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Diminishing Adult Egocentrism When Estimating What Others Know

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People often use what they know as a basis to estimate what others know. This egocentrism can bias their estimates of others' knowledge. In 2 experiments, we examined whether people can diminish egocentrism when predicting for others. Participants answered general knowledge questions and then estimated how many of their peers would know the answers. Egocentrism was revealed in the relationship between participants' own accuracy and their estimates of peer accuracy for questions that were new to the experiment. However, when participants encountered the answer to a question asked earlier in the experiment, they showed reduced egocentrism for these old relative to new questions (Experiment 1). Participants were aware that recent experience with answers spoiled their knowledge as a basis for estimating what others know. Consequently, they relied on more objective bases for prediction, which enhanced their ability to discriminate between questions that are easy versus difficult for others (i.e., relative accuracy). In Experiment 2, the relative accuracy of estimates of others' knowledge was also enhanced when experience-based cues were blocked by presenting the answer with the question. Results are discussed in terms of a dual process theory of the bases (e.g., experience vs. theory) people use for predictions for others. Further, we discuss the effects of egocentrism in educational contexts, such as a professor estimating what students know. In sum, our findings show that people can shift away from their own knowledge to diminish egocentrism and to more accurately estimate what others know.

Keywords: judgment, heuristics, experiences (events), egocentrism, metacognition

When we know something, it is difficult to discard our own knowledge to estimate what others know. As a result, predictions are misguided when others' knowledge differs from our own. In educational contexts, professors often report that it is extremely difficult for them to discount their own knowledge when attempting to estimate that of their students. If students' knowledge is overestimated, exams will be more difficult for students than the teacher intended. The goal in our experiments was to explore means of overcoming this type of adult egocentrism. We examined whether people can discount their own knowledge to diminish egocentric biases when predicting others' ability to answer general knowledge questions.

Studies investigating theory of mind development have shown that children are particularly prone to egocentric biases (for a review, see Royzman, Cassidy, & Baron, 2003). Young children have difficulty differentiating between what they know and what others know (Taylor, Esbensen, & Bennett, 1994; Wimmer &

Perner, 1983). For example, if 3-year-old children learn that a box labeled with a picture of cookies actually contains crayons, they guess that another child would know that the box contains crayons without opening it.

Although adults are typically able to overcome egocentrism of the sort observed in theory of mind tasks (e.g., Birch & Bloom, 2003; see also Epley, Morewedge, & Keysar, 2004), they continue to show egocentrism in other situations. When adults have knowledge that is not shared by others, they overestimate others' ability to identify public figures and urban landmarks (Fussell & Krauss, 1991, 1992) as well as ambiguous objects (Bernstein, Atance, Loftus, & Meltzoff, 2004; Harley, Carlsen, & Loftus, 2004). Further, adults who know the outcome of an event overestimate the likelihood that others would or should have predicted that outcome before the event occurred (i.e., hindsight bias; see Hawkins & Hastie, 1990, for a review; Fischhoff, 1975). Adults also overestimate the extent to which others share their values, beliefs (i.e., the false consensus effect; Ross, Greene, & House, 1977; see Marks & Miller, 1987, for a review), and emotional states (Keysar, 1994). Adult egocentrism is particularly evident when people use their own knowledge as a basis for estimating others' factual knowledge. Most relevant to the experiments reported here, Nickerson, Baddeley, and Freeman (1987) found that estimates of how many other students could answer particular general knowledge questions were biased by whether the participants themselves could answer the questions (see also Jameson, Nelson, Leonesio, & Narens, 1993). Participants also based their predictions for others on their confidence in their own answers, predicting highest peer accuracy for questions they answered with highest confidence.

The use of one's own knowledge as a basis for predicting what others know tends to be error prone because of a failure to take into

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account unshared knowledge (Nickerson, 1999). These errors might be particularly common for knowledge that was recently acquired. When participants had recently encountered answers to general knowledge questions, they were more accurate (Blaxton, 1989; Hamann, 1990) and faster in answering those old questions than new questions (Kelley & Lindsay, 1993). The ease of generating the answer is misattributed to qualities of the question itself rather than to relevant recent experience. As another example of such egocentrism, participants judged an ambiguous object as easier for others to identify if they had recently learned the object's identity (Bernstein et al., 2004; Harley et al., 2004). Likewise, participants rated anagrams (e.g., *fscar*) as being easier for others to solve than new anagrams when they had recently encountered the solution (*scarf*; Kelley & Jacoby, 1996).

Under some circumstances, adults acknowledge and attempt to correct for egocentrism in their estimates for others (Epley & Gilovich, 2001, 2006; Epley, Keysar, Van Boven, & Gilovich, 2004; Epley, Morewedge, & Keysar, 2004; Kruger, 1999). Accordingly, we might expect adults to be able to diminish egocentrism when they recognize that their own knowledge may not be a valid predictor of what others know. In the current experiments, we examined whether participants diminish egocentrism when they recognize that their recent experience with answers to questions spoils their own knowledge as a basis for estimating what others know. An additional goal in the current research was to better understand the psychological processes involved in diminishing egocentrism.

One possible means of diminishing egocentrism involves using one's own knowledge and experience as a starting point or anchor for estimating what others know, then adjusting this estimate to account for unshared knowledge (e.g., Epley & Gilovich, 2001, 2006; Epley, Keysar, et al., 2004; Epley, Morewedge, & Keysar, 2004; Kruger, 1999; Nickerson, 1999). Based on Tversky and Kahneman's (1974) "anchoring-and-adjustment heuristic," Epley and colleagues (Epley & Gilovich, 2001, 2006; Epley, Keysar, et al., 2004; Epley, Morewedge, & Keysar, 2004) suggest that both young children and adults use an egocentric, experience-based anchor to estimate what others know. However, only adults attempt to correct for this egocentrism by serially adjusting their estimates away from the anchor to accommodate differences between what they know and what others know. Estimates of others' knowledge remain egocentric because people do not sufficiently adjust away from the anchor. Although the type of information that informs the adjustment process is not well specified, Epley, Keysar, et al. (2004) suggest that the process involves a series of distinct mini-adjustments, with an evaluation after each to determine whether the new estimate captures what other people know. As such, anchoring and adjustment is an effortful and time-consuming process. Consistent with this view, Epley, Keysar, et al. (2004) found that people were slower to indicate that others' perceptions would be different rather than similar to their own. Further, egocentric biases increased with time pressure and decreased with incentives to be accurate. Thus, diminishing egocentrism by anchoring and adjustment is likely to produce slower estimates of what others know because it involves late correction following an initially egocentric estimate.

An alternative means of diminishing egocentrism involves a preemptive shift to consider qualitatively different information when estimating what others know, such as an analytic theory of

item difficulty, instead of their own subjective experience with the item (Kelley & Jacoby, 1996; Koriat & Levy-Sadot, 1999). Theory-based judgments are based on a deliberate analysis of declarative content, such as prior knowledge and beliefs about objective qualities of the question itself (Kelley & Jacoby, 1996; Koriat & Bjork, 2006; Koriat, Nussinson, Bless, & Shaked, 2008). The predictive value of theory-based judgments is determined by the validity of the beliefs used to analyze the question. Thus, people may be able to diminish egocentrism by adopting a different, more analytic approach to evaluating item difficulty.

Kelley and Jacoby (1996) demonstrated the importance of theory-based judgments by preventing participants from using their own experience with answering questions as a basis for predicting for others. The solution word was presented along with an anagram (e.g., *scarffscar*), and participants were asked to judge how difficult it would be for others to solve the anagram when the solution was not provided. Results revealed that being deprived of the subjective experience of solving the anagram caused participants to shift from experience-based judgments to theory-based judgments of anagram difficulty. In a rather surprising finding, this shift away from subjective experience as a basis for judgment actually decreased the accuracy of predictions for others. A theory-based judgment of anagram difficulty relies on objective qualities of the anagram itself or a rule about characteristics of the solution word (e.g., low-frequency words are more difficult to generate). People may have trouble constructing a good theory about the objective characteristics that make an anagram difficult to solve. The accuracy of their predictions for others would be quite poor if they were not using a valid theory. Kelley and Jacoby concluded that spoiled subjective experience was better than a bad theory when judging the difficulty of anagrams for others.

