Chapter

HOW BELIEFS IN THE ABILITY TO IMPROVE INFLUENCE ACCURACY IN AND USE OF METACOGNITIVE JUDGMENTS

Joyce Ehrlinger and Ainsley Mitchum
Florida State University, USA

Research on metacognition has often centered upon the purely cognitive as researchers demonstrate cognitive features of metacognitive knowledge (e.g. Dunning, Johnson, Ehrlinger, and Kruger, 2003; Ehrlinger and Dunning, 2003; Koriat and Bjork, 2006; Koriat, 2008) and qualities of metacognitive experiences (e.g. Kelley and Lindsay, 1993; Kelley and Jacoby, 1996; Koriat, Ma'ayan, and Nussinson, 2006). In the present chapter, we argue that this cognitive focus has resulted in a neglect of the fascinating role that peoples' beliefs and, consequently, motivations can play in metacognition. In particular, we will discuss several lines of research that demonstrate how a belief that one has the ability to improve can be very powerful and motivate individuals to learn about their faults as well as their strengths. This motivation to gain feedback, we argue, results in more accurate metacognitive views of one's abilities, relative to those who believe that abilities are fixed and stable over time. We will discuss how an individual's beliefs in the ability to improve their performance on domain-specific tasks, their overall level of intelligence and their ability to remember can impact motivation, influence the quality of metacognitive knowledge and also impact the way in which metacognitive beliefs drive behavior.

One reason that motivation can be such a powerful factor for metacognition is that knowing oneself well is not necessarily an individual's only, or even primary, goal. Whereas some individuals may highly value objective feedback because of its greater utility for learning, others might value maintaining a positive view of the self, even if that view is not accurate. The degree to which self-knowledge is accurate likely depends upon which goal is most prominent. We argue that a particularly fruitful way of learning about metacognition generally is to focus upon how motivation can influence metacognitive accuracy by inspiring behaviors that produce more or less accurate views. We will describe a number of studies that use beliefs in the ability to improve as a tool to discover precisely what behaviors and

processes contribute to differences in accuracy of self-estimates and in how metacognitive knowledge is used.

THEORIES OF THE ABILITY TO IMPROVE ON AN UNFAMILIAR TASK

The first evidence that beliefs in the ability to improve can impact the motivation to know oneself well stems from a simple study in which an unfamiliar task, purported to be a measure of the fictional ability of integrative orientation, was described in one of two ways. Dunning (1995) told some participants that this fictional ability was quite changeable and that, with practice, one could "dramatically improve" their level of integrative orientation. Others were told that the ability was quite stable and one that some possessed but others did not possess. Participants then completed a series of remote associates problems described as a test of integrative orientation that was rigged such that they would perform very well or very poorly. The primary dependent measure came when participants were asked to take a second test and to choose between one that offered the possibility of clear and immediate feedback on their performance and one on which the experimenter was not allowed to give them feedback. Thus, we can see how a belief that an ability is fixed or changeable, coupled with an experience of success of failure on a test of this ability, influences the desire to garner accurate feedback about this ability.

Preferences for receiving feedback depended very much on whether one was told that the fictional ability of integrative orientation was a stable trait or one that could be improved with practice. Those told that the ability was stable were more interested in feedback after experiencing success than after experiencing failure, particularly when the ability was described as very important to future success. Those who were told that they could improve their level of integrative orientation, however, showed a very different pattern. If the trait was described as important, they wanted to hear accurate feedback regardless of whether they had performed well or poorly on the first test.

Thus, the belief that one could improve his or her level of integrative orientation inspired a motivation to get accurate feedback, even if it turned out to be negative, presumably in order to learn how to improve. We argue that this motivation results in getting more frequent and more accurate feedback and, consequently, leads to more accurate metacognitive beliefs. More recent work exploring beliefs in the ability to improve one's level of intelligence provides direct evidence of this link between openness to negative feedback and accuracy in self-assessments.

THEORIES OF INTELLIGENCE AND METACOGNITION

People differ in the extent to which they believe central features of the self, such as intelligence, are malleable (for review, see Dweck, 1999). Some individuals hold an incremental theory of intelligence, one characterized by the belief that a person's intelligence is malleable and able to be developed over time, while others hold an entity theory, one characterized by the belief that a person's intelligence is unchangeable. Dweck and colleagues have amassed a substantial amount of evidence suggesting that the theory one

holds has important implications for goal-setting, (Dweck and Leggett, 1998) reactions to adversity (Hong, Chiu, Dweck, Lin and Wan, 1999), attention allocation (Plaks, Stroessner, Dweck, and Sherman, 2001), achievement and self-esteem (Henderson and Dweck, 1990; Robins and Pals, 2002).

