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Overconfidence in children's multi-trial judgments of learning

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ABSTRACT

The underconfidence with practice effect (UWP) refers to the finding that people's judgments of learning shift from overconfidence to underconfidence on and after a first study-test trial (Koriat, Ma'ayan, & Sheffer, 2002). Finn and Metcalfe (2007, 2008) proposed that people show UWP because they use their memory of prior test performance as a cue to make subsequent judgments of learning and inadequately account for new learning (i.e. the Memory for Past Test (MPT) heuristic). In contrast to adults, 3rd and 5th graders' judgments showed persistent overconfidence on and after a first study-test trial. A second experiment tested children's ability to remember their prior test performance. Children's prior performance discriminations were accurate for items that they answered correctly on the prior trial, but were overconfident for items they had answered incorrectly indicating that their continued overconfidence was a result of faulty memory, rather than a failure to use the MPT heuristic.

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1. Introduction

One of the guiding assumptions of theories of self-regulated learning is that people monitor past performance and make use of this information to regulate their future learning (e.g. Baker & Brown, 1984; Pressley, Borkowski, & Schneider, 1987; Pressley & Ghatala, 1989). Knowledge of how well one has previously performed should increase the likelihood of adopting effective and adaptive self-regulatory behaviors in the future. According to Moynahan (1973), "The ability to evaluate one's recall performance most likely is essential for effective memory monitoring, as it would seem difficult, if not impossible, for the subject to assess the effectiveness of a given recall strategy…if he did not know how well he had performed while using that strategy." (p. 246).

Adults are quite accurate in monitoring their past test performance, and can correctly discriminate previously incorrect from previously correct items (Finn & Metcalfe, 2008; Gardiner & Klee, 1976; Robinson & Kulp, 1970). In addition, adults are able to draw on their prior test performance to modify their predictive judgments and encoding strategies on subsequent learning trials (Finn & Metcalfe, 2007, 2008; Gardiner, Passmore, Herriot, & Klee, 1977; Halff, 1977; King, Zechmeister, & Shaughnessy, 1980; LaPorte & Voss, 1974). Children however, are not always able to make good use of their prior test performance to adjust their judgments and study strategies during successive learning trials (e.g. Bisanz, Vesonder, & Voss, 1978; Stipek & Hoffman, 1980; Stipek, Roberts, & Sanborn, 1984). There is some indication that children may remain overly optimistic even after they have had experience and feedback with a task (e.g. Lipko, Dunlosky, & Merriman, 2009; Shin, Bjorklund, & Beck, 2007; but see Lipko, Dunlosky, Lipowski, & Merriman, 2012) a pattern that may be protective against a loss of motivation (Bjorklund, 1997). Lipko et al. (2009) for example, asked preschool children to study 10 pictures, predict how many they would recall and then attempt to recall them. This entire cycle was repeated three times, with new pictures each time. Results showed that the preschooler's recall predictions were overconfident across all three trials, that is, they appeared not to use their recent experience to regulate their confidence about how they would perform on the new list.

Adults, in contrast, do use their prior experiences to regulate their metacognitions. While adults are typically overconfident on a first learning trial, they then shift to underconfidence on subsequent learning trials (e.g. Ariel & Dunlosky, 2011; Finn & Metcalfe, 2007, 2008; Koriat, Sheffer, & Ma'ayan, 2002; Serra & Dunlosky, 2005), a well-studied phenomenon known as underconfidence with practice. In the standard paradigm showing the underconfidence with practice effect, participants study cue target pairs, make judgments of learning (JOLs, predictive judgments about performance on an upcoming test), and then take a cued recall test. The study–judge–test cycle is repeated multiple times with the same list of items, and underconfidence is shown after the first study-test trial. Finn and Metcalfe (2007, 2008) showed that underconfidence with practice results because people rely on their memory of their performance on the prior test to make the subsequent judgments of learning (i.e. the Memory for Past Test (MPT)

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heuristic, and see also Ariel & Dunlosky, 2011; Cosentino, Metcalfe, Butterfield, & Stern, 2007; England & Serra, 2012 and Touron, Hertzog, & Speagle, 2010) and do not adjust for the new learning that has occurred during the subsequent trial.

In the current study, we tested children using the same paradigm as the one in which adults show a shift from overconfidence to underconfidence: In a first experiment, children studied, made item by item JOLs about their upcoming test performance, and were tested on the same list of vocabulary words for three trials. A second experiment tested children's ability to remember their prior test performance. A major objective was to explore children's JOLs over multiple trials to determine if their judgments, like those of adults, would demonstrate underconfidence with practice, or whether, as other research suggests (see e.g. Shin et al. 2007; for a review), they would stay persistently overconfident. The multi-trial paradigm has been extensively explored with adults, with results demonstrating that adults use their prior test experience to regulate their confidence. Thus, the paradigm allowed us to investigate the cues the children use to make their metacognitive judgments, to assess why children might fail to show the shift to underconfidence, and to isolate the locus of the expected overconfidence.