In contrast to anagrams, other materials might be far richer in the objective bases they offer for judgments of difficulty. For example, general knowledge questions (e.g., "Which playwright wrote *A Streetcar Named Desire*?") carry potential diagnostic cues about their base-rate difficulty. Cues about the general domain of the question, such as the popularity of theater among peers, suggest how many peers would know the name of any playwright. Further, prior knowledge that this play is required reading in high school suggests that this particular playwright is relatively well known. These cues within the question are available even if the correct answer is unknown (Metcalf, Schwartz, & Joaquim, 1993; Reder & Ritter, 1992). Thus, theory-based judgments may be less accurate than experience-based judgments of difficulty only when applied to impoverished materials that are not susceptible to analysis. When participants are asked to estimate peers' knowledge with more complex materials, such as general knowledge questions, they may diminish egocentrism and improve the accuracy of their estimates by shifting to a theory-based judgment of peers' knowledge.

Overview of Current Experiments

In the current experiments, we examined effects of recent experience on egocentrism in estimating what others know. Participants were presented with correct answers to general knowledge questions that they would later encounter. After a short delay, participants answered general knowledge questions and estimated the percentage of their peers that would know the correct answer

after each question. The general knowledge questions included new questions as well as questions whose answers had been recently encountered (i.e., old questions). We expected that recent experience with answers would increase participants' ease and accuracy of later answering the questions. We examined whether participants would diminish egocentrism in their estimates of what others know when their own knowledge was biased by recent experience.

Our primary measures of egocentrism directly explored the relationship between participants' own performance and their estimates of peer performance with fine-grained analyses at the question level. First, we examined whether estimates of peers' ability to answer a general knowledge question were biased by participants' own ability to answer the questions (e.g., Nickerson et al., 1987). If participants use their own knowledge to estimate others' knowledge, egocentrism would be evidenced by a strong correlation between each participant's own accuracy and his or her predictions of others' accuracy across questions. Second, we examined the relationship between estimates of peer accuracy and the ease with which the answer came to mind for the participant (i.e., retrieval fluency as measured by response time). Participants may attribute the ease of retrieving an answer to the difficulty of the question itself (e.g., Kelley & Jacoby, 1996). If so, egocentrism would be evidenced by a strong negative correlation between participants' response time to answer questions and their estimates of peer performance across questions.

Further, we also investigated the speed with which participants estimated others' performance on the general knowledge questions to get a better understanding of the psychological processes involved in diminishing egocentrism. If participants diminish egocentrism for old questions by serially adjusting their estimates from an egocentric anchor (Epley, Keysar, et al., 2004), they should be slower to make their peer estimates for old questions than new questions because more adjustment is required. In contrast, if participants shift to a different, theory-based approach to estimate others' knowledge for old questions, we would not necessarily expect slower estimates for old than new questions.

Finally, we also examined the accuracy of participants' estimates of others' performance on the general knowledge questions. That is, did prior experience with the answer to a question influence people's ability to predict peers' performance on the same questions? Accuracy of peer estimates can be assessed in two ways. First, the absolute accuracy of peer estimates is a calibration measure of the difference between participants' predicted peer accuracy and the observed accuracy when the question was new to the experiment. Returning to our example of a professor evaluating exam questions, high absolute accuracy would be analogous to the professor being able to estimate precisely how many students would get a particular question right (e.g., 73%). Second, the relative accuracy of estimates of others' knowledge reflects the ability to discriminate between questions that will be easy or difficult for others. Many professors grade exams on a curve or award grades based on performance relative to all other individuals rather than performance relative to an absolute standard. A measure of relative accuracy may be more important when considering which questions the professor will include on the exam. Further, it is conceivable that diminishing egocentrism may influence absolute and relative accuracy in different ways. For example, if participants shift to theory-based analysis of old questions, they

may tend to overestimate the ease of questions overall, resulting in poorer calibration. However, the information retrieved in theory-based analyses could enhance fine-grained discrimination of comparative difficulty across questions, which would enhance relative accuracy.

Given previous research (Bernstein et al., 2004; Kelley & Jacoby, 1996), we might expect participants to base their estimates for others on their own performance with old questions if they do not recognize that their knowledge of answers was informed by recent experience. If so, we would expect a strong relationship between participants' own performance and estimates of peer performance for both old and new questions. However, recent experience was expected to increase the amount of participants' knowledge that would not be shared by their peers. Consequently, if participants use their own performance to estimate others' performance for old questions, the relative accuracy of peer estimates should be worse for old than new questions.

We expected that estimates of what others know about new questions would be largely based on participants' own knowledge of the answer (e.g., Jameson et al., 1993; Nickerson et al., 1987). However, for old questions, we expected participants to take into account the effect of their recent encounter with the answer and shift to a more objective basis for predicting the performance of others. Accordingly, we expected that participants would diminish egocentric biases in estimating what others know for old questions. Reduced egocentrism would be evidenced by weaker correlations between participants' own performance and their estimates of peer performance. Given the rich set of potential cues afforded by general knowledge questions, theory-based estimates for others may be better predictors than experience-based estimates of others' accuracy. Accordingly, a good theory would be better than spoiled subjective experience when estimating what others know about general knowledge questions.

In sum, the current experiments address several new questions about diminishing egocentrism in estimating others' knowledge. First, do participants take into account their recent experience with old questions by diminishing egocentrism in their estimates for others? Second, what are the means of diminishing egocentrism? Do people initially consider their own performance and then serially adjust to account for unshared knowledge? Alternatively, do they shift to a different, theory-based judgment? Third, does diminished egocentrism improve the accuracy of their estimates of others' knowledge?

Experiment 1

Method

Twenty-six younger adults (11 male, 15 female) were recruited from the Washington University student participant pool. Participants were given course credit or monetary compensation (\$10 per hr) for their participation.

Design and materials. This study was a repeated-measures design with experience with question (old, new) manipulated within participants. Dependent measures focused on participants' own performance on the trivia test (accuracy and response time) and their estimates of peer accuracy (estimates and response time). The materials consisted of 160 general knowledge questions selected from Nelson and Narens' (1980) set. Based on accuracy

from Nelson and Narens' normative data, the questions ranged from difficult (e.g., *What is the name of the substance derived from a whale that is used to make perfume?* Answer: *Ambergris*) to easy (e.g., *What is the name of the long sleep that some animals go through in the winter?* Answer: *Hibernation*; range_{acc} = .05–.92). All correct answers consisted of a single word (e.g., *Ambergris*, *Hibernation*). The questions were divided into two sets of 80 questions with each set matched on normative accuracy ($M = .49$, $SD = .28$). The sets of questions served equally often across conditions (old, new).

Procedure. All participants were tested individually. The experiment consisted of three phases: a preexposure phase, a filled interval, and a test phase. Before the preexposure phase, participants were told that they would be presented with a series of trivia questions with their correct answers. They were instructed to evaluate whether they knew the answer prior to the experiment and to learn the answer if they did not know it previously. Then, participants were presented with a series of 80 questions and answers, with each presented on the computer screen for 6 s followed by a blank screen for 1 s. After the final question, participants were presented with a series of two questions on screen about their knowledge of the answers. First, they were asked to estimate the percentage of the answers they knew before the experiment. Then, they were asked to estimate the percentage of answers they knew after the preexposure phase. Participants typed their responses into a response box on screen.