Because incremental theorists believe intelligence is changeable they are motivated to learn and improve their own intelligence. This orientation toward learning, we argue, results in being more open to negative feedback and, consequently, more accurate views of their current ability level. By contrast, entity theorists, believing that their intelligence cannot be improved, are likely to be more motivated to maintain a positive view of their intelligence and to avoid feedback that might be inconsistent with that self-view. Indeed, recent research from our lab demonstrates that one's theory of intelligence can have important consequences for self-assessment (Ehrlinger, Dweck, and Mitchum, 2009). In this study, entity and incremental theorists took a 10-item test of antonym problems and then estimated how well they performed on that test. On average, participants displayed a degree of overconfidence nearly identical to that in past research (Ehrlinger and Dunning, 2003). A closer look, however, shows a sharp difference in accuracy of estimates between incremental and entity theorists. Those who believed in the possibility of improving one's intelligence were far more accurate both in estimates of percent correct and of relative performance than were those who believed intelligence is fixed.

Entity theorists might hold less accurate views of their abilities by virtue of orienting their world in such a way that they rarely encounter negative feedback. Whereas incremental theorists are more often drawn to challenging tasks that could result in failure, but also present an opportunity for learning, entity theorists tend to prefer tasks that allow them to appear smart, demonstrating abilities they already possess rather than seeking new knowledge (Dweck and Leggett, 1988; Hong, et al, 1999). A host of evidence suggests that entity theorists, compared to incremental theorists, tend to see negative feedback as more threatening because they believe that this feedback speaks to their underlying ability level (e.g. Hong, Chiu, Dweck, Lin, and Wan, 1999). Consequently, entity theorists rob themselves of information from which to gain self-insight by avoiding situations that might lead to negative feedback. This tendency to choose tasks that promise success and positive feedback over tasks that might be accompanied by negative feedback will leave entity theorists with inflated perceptions of their abilities relative to incremental theorists, who more often experience failure on their road towards learning.

Recent research suggests that, even for tasks in which entity theorists cannot avoid the possibility of negative feedback, they allocate less attention to that feedback and, instead, focus on those portions of the task on which they succeed. Plaks, et al, (2001) demonstrated that participants who held an entity view of intelligence paid less and less attention to performance information as it became less and less consistent with their expectations about another student's ability. Moreover, entity theorists only incorporated inconsistent information into future predictions when there was an overwhelming amount of it. Incremental theorists made predictions regarding the student's likely future performance in a way closely connected to the proportion of expectation-inconsistent information provided. Ehrlinger, Dweck, and Mitchum (2009) have shown that this same pattern applied to information about the self, such that those possessing an entity theory regarding intelligence paid more attention to information consistent with a positive self-view and less attention to

information that is negative than did incremental theorists. As a consequence, entity theorists were able to maintain positive views of self even in the face of negative feedback.

In one study, we asked incremental and entity theorists to take a short test made up of a mix of particularly easy and particularly difficult problems. As expected, theories of intelligence predicted the way people allocated their attention, as measured by time spent on different task aspects. Incremental theorists, motivated by a goal to learn, allocated attention to hard and easy aspects of the task. As a result, they made relatively accurate judgments about the quality of their performance. Entity theorists, in contrast, focused primarily on easy aspects of the task, giving less attention to difficult aspects. As a result, they made overconfident judgments of their performance.

We also directly explored the role of focusing on difficult and easy problems on confidence for incremental and entity theorists (Ehrlinger, Dweck and Mitchum, 2009). After completing a short trivia test made up of easy and difficult problems, we asked participants to go back through those problems and perform a short task for each. In one condition, we directed participants to focus on the easy problems by asking them to recopy the text of those problems, being careful to copy them exactly and to proofread their work to ensure that they have done so perfectly. These individuals were also asked to look back at difficult problems but only for the time necessary to tell us the color of the text. Participants assigned to the "focus on hard" condition were less lucky. We asked them to carefully recopy the text of the difficult trivia problems. While these participants also reviewed the easy problems, we asked them to simply tell us the text color and then move on to the next task. This manipulation resulted in a drop in entity theorists' confidence and judgments of performance, which were now as accurate as those offered by their incremental theorist peers.