Understanding the source of children's persistent overconfidence even after multiple test trials, is critical if we are to inform educators and students how to evaluate learning more effectively and, consequently, optimize self-directed study. Because overconfidence has been shown to have critical consequences for the choices that students make when they self direct their own learning (Metcalfe & Finn, 2009), persistent overconfidence on the part of children could have adverse consequences. For example, inflated confidence could mislead students into overlooking items and concepts that could benefit from additional study time. This is not a trivial problem, as elementary school children are frequently given deskwork and homework during which time they are expected to effectively regulate their own study processes (Hofferth & Sandberg, 2001, and see also Metcalfe & Finn, 2013).

1.1. Metacognitive markers of the underconfidence with practice effect

The underconfidence with practice effect, repeatedly found with adults in multi-study-test trial experiments (e.g. Finn & Metcalfe, 2007, 2008; Koriat et al., 2002; Serra & Dunlosky, 2005), has been theorized (Finn & Metcalfe, 2007, 2008) to be due to use of the MPT heuristic after the first study-test trial to make JOLs about performance on the current trial. After the first study-test trial, JOLs incorporate information about item specific performance on the prior test. If the participant remembers that they failed to recall a particular item on the immediately past test, they give that item a lower JOL rating than if they remember that they recalled that item on the prior test. Underconfidence occurs if participants incorporate prior performance into their judgments and do not adjust appropriately for the new learning that has occurred in the study trial following the test. JOLs do increase over trials, but not enough to account for the new learning.

Underconfidence with practice is also characterized by changes in both the absolute and the relative accuracy of the metacognitive judgments over trials. The absolute accuracy, or calibration of the judgments, measures how well the mean item-by-item JOLs correspond to mean final test performance and provides an indication of whether a person can estimate their overall recall performance accurately (cf. Gigerenzer, Hoffrage, & Kleinböting, 1991). With repeated study-test trials JOLs display a calibration bias shift from an overestimation to an underestimation of performance. Whether a student's metacognitions are calibrated to their performance has important consequences for learning outcomes, since students study behaviors are closely tied to their metacognitions (Dunlosky & Thiede, 2013; Finn, 2008; Hacker, Bol, & Keener, 2008; Metcalfe & Finn, 2008): When students are overconfident they choose to study fewer items (Metcalfe & Finn, 2008) and their performance suffers (Dunlosky & Rawson, 2012).

Underconfidence with practice is also characterized by an increase in relative accuracy, or resolution, over trials. Resolution is an assessment of how well people can discriminate which items will be remembered and which will be forgotten. Resolution is high when people give low JOLs to items that they will get wrong on the test and high JOLs to items that they will answer correctly.

Along with the MPT heuristic, an anchoring-and-adjustment hypothesis has also been put forward as a companion explanation of the underconfidence component of the underconfidence with practice effect (England & Serra, 2012; Scheck & Nelson, 2005). It should be noted that the account does not attempt to account for the increase in relative accuracy over trials that also characterizes the underconfidence with practice effect. According to an anchoring explanation, people adjust their mean JOLs away from an anchor point. Underconfidence results when people adjust up from a psychological anchor point on the JOL scale but memory performance remains higher than the adjustment (Connor, Dunlosky, & Hertzog, 1997; England & Serra, 2012; Richards & Nelson, 2004; Scheck & Nelson, 2005). Generally, the anchoring explanation posits that people will be overconfident when performance is low (and below the anchor), and under confident when performance is high (and above the anchor). The explanation says that the underconfidence with practice effect is found because on the first learning trial performance is generally low (an overconfidence situation) but over learning trials becomes high (a classic underconfidence situation). Scheck and Nelson (2005) applied this logic to explain the underconfidence with practice effect and England and Serra (2012) have shown that when people are given instructions that the list will be easy as compared to difficult, overall judgments are different, providing evidence that anchoring affects JOLs.

2. The current studies

In Experiment 1 we tested whether Grade 3 and Grade 5 children's multi-trial judgments would show persistent overconfidence or show underconfidence with practice. Our hypothesis, given the large body of work demonstrating children's tendency toward overconfidence (e.g. Lipko et al., 2009; Shin et al., 2007), was that the children would not show underconfidence with practice (hypothesis 1). In contrast to our predictions, however, in a related experiment Lipko et al. (2012) concluded that by the 3rd grade children do show the underconfidence with practice effect. In their study kindergarten, 1st grade and 3rd grade participants were presented with a set of pictures of basic objects (e.g. clock, bug; 10 pictures were used for the kindergarteners and 1st graders, and 16 pictures were used for the 3rd graders). After the study phase, students were asked to make a global judgment about how many pictures they would remember after the pictures were covered. Then the pictures were covered and the students were asked to free recall the names of the pictures. After the recall phase the experimenter told the students how many they had recalled. The same procedure was then repeated immediately with the same set of pictures, in the same order, for a total of three study-test trials. Results showed that the Grade 3 children showed underconfidence on the second trial, but were not significantly underconfident on the third trial. Kindergarten and 1st grade children never showed underconfidence.

Although the results are suggestive, the paradigm used in the Lipko et al. study did not use a standard underconfidence with practice paradigm. It used pictures, not words; it used free recall rather than cued recall (as is normally the case in demonstrations of

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