Following the preexposure phase, participants were given a 10-min category fluency task (Ryan, Cox, Hayes, & Nadel, 2008) to provide a short delay between presentation of the facts and the test phase with questions that could be answered with some of those facts. Participants were asked to generate as many examples of a particular category as they could (e.g., things in a garage) in 36 s. Participants typed their examples, which appeared in a response box onscreen. A tone sounded to indicate the end of each trial and was followed by an 8-s interval before the next trial began.

Before the test phase, participants were told that they would be asked a series of general knowledge questions to answer as quickly as possible. They were not told that some of the questions could be answered with facts they had seen earlier (i.e., in the preexposure phase). For the peer estimate, they were asked to estimate how many of their peers (out of 100) would know the correct answer to the question. Participants were told that their peers consisted of other students at Washington University. Each general knowledge question appeared in the center of the screen above a response box where participants' typed response appeared onscreen. Response times for answering the question were recorded when the participant pressed *Enter* to move on to the peer estimate for the same question. The question remained on screen for the peer estimate along with the text prompt *% of peers?* above a sliding scale ranging from 0 to 100 on the bottom of the screen. Participants moved a red marker to the point on the scale that represented their estimate of peer accuracy and then clicked an onscreen button to continue. Response times for making the peer estimate were recorded from clicking to move the red marker to clicking the onscreen button to move on to the next trial. For both the general knowledge question and the estimate of peer accuracy steps, the program moved forward to the next screen if the participant had not pressed *Enter* before 20 s had elapsed.¹ A fixation cross

appeared for 1 s before the next question appeared. Following the test phase, participants were debriefed and compensated for their participation.

Results

Overall, participants estimated that they knew 61% of the answers before and 80% of the answers after the preexposure phase. In each of the experiments, the significance level for all statistical tests was set at $\alpha = .05$. We do not report interactions or main effects when higher order interactions are significant, unless they are directly relevant to our hypotheses.

Participants' own accuracy versus their estimates of peer accuracy. First, we compared participants' own accuracy and their estimates of peer accuracy (i.e., performance type: own, estimated other) for old and new questions (see Figure 1). We expected participants' own accuracy to be much higher for old than new questions because of participants' recent exposure to the answers of old questions. Our primary aim was to examine whether participants reduced egocentrism by discounting their own performance on old questions in their estimates of what others know. Results showed evidence of discounting such that the increase in estimates of peer accuracy for old compared to new questions was much smaller than the increase in participants' own accuracy (6% vs. 40% difference), which is supported by a significant Experience With Question \times Performance Type interaction, $F(1, 25) = 319.03$, $\eta_p^2 = .93$. These results suggest that participants were discounting their own knowledge of answers to recently studied questions when estimating for others, and they provide preliminary evidence of diminished egocentrism for old compared to new questions. Next, we explore more precise measures of egocentrism in estimating what others know by examining item-level relationships between participants' own performance and their estimates of peer accuracy.

Egocentrism in peer estimates. We explored egocentrism in peer estimates by analyzing the extent to which estimates of peer accuracy correlated with participants' own performance on the general knowledge questions. First, we compared egocentrism for old and new questions by measuring gamma correlations between test accuracy and estimates of peer accuracy for old and new questions (see Figure 2). Gamma correlations index item-level relationships between participants' own accuracy and their judgments of peer accuracy (see Nelson, 1984) by measuring the extent to which correctly answered questions are associated with high estimates of peer accuracy and incorrectly answered questions are associated with low estimates of peer accuracy. A gamma correlation of ± 1.0 indicates a perfect relationship between participants' own accuracy and their peer estimates. Gamma correlations were computed for each participant and then analyzed by means of a repeated-measures analysis of variance (ANOVA) on experience with question. These analyses could not be computed for two participants due to constant values (i.e., test accuracy of 100%) on at least one of the variables. In addition, data from

¹ Across all studies, participants submitted their answer to the general knowledge questions before the program moved on automatically on most trials. The program moved on automatically for less than 5% of all critical trials across studies. Note that participants only started typing their answers on less than 1% of these trials, with all remaining answers left blank.

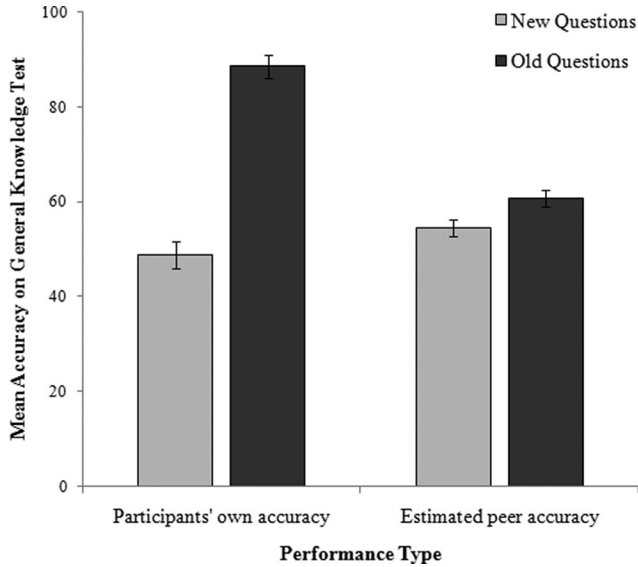


Figure 1. Participants' own accuracy and predicted peer accuracy for old and new questions on the general knowledge test in Experiment 1. Error bars display the standard error of the mean.

one participant were excluded from analyses due to an outlying data point (± 3 SD from the condition mean). Estimates of peer accuracy were more strongly related to participants' own accuracy when the questions were new as compared to old (.74 vs. .63), $F(1, 22) = 7.15$, $\eta_p^2 = .25$. These results suggest that participants took into account the effects of prior experience on old questions by discounting their own performance when predicting the performance of others.

Next, we examined egocentrism by measuring the correlation between participants' response time to answer questions and their estimates of peer accuracy. As expected, participants were faster to correctly answer old than new questions (4,164 vs. 6,250 ms), $F(1, 25) = 203.31$, $\eta_p^2 = .89$, because they had recently seen the answers to old questions. If an answer is retrieved quickly, participants may attribute this retrieval fluency to the ease of the question and estimate that more of their peers will know the answer. Thus, greater egocentrism would be evidenced by stronger negative correlations (i.e., closer to -1.0) between participants' response time and their estimates of peer accuracy. Gamma correlations were calculated for all correctly answered questions for each participant and then analyzed by means of a repeated-measures ANOVA on experience with question. Participants' estimates of peer accuracy were more strongly related to their response time when answering new as compared to old questions (-0.24 vs. -0.09), $F(1, 25) = 24.96$, $\eta_p^2 = .50$.

In sum, these analyses revealed diminished egocentrism in estimating others' knowledge when participants' own knowledge was informed by recent experience with answers to the questions. Participants were more likely to use their own performance as a basis for estimating others' knowledge for new questions compared to old questions. Next, we examined the speed with which participants estimated peer accuracy to get a sense of the means by which participants diminished egocentrism.

Speed of estimating peer accuracy. We examined the speed with which participants made their estimates of peer accuracy to get a better understanding of the psychological processes involved in diminishing egocentrism. Participants showed diminished egocentrism in their estimates of peer accuracy for old compared to new questions. If participants diminished egocentrism by adjusting from an egocentric anchor (i.e., their own knowledge of the answer), we would expect peer estimates to be slower for old than new questions because serial adjustment is a time-consuming process. However, a repeated-measures ANOVA on experience with question revealed that participants were actually faster to make their peer estimates for old compared to new questions (573 vs. 624 ms), $F(1, 25) = 12.11$, $\eta_p^2 = .33$. These findings suggest that participants did not diminish egocentrism through anchoring and adjustment. Instead, they apparently shifted to an alternative basis for their peer estimates, such as a theory-based analysis of question difficulty.

Accuracy of peer estimates. If recent experience with the answer biases their own knowledge, participants diminish egocentric biases in estimating others' knowledge of the answers. A remaining question is whether different bases for judging the difficulty of the question influence the accuracy of participants' estimates of what others know.

