with—and may sometimes over-ride—the goal of accuracy.

How do people monitor the veracity of their memories? Several cues have been discussed in the metacognitive literature, such as the ease with which information comes to mind (Koriat 2007). In the source-monitoring framework (Johnson 1997), phenomenal cues such as vividness and perceptual detail are assumed to support reality monitoring. In the attributional approach to memory (e.g. Jacoby *et al.* 1989), illusions of memory are seen to result from the misattribution of fluent processing to the past. Others have proposed more specific mechanisms for screening out false memories (e.g. Dodson and Schacter 2002; Brainerd *et al.* 2003). At the same time, there is increasing

interest in strategic processes that prevent false information from coming to mind in the first place (e.g. Jacoby *et al.* 2006) rather than by screening out false memories after they come to mind.

The consideration of the monitoring and control processes that operate in remembering can shed new light on many memory phenomena and raise new questions. Among these is the observation that although memory quantity performance decreases over time, memory accuracy performance can sometimes be quite stable, possibly because people strategically increase the coarseness of the information that they report as the retention interval increases (Goldsmith *et al.* 2005).

I have argued that the emerging accuracy-oriented conception of remembering leads to a greater concern with (1) the active role of the rememberer in guiding the process of remembering, in accordance with personal and situational goals; (2) the mechanisms that contribute to memory accuracy and distortion; and (3) the role of subjective experience and phenomenal cues. It should be noted, however, that any act of deliberate remembering also involves automatic activations of memories and a complex interplay between top-down and bottom-up processes (Koriat 2000). Furthermore, remembering can also occur involuntarily, with memories emerging spontaneously and unexpectedly into consciousness, sometimes even against one's own will, as with post-traumatic memories. Such nondeliberate memories also fall under the concept of remembering because of their phenomenological qualities.

Are the metacognitive monitoring and control processes emphasized in this chapter uniquely human? Although some rudimentary aspects of accuracy-oriented metacognitive regulation may be found in some animals (Smith *et al.* 2003), this is still an open question that deserves further scrutiny (Goldsmith and Koriat 2003).

Acknowledgment

This chapter is the product of discussion with Morris Goldsmith, and reflects our shared views on this topic.