While the above studies are illustrative, they also represent only correlational evidence of a relationship between theories of intelligence and confidence. To explore the causal role played by theories of intelligence, we assigned participants to read one of two articles designed to manipulate their beliefs regarding the modifiability of intelligence (Ehrlinger, Dweck & Mitchum, 2009). The entity article argued that "the environment plays an important role only during the first three years of life, after which — barring brain damage — it seems to have almost no influence on intelligence whatsoever." It backed this statement up with (fictional) examples of both anecdotal and experimental evidence. Other participants read an incremental article that argued "intelligence has a minimal genetic component. Although people may be born with a given level of intelligence, our findings show that they can increase their IQ by up to 50 points." This article also included fictional examples of anecdotal and experimental evidence to convince participants that intelligence is, indeed, changeable. Participants then took a short test and estimated how well they performed.

Just as in the previous studies involving those who came into the lab holding an incremental or an entity belief, participants convinced of the incremental and entity view in the lab showed reliable differences in how they allocated their attention and in levels of confidence in their test performance. Teaching individuals the view that intelligence is fixed led them to allocate their attention in biased ways, spending longer periods of time reviewing easy problems and less time on more difficult problems than their entity counterparts. As a result, these individuals offered overconfident estimates of their test performance. In contrast, teaching individuals the view that intelligence is a changeable trait, led them to allocate their attention to both easy and difficult aspects of a task and, consequently, to make relatively accurate evaluations of the quality of their test performance.

Thus, it seems that a belief that intelligence is fixed leads individuals to allocate their attention to aspects of a task that inspired overconfidence in their task performance. Across a variety of tasks those who come to the lab believing that intelligence is fixed, or who read an article meant to convince them of this view, show considerably more overconfidence than those with the view that intelligence is changeable. Because these individuals are more motivated than their incremental counterparts to believe that they are performing well, they allocated their attention in ways that allowed them to maintain this belief. Those with a view that intelligence can be acquired, in contrast, more often seek to improve and, as such, allocate their attention in a less biased fashion. These individuals, then, were left with less biased impressions of how well they performed. The view that intelligence is fixed, then, introduces error into self-judgments by virtue of inspiring behaviors, such as allocating attention in biased ways, that allow them to hold overly positive views of their performance.

THEORIES OF MEMORY AND METACOGNITION

The research described thus far demonstrates how a belief in the ability to improve, with respect to an unfamiliar fictional ability and with respect to one's overall level of intelligence, leads individuals to be relatively open to negative feedback and, consequently, make more accurate self-assessments. Recent research exploring beliefs in the ability to improve one's memory, often through the use of cognitive strategies, can impact the way in which people use metacognitive knowledge when determining how to approach a task (Hertzog, Lineweaver, and McGuire, 1999; Serra, Hertzog, and Dunlosky, 2008).

The impact of beliefs on metacognitive judgments and memory performance has been the focus of a number of studies on the aging and memory literature. As a group, it has been well established that older adults both perform more poorly on memory tasks and have less confidence in their memory ability than younger adults (Salthouse, 1991; Lachman, Bandura, Weaver, and Elliott, 1995). Because memory ability does decline with age, one can distinguish between several types of beliefs regarding the ability to change one's memory ability. For example, one could explore the impact of an individual's belief in the ability to improve one's memory skill and, separately, in the ability to slow the rate of age-related decline in memory skill. Lachman and colleagues have developed a scale, conceptually similar to the measures described in the previous section, that measures several beliefs related to the degree to which one can control one's memory ability (Lachman, Bandura, Weaver, and Elliott, 1995), Indeed, older adults also tend to believe they have less control over their memory performance than do younger adults. As a result, they often are less likely to choose to use effortful memory strategies that would improve performance (Devolder and Pressley, 1992; Hertzog, McGuire, and Lineweaver, 1998; Kuypers and Bengston, 1973; Lachman et al., 1995; Lineweaver and Hertzog, 1998). Supporting this view, several studies have shown that those who believe they have greater control over their memory tend to perform better on memory tests (Berry and West, 1993; Devolder and Pressley, 1992; Hertzog, Dixon, and Hultsch, 1990; Hertzog and Hultsch, 2000; Lachman, Andreoletti, and Pearman, 2006). Subsequent studies have found that the relationship between beliefs that one can control one's memory ability and performance on memory tasks may be mediated by differential use of cognitive strategies that have been shown to be effective aids for memory (Lachman and

Andreoletti, 2006). Older adults who feel they have more control over their memory performance are more likely to choose effective memory strategies, which leads to better memory performance.