First, we examined the absolute accuracy of estimates of others' knowledge with a calibration measure in which estimates of peer accuracy were compared to observed accuracy when the question

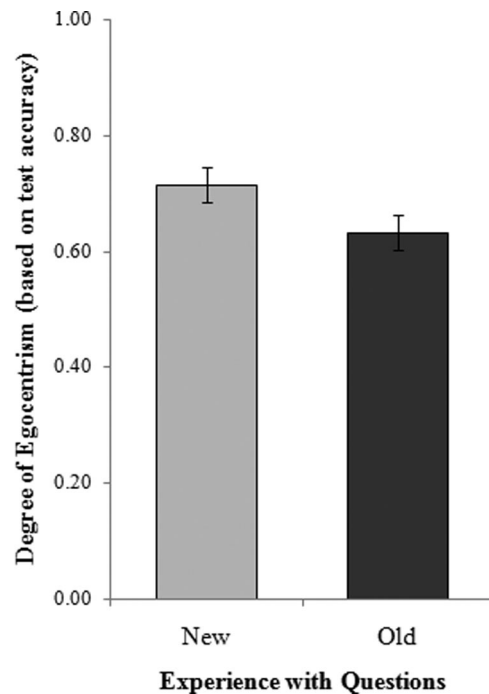


Figure 2. Egocentrism in peer estimates based on gamma correlation between participants' own accuracy and estimated peer accuracy in Experiment 1. Error bars display the standard error of the mean. New = new questions; Old = old questions.

was new to the experiment.² Calibration scores were computed by taking the signed difference score between estimated peer accuracy and normative accuracy for each participant, with a score of zero representing perfect calibration. Participants overestimated peer accuracy for both old and new questions (i.e., all calibration scores were significantly different from zero; $t_s > 3.30$). However, the degree of overestimation was greater for old (12.07) than new questions (5.88), $t(25) = 5.36$, $d = 1.05$.

Next, we examined the relative accuracy of estimates of others' knowledge for old and new questions, which reflects the ability to discriminate between questions that will be easy or difficult for others. The correlations used to examine egocentrism in the previous section assessed the relationship between a person's own performance and predicted peer performance. To assess the relative accuracy of estimates of others' knowledge, we examined the relationship between predicted performance of peers and actual performance of peers, as measured by observed normative accuracy when the questions were new to the experiment. Gamma correlations measure the extent to which items with higher normative accuracy are also given higher estimates of peer accuracy relative to those for items with lower normative accuracy. Gamma correlations between estimates of peer accuracy and normative accuracy were computed for each participant and then entered into a repeated-measures ANOVA on experience with question (see Figure 3). The relative accuracy of peer estimates was significantly higher for old than new questions (.55 vs. .49), $F(1, 25) = 23.44$, $\eta_p^2 = .48$. These results suggest that participants were better able to judge the relative difficulty of individual questions for old than new questions.

Discussion

These results provide evidence that people discount their own knowledge to diminish egocentrism in estimating what others

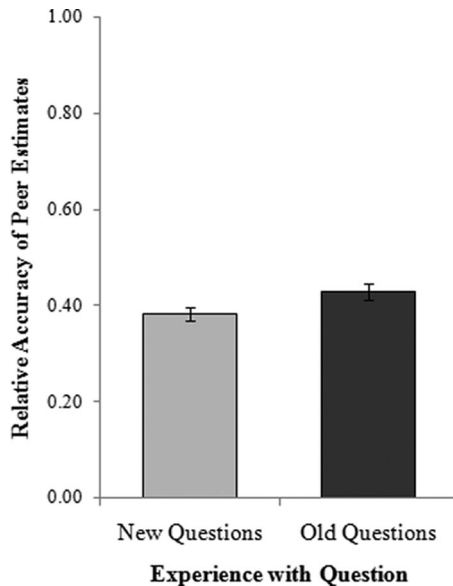


Figure 3. Relative accuracy of peer estimates based on gamma correlation between predicted peer accuracy and actual normative accuracy in Experiment 1. Error bars display the standard error of the mean.

know. The results also suggest that participants used qualitatively different bases for estimating others' performance for old and new questions. If participants were simply discounting their own performance by giving lower estimates of peer accuracy for old compared to new questions, the relative accuracy of these estimates would not differ between old and new questions. However, the relative accuracy of their predictions actually improved for old as compared to new questions, revealing that participants shifted to an alternative basis for their judgments to overcome egocentrism. Further, participants were actually faster to estimate peer performance for old than new questions. Calibration was not found to be more accurate for old than new questions, although relative accuracy was higher for old questions. The differential effect on calibration and relative accuracy is easily understood if there was a qualitative shift in the basis for prediction for old as compared to new questions. The shift to theory-based judgments might reduce the accuracy of judged overall difficulty (calibration) while improving judgments of relative difficulty, as in the case of a professor predicting students' performance on an upcoming test. In contrast, it is not obvious how an anchoring and adjustment model would account for the discrepancy between effects on calibration and judgments of relative difficulty.

Experiment 2

Results from Experiment 1 revealed that people diminish egocentrism in estimating what others know for old questions. In Experiment 2, we aimed to replicate and extend the results of Experiment 1. Participants may be more likely to discount their own knowledge when estimating for old questions if the answer was learned in the experiment. Our first goal was to differentiate effects for recently acquired facts from those for previously known facts that were made more accessible through recent exposure. To examine this possibility, we made the general knowledge questions either easy or difficult. Participants' answers for difficult questions are more likely to be learned in the experiment than are answers to easy questions. Participants might recognize that their peers are unlikely to know the answers to these difficult questions and discount their own knowledge of the answers when estimating for their peers. Therefore, we expected participants to diminish egocentrism more for difficult than easy questions when participants had just seen the answers (i.e., old questions). Further, we explored the relative accuracy of their peer estimates by examining the correlation between estimates of peer accuracy and actual peer accuracy.

As in Experiment 1, we also investigated the speed with which participants made their estimates of peer accuracy using a more precise measure of response time. In Experiment 1, the speed of making the peer estimate was measured from the moment participants clicked the red marker to move it along the scale rather than from the start of the trial. Participants may have arrived at their

² In the current studies, normative accuracy from participants (on new questions) was highly correlated with normative accuracy as reported by Nelson and Narens (1980), with Pearson correlations across questions of $r(158) = .79$ in Experiment 1 and $r(118) = .89$ in Experiment 2. Further, when we used normative accuracy from Nelson and Narens as the criterion measure for all analyses of calibration and relative accuracy (i.e., resolution), the same statistical outcomes were observed.

peer estimate before making their response. In Experiment 2, we improved on this measure by recording response time from the first prompt to make each peer estimate.

Our second goal was to investigate estimates of peer accuracy for a group in which experience-based cues were blocked by presenting the answer along with the question before participants estimated peer accuracy (cf. Kelley & Jacoby, 1996, Experiment 1). When the answer was present, participants could not use their own subjective experience of answering the question to estimate its difficulty. Half of the participants read questions and answers prior to making their peer estimates (read group). The other half answered questions prior to making their peer estimates (answer group), as in Experiment 1. If participants discount experience-based cues when estimating others' performance on old questions, their peer estimates after answering a question should be similar to those in the condition in which experience-based cues were blocked by the presence of the answer at test.

In Experiment 1, participants' tendency to diminish egocentrism for old relative to new questions suggests some level of awareness that their own performance was not diagnostic of others' performance on old questions. In Experiment 2, we directly investigated whether participants were able to evaluate the accuracy of their estimates of others' knowledge through metacognitive processes. As in prior experiments, participants were asked to estimate peer accuracy for each question (i.e., *forced report*), even though they may not have a solid basis for their estimate. After making each peer estimate, participants rated their confidence in their estimate of peer accuracy. If participants are aware that egocentrism would bias their peer estimates for old questions and shift to an alternative basis, they may be more confident in their peer estimates for old than new questions.

Confidence in estimates of students' performance on an exam question may determine whether the professor decides to use a particular question on the exam. In Experiment 2, participants were given an option either to volunteer or to withhold their estimate of peer performance (i.e., volunteered estimates correspond to *free report*), as in the example of the professor discarding questions. Koriat and Goldsmith (1996) used a free report procedure in the context of memory tasks to demonstrate that people can strategically regulate the accuracy of their reported memories. Memory accuracy improved for volunteered items in free report as compared to forced report. We sought to determine whether participants were able to effectively evaluate their estimates of what others know so as to improve the accuracy of these estimates using the free report option. To address this question, we compared the calibration and resolution of participants' estimates of peer performance between free report (i.e., volunteered estimates) and forced report (i.e., all estimates).

Method

Participants. Forty-eight younger adults (16 male, 32 female) were recruited from the Washington University student participant pool to participate in this study. Participants were given course credit or monetary compensation (\$10 per hr) for their participation. Participants were randomly assigned to the answer or read test tasks.

Design and materials. This study was a 2 (experience with question) \times 2 (question difficulty) \times 2 (test task) mixed factorial

design, with experience with question (old, new) and question difficulty (easy, hard) as within-subjects factors and test task (answer, read) as a between-subjects factor. The materials consisted of 120 general knowledge questions (60 easy, 60 hard) selected from the same set used in Experiment 1 (Nelson & Narens, 1980). The questions were divided into two sets of 60 questions, with 30 easy ($M = .70$, $SD = .13$) and 30 hard questions ($M = .12$, $SD = .04$) matched on normative accuracy across sets. Each set of questions served equally often as old and new items.

Procedure. The procedure was similar to that of Experiment 1, with a preexposure phase, a filled interval, and a test phase. The preexposure phase consisted of a series of 60 general knowledge questions paired with correct answers presented for 5 s, with each followed by a fixation cross for 1 s. The rest of the procedure for the preexposure phase was identical to that in Experiment 1.

After the same filled interval as in Experiment 1, participants began the test phase of the experiment. The test instructions reminded participants that their peers would not have had the same recent experience with world facts. The test task manipulation varied what participants did with the question prior to making their estimate. In the read group, each general knowledge question appeared in the center of the screen with its answer below for 10 s or until they pressed *Enter* to move on to the peer estimate for the same question. Participants read each question and answer rather than answering the questions during the test. In contrast, in the answer group, each general knowledge question appeared in the center of the screen above a response box where participants' typed response appeared onscreen. The question remained onscreen while participants made their peer estimate. In contrast to the sliding scale (0–100) used to enter peer estimates in Experiment 1, the number pad was now used to type in the percentage of their peers that participants predicted would know the correct answer to the question. Participants were told to press *Enter* after typing their estimate to move on to the next question. Unlike in Experiment 1, response times for making the peer estimate were recorded from the start of the onscreen prompt for peer estimates to the time participants pressed the onscreen button to continue. The program moved to the next step for both the question and the peer estimate steps if the participant had not pressed *Enter* before 20 s had elapsed.

Finally, two more steps were added to the test procedure for each general knowledge question in both groups. After they made their peer estimate, participants were asked to rate their confidence in the accuracy of their peer estimate (i.e., the extent to which their estimate of peer accuracy reflected actual peer accuracy). A sliding scale ranging from 0 (*wild guess*) to 100 (*certain correct*) appeared on the bottom of the screen. Participants moved a red marker to the point on the scale that represented their level of confidence and then clicked an onscreen button to continue. In the response judgment step, participants were given the option to volunteer their peer estimate for points or withhold their estimate for no points by selecting the relevant onscreen button (i.e., *Volunteer* or *Withhold*). If participants volunteered their peer estimate, they were told that they would gain 10 points if their peer estimate was accurate (within 8% of actual peer accuracy); otherwise, they would lose 10 points. No points would be gained or lost for withheld estimates. Participants were not given feedback on their point accumulation during the task. Both confidence ratings and response judgments were self-paced. A fixation cross appeared for

1 s before the program moved on to the next question. Following the test phase, participants were debriefed and compensated for their participation.

Results and Discussion

Participants' own accuracy versus estimates of peer accuracy.

As in Experiment 1, participants were found to discount their own accuracy when predicting the performance of others on old questions, especially when answers were likely to be learned in the experiment. We compared participants' own accuracy and their estimates of peer accuracy for old and new questions as a function of question difficulty for the answer group only (see Figure 4A). As in Experiment 1, the increase in estimates of peer accuracy for old compared to new questions was much smaller than the increase in participants' own accuracy (8% vs. 48% difference), as revealed by a significant Performance Type \times Experience With Question interaction, $F(1, 23) = 903.24$, $\eta_p^2 = .98$.

Further, participants showed even greater discounting in their peer estimates for old questions when the questions were difficult and, thus, more likely to reflect answers learned in the experiment. This finding was supported by a significant Performance Type \times Experience With Question \times Difficulty interaction, $F(1, 23) = 93.57$, $\eta_p^2 = .80$. For easy questions, participants' own accuracy increased by 30% for old compared to new questions, whereas their estimates of peer accuracy increased by only 11%. For difficult questions, participants' own accuracy increased by 65% for old compared to new questions, whereas participants' estimates of peer accuracy increased by only 5%. These results replicate and extend results of Experiment 1 to suggest that people discount their

own experience answering a question when estimating others' performance if they have recently encountered the answer, especially for extremely difficult questions.

Estimates of peer accuracy for read versus answer groups.

Next, we examine whether estimates of peer accuracy for old and new questions changed as a function of test experience (see Figure 4B). In particular, members of the read group did not have experience answering the general knowledge questions prior to estimating their peers' performance on the question. The presence of the answer at test blocked participants from using their own knowledge of or ease of retrieving the answer to estimate others' knowledge, as shown by a significant Experience With Question \times Difficulty \times Test Task interaction, $F(1, 45) = 4.10$, $\eta_p^2 = .08$. Both groups estimated that more of their peers would know the answers to old than to new questions, regardless of whether they had read the answer or answered the question before making their peer estimates. However, this difference in estimates of peer accuracy between old and new questions was attenuated when participants read the answers prior to making their peer estimate, at least for easy questions (11% vs. 5% for answer vs. read groups, respectively). In contrast, test task did not influence the magnitude of the difference in peer estimates between old and new questions when they were difficult (5% vs. 3% for answer vs. read groups, respectively).

As noted above, participants discounted experience-based cues for old questions that were difficult, probably because they were aware that these answers were learned in the experiment. If participants in the answer group were discounting experience-based cues for difficult questions, the relative accuracy of their peer