The effect of beliefs about memory control on monitoring accuracy is less clear in part because it has been explored only indirectly in studies whose primary focus is the age differences in both memory control beliefs and performance on memory tasks. We know that older adults often believe they have less control over their memory but there does not seem to be a consistent effect of age on metacognitive accuracy. In some cases, older adults are as accurate as younger adults in self-assessments of their memory performance (Hertzog, Kidder, Powell-Moman, and Dunlosky, 2002). Other studies however show either greater overconfidence (Perlmutter, 1978; Bruce, Coyne, and Botwinick, 1982; Devolder, Brigham, and Pressley, 1990) or underconfidence (Hertzog, Dixon, and Hultsch, 1990; McDonald-Miszczak, Hunter, and Hultsch, 1994; Hertzog, Saylor, Fleece, and Dixon, 1994) among older adults, compared to younger adults.

Although there is not a clear relationship between metacognitive accuracy and memory control beliefs, there is an age difference in the degree to which individuals trust and base decisions upon their metacognitive judgments. In multiple trial learning experiments, older adults' item-by-item judgments predicted their study time for individual items to a lesser extent than did younger adults' judgments (Dunlosky and Connor, 1997). These differences in study time were related to overall recall and were seen as a contributing to age-related differences in memory performance. More recent research has suggested that one reason older adults do not make use of their own monitoring judgments is that they are less confident in the accuracy of these judgments, and that this reduced confidence may stem from beliefs about memory efficacy (Serra, Dunlosky, and Hertzog, 2008). Changes in memory efficacy beliefs across the lifespan are well documented, though these changes do not necessarily parallel actual changes in functioning (McDonald-Miszczak, Hertzog, and Hultsch, 1995).

CONCLUSION

Metacognitive research has often focused on more cognitive factors influencing metacognition and devoted little time to the impact of motivation and beliefs. The research reviewed in this chapter, however, showed that beliefs in the ability to improve influence openness to negative feedback (Dunning, 1995; Ehrlinger, Dweck and Mitchum, 2009) and, consequently, the accuracy of metacognitive judgments (Ehrlinger, Dweck and Mitchum, 2009). In addition, beliefs in the ability to improve one's memory influences the degree to which people trust their metacognitive judgments (Serra, Dunlosky, and Hertzog. 2008) and rely on them to determine how long they should study (Dunlosky and Connor, 1997). As such, by ignoring the role of beliefs, metacognitive researchers might be missing an important part of the story. We argue for greater attention to individual differences for two reasons. First, by not exploring how metacognition might differ across individuals, we might present an incomplete, and for some individuals, inaccurate view of their metacognitive skills. Second, and even more interesting to us, exploring how and why individuals differ in metacognitive skills gives us insight into the roots of metacognition and what qualities lead to greater self-knowledge.

More generally, the work summarized in this piece suggests that there are both motivational and cognitive factors that introduce error into metacognitive judgments. While a simple desire to believe that one has performed well may not be enough to produce overconfident assessments of performance, it does seem to inspire the sort of behaviors that make overconfidence possible. This work also suggests a means of inspiring more accurate impressions of one's performance. Offering incentives for people to be accurate does not seem to lead to more accurate self-assessments. Even when offered $100 as an incentive for making accurate judgments of how well they had performed on a task, individuals were not able to improve their accuracy at all (Ehrlinger, Johnson, Banner, Dunning, and Kruger, 2008). Instead, one must change the behaviors that people engage in to maintain positive beliefs. Recent work in our lab has demonstrated two ways to improve self-assessments (Ehrlinger, Dweck, and Mitchum, 2009). First, forcing entity theorists to attend to the times that they are having difficulty and reducing their focus on times when they are performing well leads to a dramatic drop in overconfidence. While this manipulation was successful in improving self-assessments, it is not one that is easily imported to real world tasks. However, our second means of improving the accuracy of self-assessments is quite generalizable. Teaching participants that intelligence is something that can be improved upon lead them to allocate their attention in even handed ways and result in more accurate metacognitive judgments.

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