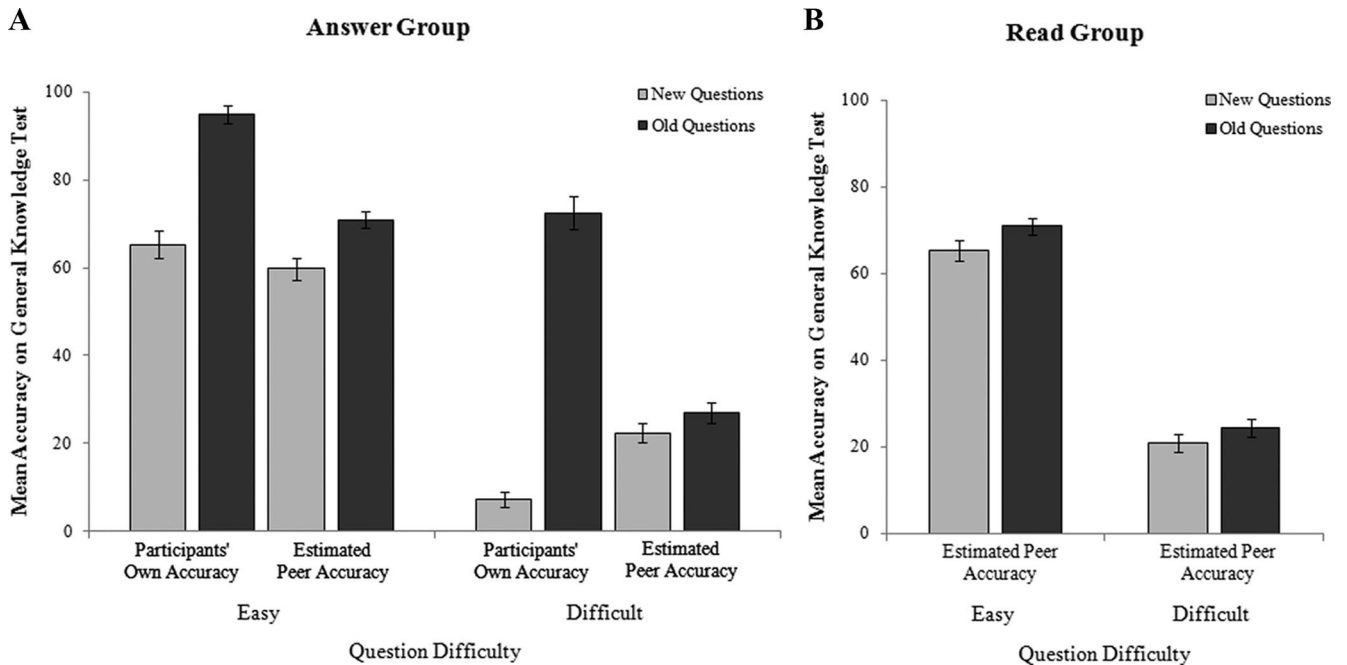


Figure 4. A: Participants' own accuracy and predicted peer accuracy for old and new questions as a function of question difficulty for answer group ($n = 24$). B: Predicted peer accuracy for old and new questions as a function of question difficulty for read group in Experiment 2 ($n = 24$). Error bars display the standard error of the mean.

estimates should be similar to the group in which experience-based cues were blocked by the presence of the answer at test, as it was.

Egocentrism in peer estimates. As in Experiment 1, egocentrism was found to be diminished when estimating others' knowledge if participants' own knowledge was informed by recent experience with answers to the questions. We used the same approach to analyses as in Experiment 1, with correlations collapsed across question difficulty. Estimates of peer accuracy were correlated with participants' own accuracy to a greater extent when questions were new than old (.79 vs. .65), $F(1, 23) = 12.34$, $\eta_p^2 = .35$. As in Experiment 1, participants discounted their own retrieval fluency for old questions. Participants were faster to answer old than new questions (4,498 vs. 6,691 ms; see Table 1), $F(1, 23) = 497.07$, $\eta_p^2 = .96$.³ However, estimates of peer accuracy were tied to participants' own response time when answering questions to a greater extent for new than old questions (−.29 vs. −.17), $F(1, 23) = 20.03$, $\eta_p^2 = .47$.

Speed of making peer estimates. As in Experiment 1, we examined the speed with which participants made their estimates of peer accuracy to get a better understanding of the psychological processes involved in diminishing egocentrism. Participants showed diminished egocentrism in their estimates of peer accuracy for old compared to new questions. As in Experiment 1, participants were faster to make their peer estimates for old than new questions (3,592 vs. 3,901 ms), $F(1, 47) = 7.76$, $\eta_p^2 = .14$. The difficulty of the question did not influence speed of making peer estimates, nor was there a significant interaction with experience with question ($F_s < 1$). These findings provide further evidence that participants did not diminish egocentrism through anchoring and adjustment. Instead, they shifted to an alternative basis for their peer estimates, such as a theory-based analysis of question difficulty.

Accuracy of peer estimates. Calibration scores were again used as a measure of the absolute accuracy of estimates of peer accuracy. All calibration scores were significantly different from zero ($t_s > 2.10$), except for calibration scores on old, easy questions in both test tasks ($t_s < 1$, *ns*). Calibration scores were compared for old and new questions as a function of difficulty and test task. There was a significant Difficulty \times Experience With Question interaction, $F(1, 46) = 13.34$, $\eta_p^2 = .23$. For new questions, participants underestimated peer accuracy on easy questions (−7.7) and overestimated peer accuracy on difficult questions (9.7). This pattern corresponds with the *hard–easy effect* typically observed in choice confidence (e.g., Lichtenstein & Fischhoff, 1977). People tend to be overconfident in their answers to difficult questions and underconfident in their answers to easy questions.

Table 1
Mean Response Time (in ms) on Attempted Old and New Questions as a Function of Difficulty in Experiment 2 for the Answer Test Task Only

Test task	Easy questions		Difficult questions	
	New	Old	New	Old
Answer	6,001 (936)	4,244 (716)	7,380 (855)	4,751 (699)
Read				

Note. Standard deviations are reported in parentheses.

These data suggest that the hard–easy effect extends to estimates of what others know.

In contrast, for old questions, participants were perfectly calibrated for easy questions. Further, they were better calibrated for old easy questions than for new easy questions (0.7 vs. −7.7), $t(46) = 6.93$, $d = 1.04$. In contrast, calibration of difficult questions was better for new than old questions, although participants overestimated peer accuracy for both (9.7 vs. 13.6), $t(46) = 4.49$, $d = 0.66$. The Experience With Question \times Test Task interaction only approached significance, $F(1, 46) = 3.85$, $p = .052$, $\eta_p^2 = .08$, showing a trend for estimates of peer accuracy to be better calibrated for new than old questions in the answer group but not in the read group.

Further, we found that the relative accuracy of peer estimates improved when experience-based cues were diminished or blocked by the presence of the answer. We computed gamma correlations between estimates of peer accuracy and normative accuracy for each participant and compared the relative accuracy of old and new questions as a function of test task (see Figure 5). A significant Experience With Question \times Test Task interaction, $F(1, 46) = 4.16$, $\eta_p^2 = .08$, revealed that relative accuracy of peer estimates was higher for old than new questions only when participants answered the questions before making their estimate of peer accuracy (.58 vs. .51), $t(23) = 2.91$, $d = 0.59$. When participants read the answer, there was no difference in relative accuracy between old and new questions (.58 vs. .58), $t < 1$, *ns*. The presence of the answer prevented participants from using their subjective experience as a basis for their peer estimates, which produced an increase in the relative accuracy of their peer estimates for new questions. These results provide converging evidence that people's ability to estimate others' knowledge improves when egocentric biases are diminished.

Interim summary. Results replicated Experiment 1 by showing that participants discounted experience-based cues to make peer estimates for old compared to new questions and, thereby, improved relative accuracy of their estimates of what others know. Further, reliance on experience-based cues was blocked by presenting the answer at test in the read group. For the read group, the difference in overall peer estimates between old and new questions was attenuated, and the relative accuracy of estimates for new questions increased to the level of estimates for old questions. These data provide further evidence that the relative accuracy of estimating others' knowledge improved when participants shifted away from experience-based cues to use an alternative basis for judgment.

Together with the results of Experiment 1, these findings also suggest that participants were aware that their own knowledge was not representative of what others know about old questions. Next, we examine whether these alternative bases for judging others'

³ Participants were faster to answer easy than difficult questions, $F(1, 23) = 100.79$, $\eta_p^2 = .81$, especially when the questions were new to the experiment as revealed by a significant Experience With Question \times Difficulty interaction, $F(1, 23) = 22.32$, $\eta_p^2 = .49$.

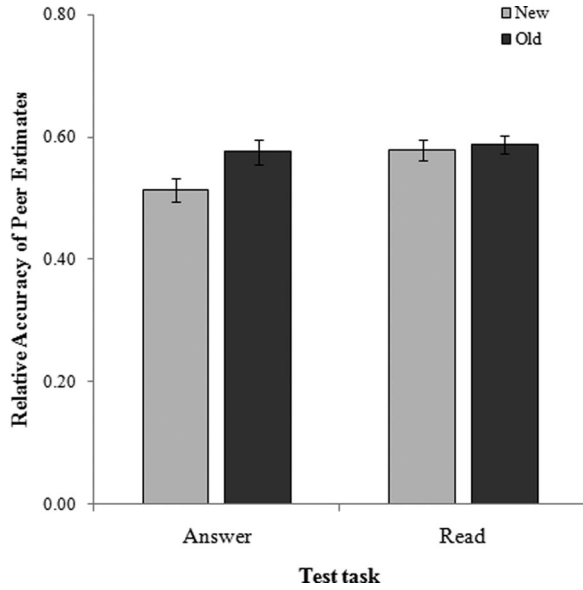


Figure 5. Relative accuracy of peer estimates based on gamma correlation between predicted peer accuracy and observed accuracy, as a function of test task in Experiment 2. Error bars display the standard error of the mean. New = new questions; Old = old questions.

knowledge influence participants' metacognitive monitoring of their peer estimates.

Metacognitive judgments for estimates of peer accuracy.

Overall, we found that participants were more confident and more likely to volunteer their peer estimates for the conditions in which the relative accuracy of those judgments was also high. Table 2 displays participants' mean confidence ratings and their likelihood of volunteering their peer estimates for old and new questions as a function of question difficulty and test task (answer, read). Overall, participants were more confident and more likely to volunteer their estimates of peer accuracy for easy compared to difficult questions (69 vs. 51 for confidence; .62 vs. .52 for proportion volunteered), $F(1, 46) = 66.48$, $\eta_p^2 = .59$ for confidence and $F(1, 46) = 34.80$, $\eta_p^2 = .43$ for proportion volunteered, and, more important, for old compared to new questions (63 vs. 57 for confidence; .62 vs. .53 for proportion volunteered), $F(1, 46) = 31.87$, $\eta_p^2 = .41$ for

confidence and $F(1, 46) = 45.63$, $\eta_p^2 = .50$ for proportion volunteered.

Further, there were significant Experience With Question \times Test Task interactions, $F(1, 46) = 29.67$, $\eta_p^2 = .39$ for confidence ratings and $F(1, 46) = 45.63$, $\eta_p^2 = .50$ for likelihood of volunteering. These interactions revealed that metacognitive judgments depended on whether participants read or answered questions before making their peer estimate. In the answer group, participants gave higher confidence ratings and volunteered more estimates of peer accuracy when questions were old as compared to new, $t(23) = 6.54$, $d = 1.47$ for confidence ratings, $t(23) = 8.02$, $d = 1.63$ for likelihood of volunteering. In the read group, confidence ratings and volunteered estimates of peer accuracy did not differ for old and new questions (t s < 1 , *ns*), possibly because the difference in peer estimates for old and new questions was diminished because these participants did not have subjective experience with answering the questions.

Metacognitive monitoring: Free versus forced estimates of peer accuracy.

The primary question addressed in these analyses was whether the alternative bases used to judge peer accuracy on old and new questions influenced metacognitive monitoring and control over peer estimates. Forced report includes all estimates of peer accuracy, whereas free report includes only volunteered estimates of peer accuracy. An improvement in accuracy of peer estimates from forced to free report would suggest better metacognitive monitoring and control over what is reported. To avoid redundancy with previously reported analyses, we report only significant effects of the free versus forced report option.

First, we examined whether the absolute accuracy of participants' peer estimates improved from forced to free report (see Table 3). Calibration scores were entered into a Report Option \times Experience With Question \times Question Difficulty \times Test Task ANOVA. These analyses of conditional probability excluded four participants due to lack of variability (constant values, or 100% volunteered/withheld estimates) on at least one of the variables and one participant due to outlying data points (± 3 *SD* from group mean). Most important, there was a significant Report Option \times Experience with Question \times Question Difficulty interaction, $F(1, 41) = 15.00$, $\eta_p^2 = .27$, showing that estimates of peer accuracy were better calibrated in free report than forced report for new questions but not for old questions. For new questions, this improvement in calibration under free report was particularly pro-

Table 2

Mean Confidence Ratings and Likelihood of Volunteering Estimates as a Function of Test Task and Question Difficulty for Old and New Questions in Experiment 2 ($n = 48$)

Test task	Easy questions		Difficult questions	
	New	Old	New	Old
Confidence rating				
Answer	62.3 (15.1)	73.6 (10.9)	40.2 (21.0)	52.2 (19.2)
Read	70.0 (11.7)	71.1 (9.4)	55.9 (19.7)	55.2 (18.3)
% estimates volunteered				
Answer	0.52 (0.30)	0.72 (0.27)	0.32 (0.27)	0.48 (0.30)
Read	0.70 (0.22)	0.72 (0.24)	0.56 (0.30)	0.55 (0.27)

Note. Standard deviations are reported in parentheses.

Table 3

Calibration of Estimated Peer Performance Under Forced Report (All Trials) and Free Report (Volunteered Trials Only) for Old and New Questions as a Function of Difficulty and Test Task in Experiment 2

Report option	Easy questions		Difficult questions	
	New	Old	New	Old
Forced report				
Answer group ($n = 20$)	-7.8 (11.4)	2.3 (8.5)	11.0 (11.7)	14.5 (12.5)
Read group ($n = 23$)	-4.9 (11.5)	0.6 (9.8)	8.7 (7.8)	11.7 (8.8)
Free report				
Answer group ($n = 20$)	2.1 (11.1)	6.9 (8.2)	9.0 (17.3)	16.2 (17.6)
Read group ($n = 23$)	2.5 (11.6)	6.4 (8.6)	5.5 (8.9)	10.4 (11.7)

Note. Data are M (SD).

nounced for easy questions, $t(41) = 6.90$, $d = 1.11$, but was also observed with difficult questions, $t(41) = 2.31$, $d = 0.42$. In contrast, there was no improvement in the calibration of old questions under free report ($F < 1$, ns). The read and answer groups did not differ in their improvement in calibration under free report instructions ($F_s < 1$, ns). This finding suggests that participants may be better able to monitor the accuracy of their peer estimates for new than old questions under free report.

Next, we examined whether the relative accuracy of participants' peer estimates improved from forced to free report (see Table 4). Gamma correlations were collapsed across easy and difficult questions. These analyses of conditional probability excluded four participants due to lack of variability on one or more of the variables (constant values, or 100% volunteered/withheld estimates) and four participants due to too few observations (i.e., very few trials volunteered). The effect of report option was not significant ($F < 1$), nor did report option interact with any of the other variables. Participants were not able to enhance the relative accuracy of their peer estimates (i.e., their ability to discriminate between relatively easy and difficult questions for others) under free report compared to forced report.

In sum, results from the free versus forced responding analyses differ from those typically found in memory experiments. Although participants are often able to improve the accuracy of their responses in memory experiments (e.g., Koriat & Goldsmith, 1996), those in Experiment 2 were largely unable to improve their ability to predict for others. In other domains, such as that of a

professor selecting questions for an exam, there may be more rich cues to inform theories and to improve the ability to discard questions if one is not confident in their predicted difficulty.

General Discussion

The results of two experiments support our key hypothesis that people are able to diminish egocentrism when estimating what others know about general knowledge questions. When questions were new, participants showed egocentrism with estimates of peer accuracy that were strongly related to their own accuracy and the time they spent answering the questions. However, when participants had recently encountered the answer to a question, they discounted their own performance as a basis for estimating others' knowledge of the answer. Further, participants were better able to discriminate between easier and more difficult questions for old than new questions, as demonstrated by stronger correlations between estimates of peer accuracy and actual peer accuracy on these questions when they were new to the experiment. The relative accuracy of estimating others' knowledge also improved when participants did not answer the questions prior to making their peer estimates (Experiment 2).

Results also support our central claim that participants were using qualitatively different bases for estimating others' performance for old and new questions. According to this view, the underlying basis of diminishing egocentrism sometimes involves a controlled shift from experience-based to theory-based judgments when a question is recognized as one whose answer was recently encountered. In contrast, others have forwarded an anchoring and adjustment approach to account for diminishing egocentrism (Epley & Gilovich, 2001, 2006; Epley, Keysar, et al., 2004; Epley, Morewedge, & Keysar, 2004; Kruger, 1999; Nickerson, 1999). By that view, people adjust their peer estimates away from an egocentric anchor. The primary distinction between these two means of diminishing egocentrism is the point at which cognitive control overcomes the more automatic egocentric biases. In a similar vein, memory researchers have highlighted the difference between early selection and late correction models of controlling memory retrieval (e.g., Halamish, Goldsmith, & Jacoby, 2012; Jacoby, Shimizu, Daniels, & Rhodes, 2005). Early selection involves the use of cognitive control to regulate what is retrieved from memory and, thereby, serves as a preaccess mode of control by influencing what first comes to mind. This cognitively controlled basis for

Table 4

Relative Accuracy of Estimated Peer Performance Under Forced Report (All Trials) and Free Report (Volunteered Trials Only) as a Function of Experience With Question and Test Task in Experiment 2

Test task	Relative accuracy of estimated peer performance			
	Forced report		Free report	
	New	Old	New	Old
Answer	0.55 (0.06)	0.60 (0.06)	0.57 (0.08)	0.60 (0.06)
Read	0.58 (0.08)	0.59 (0.08)	0.55 (0.06)	0.59 (0.08)

Note. Data are M (SD).

responding is akin to relying on a theory to predict the performance of others. For late correction, cognitive control does not constrain what comes to mind but, rather, inspects responses that do come to mind so as to discard erroneous responses. Likewise, diminishing egocentrism may involve either early selection of qualitatively different information (e.g., theoretical analysis of question of difficulty) or late correction of initially egocentric estimates.

The anchoring and adjustment approach predicts that people will be slower to make estimates of peer accuracy when they diminish egocentrism because they have to correct their initially egocentric estimate. However, in both experiments we found that people were actually faster to estimate others' performance when they diminished egocentrism (i.e., old compared to new questions). This important finding suggests that participants must be considering alternative information as a basis for their judgments when they discount their own experience to estimate others' knowledge. We suggest that people diminish egocentrism by shifting to a theory-based judgment of the difficulty of questions for others. Likewise, participants may rely on theory-based judgments when they are deprived of experience answering the question (e.g., read group in Experiment 2). Of course, in other situations, a late-correction means of avoiding egocentrism might be employed.

Experience-based judgments are based on inferences about the subjective experience of retrieval, such as ease of retrieving the answer to a question. These judgments evaluate mnemonic cues, which reflect the product of implicit and nonanalytic cognitive processes (Kelley & Jacoby, 1996; Koriatic & Bjork, 2006; Koriatic et al., 2008). Consistent with this view, Sanna, Schwarz, and Stocker (2002) suggest that people use not only retrieval of relevant information but also the subjective ease of retrieval to guide their estimates of the likelihood of an event outcome. In the case of the current experiments, people used their own knowledge of the answer as well as the ease of retrieving that answer to estimate the difficulty of the question for others. For questions that were new to the experiment, estimates of peer accuracy were likely to be based on participants' own experience with the question, as revealed by the strong correlation between estimates for others and participants' own accuracy and ease of retrieval for the questions.

However, estimates of others' knowledge were less reliant on participants' subjective experience answering the questions when they had recently seen the answers. It is also conceivable that participants consider different mnemonic cues when judging old questions, such as their familiarity with information in the question (i.e., cue familiarity, Metcalfe et al., 1993; Reder & Ritter, 1992) or the amount of information retrieved that is related to the question (i.e., accessibility of partial information, Dunlosky & Nelson, 1992; Koriatic, 1993; Koriatic & Levy-Sadot, 2001).

However, we favor the explanation that participants employ theory-based judgments about old questions. These judgments are based on a deliberate analysis of declarative content, such as prior knowledge and beliefs about objective qualities of the question itself (Kelley & Jacoby, 1996; Koriatic & Bjork, 2006; Koriatic et al., 2008). The predictive value of theory-based judgments is determined by the validity of the beliefs used to analyze the question. Kelley and Jacoby (1996) found that people generated flawed theories about the objective difficulty of anagrams. However, results of the current study suggest that theory-based judgments were better than subjective experience for estimating others'

knowledge when materials were sufficiently rich to provide support for a useful theory.

When participants shift to analyze the question itself rather than their experience answering it, they may tap into diagnostic cues about the normative difficulty of the question that improve the accuracy of their predictions for others. These diagnostic cues may be ignored or underutilized when predicting others' performance on new questions because of the salience of experience-based cues. Previous research suggests that people tend to underutilize normative information (Calogero & Nelson, 1992; Nelson, Leonesio, Landwehr, & Narens, 1986), which "is perhaps the major error of intuitive prediction" (Kahneman & Tversky, 1982, p. 416). People may be more likely to consider normative information when estimating for others if they recognize that their own performance is not representative of others' performance. Results of the current study suggest that participants constructed good theories about the objective difficulty of general knowledge questions. Further, a good theory was better than subjective experience in estimating others' knowledge.

Egocentrism afflicts our predictions for others across a variety of social judgments. Prior research has referred to this difficulty in discarding what we know to estimate what others know as *the curse of knowledge* (Birch, 2005; Camerer, Loewenstein, & Weber, 1989). However, the use of our own knowledge to estimate others' knowledge may not be a curse after all. Our own knowledge and subjective experience often provide us an easy and valid heuristic for estimating what others know. It is not surprising that people rely on their own knowledge as a quick and easy heuristic if this approach is generally adaptive (Gigerenzer & Gaissmaier, 2011; Nickerson, 2001). Consistent with this view, Dawes (1989) argued that the false consensus effect is not truly false because one's own view often has heuristic value in estimating the opinions of the group. In the studies reported here, participants estimated the knowledge of peers at the same university, a sample that may share much of their background knowledge. Their own knowledge of the answer may be a fairly good predictor of their peers' knowledge of the answer to new questions.⁴

However, egocentrism misguides estimates for others when there is asymmetry between one's own background knowledge and that of the sample targeted in the predictions, as in the case of the college professor. The ability to recognize when there is unshared knowledge and to diminish egocentrism improved the accuracy of estimates of others. In the present studies, participants took into account unshared knowledge by discounting their performance on the question but only if they had recently encountered its answer. When these egocentric biases were diminished, they considered alternative information that enhanced their estimates of others' knowledge. Results of the current experiments suggest that people can break the curse of knowledge to partially avoid egocentrism and to more accurately estimate what others know.

⁴ For new questions, participants' own accuracy on the general knowledge questions was highly correlated with normative accuracy from Nelson and Narens (1980; $G = 0.80$ in Experiment 1 and $G = 0.74$ in Experiment 2). In contrast, this correlation was weaker for old questions ($G = 0.57$ in Experiment 1 and $G = 0.62$ in Experiment 2) because recent exposure to the answers increased the amount of participants' own knowledge that was not shared by their peers.

We end by returning to our example of a professor estimating what students know to highlight the importance of accuracy in estimating others' knowledge. In addition to selecting appropriately difficult exam items, judging what others know may be critical for scheduling the presentation of new information to optimize learning. Indeed, the ability to predict what students know and anticipate the difficulty of particular concepts may be an important measure of teaching ability. In this vein, we ran a preliminary study with college professors and teaching assistants to examine whether predictions of students' performance on exam questions correlated with students' actual performance (Thomas, Rogers, & Jacoby, 2012). Results were gratifying, in that several professors had extremely accurate predictions of students' performance, especially an award-winning teacher with excellent student evaluations. In sum, the ability to diminish egocentrism to more accurately estimate what others know may be an essential skill for teaching and optimizing student learning.

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