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Auditor Mindsets and Audits of Complex Estimates

ABSTRACT

Auditors experience significant problems auditing complex accounting estimates, and this increasingly puts financial reporting quality at risk. Based on analyses of the specific errors that auditors commit, we propose that auditors need to be able to think more broadly and incorporate information from a variety of sources in order to improve audit quality for these important accounts. We experimentally demonstrate that a deliberative mindset intervention improves auditors’ ability to identify unreasonable estimates by improving their ability to identify and incorporate into their analyses contradictory information from other parts of the audit. We perform additional analyses to demonstrate that our intervention improves auditor performance by causing them to think differently rather than simply to work harder. We demonstrate that thinking more broadly can improve the identification of unreasonable estimates and, in doing so, provide new directions for addressing audit quality issues.

Key Words: Accounting estimates, audit quality, fair value, impairment, mindset, professional skepticism
Auditor Mindsets and Audits of Complex Estimates

1. Introduction

Complex accounting estimates, including fair values, impairments, and valuation allowances, are increasingly important to financial statements (e.g., Barth [2006]). However, auditors experience significant difficulty in auditing complex estimates, suggesting that audit quality may be low in this area (Public Company Accounting Oversight Board (PCAOB) [2010e], Griffith, Hammersley, and Kadous [2014], Bratten, Gaynor, McDaniel, Montague, and Sierra [2013], Cannon and Bedard [2014]). Some of the difficulties auditors experience can be attributed to high levels of uncertainty about valuations given volatile financial markets and innovative securities (Christensen, Glover, and Wood [2012], Bratten et al. [2013], Cannon and Bedard [2014]). However, others arise from problems with auditor judgment and the audit process. Analysis of PCAOB inspection reports for the largest accounting firms reveals that fair value measurements, including impairments, and other estimates are among the most frequently cited accounts for auditor errors, and that, while other audit deficiencies have decreased over time, deficiencies involving fair values and impairments have not (Church and Shefchik [2012]).

Chief among auditors’ judgment problems associated with auditing complex estimates are that auditors fail to adequately test the data and assumptions underlying management’s estimates and they fail to notice and incorporate into their analysis inconsistencies among the assumptions, other internal data, and external conditions (Griffith et al. [2014]). These types of shortcomings result in over-reliance on management’s process for generating estimates (Griffith et al. [2014]), which implies that any management bias in an estimate may survive the audit. Consistent with this concern, financial statement users tend to view estimates as less reliable than...
other financial statement items, and they discount them accordingly (Richardson, Sloan, Soliman, and Tuna [2005], Lev, Li, and Sougiannis [2010]).

In this paper, we examine whether and how changing auditors’ mindsets can improve audits of estimates, thereby enhancing audit quality in this important area. Mindsets are the judgment criteria, cognitive processes, and procedures that produce a disposition or readiness to respond in a certain manner (Hamilton, Vohs, Sellier, and Meyvis [2011], Gollwitzer [1990]). Mindsets have two essential features: (1) the cognitive processes and procedures that make them up are more general than what is required for the task at hand and (2) once activated, mindsets remain active beyond the initial task to influence subsequent tasks (Gollwitzer [1990], Hamilton et al. [2011]). Thus, mindsets are not merely a template for approaching a particular type of task; they represent a more global readiness to respond in a particular way. Indeed, mindsets are independent of the particular goal to which they are directed and of the semantic content to which the mindset’s criteria, processes, and procedures are applied (Wyer and Xu [2010]).¹

Auditors’ over-reliance on management’s process for generating estimates arises in part from structural features of the audit context, including audit firms’ choice to audit management’s model and their use of step-by-step audit programs (Griffith et al. [2014]). We propose that these features cause auditors to approach the audit of estimates in a mindset that encourages efficient completion of a verification task rather than one that encourages critical thinking and

¹Prior auditing research uses the term “mindset” in varying ways. One stream of research examines prompts designed to increase auditors’ awareness of specific risks such as heightened fraud risk or low client integrity and labels these prompts as “mindsets” (e.g., fraud mindset, skepticism mindset) (Hammersley, Bamber, and Carpenter [2010], Bowlin, Hobson, and Piercey [2013]). These prompts are not independent of the tasks under study. A second stream of research examines judgment frameworks based on psychological theories related to mindsets (Rasso [2013], Backof, Bamber, and Carpenter [2013a], Backof, Thayer, and Carpenter [2013b]). These judgment frameworks provide task-specific instructions and documentation requirements. Task independence is a critical feature of the definition of mindset we employ in this study. We design our study to ensure the mindset intervention is independent of the experimental task to isolate the effect of mindset on auditor judgments from factors that are specific to the experimental task.
consideration of a broad set of evidence. We examine whether prompting auditors to adopt a deliberative mindset can improve auditor judgments in this area.

We focus on auditors’ failure to identify and incorporate contradictory information into their analyses because this is a key judgment problem undermining audit quality in this area (PCAOB [2010e], Griffith et al. [2014]). Moreover, it is not a problem that can be readily addressed by writing new standards or creating more comprehensive checklists. That is, all information that is relevant to a key assumption underlying an estimate is not necessarily known or knowable while planning an evaluation of the assumption. Some such information will be available only incidentally—in another part of the audit or in external information collected for another purpose. Auditors must be able to recognize the relevance of the incidentally presented information and must be open to incorporating it into analysis of the assumption.

We develop theory predicting that putting auditors in a deliberative mindset can improve audits of complex estimates in realistic settings in which all the relevant information is not provided to auditors directly. In particular, a deliberative mindset facilitates broad focus of attention (Gollwitzer and Bayer [1999]), recognition of incidental information (Fujita, Gollwitzer, and Oettingen [2007]), and impartial information processing (Beckman and Gollwitzer [1987]). A deliberative mindset thus should improve auditors’ ability to identify an unreasonable estimate by facilitating auditors’ consideration of a broad set of evidence, facilitating their identification of inconsistencies between assumptions and data by allowing them to “hold open” the decision space while moving from one assumption to the next, and prompting a critical analysis of issues underlying management’s estimate.

We conduct an experiment in which we assign 94 senior-level auditors from three Big Four audit firms to one of three mindset conditions (deliberative, implemental, or control) and
ask them to audit a client’s step one analysis of a goodwill impairment test.\(^2\) In our case, the client concluded that the calculated fair value of its business unit exceeds book value and thus has no goodwill impairment. However, the case contains seeded errors and inconsistencies among certain assumptions that imply the step one analysis is biased and overstates the fair value. Consequently, goodwill may be impaired. We expect that auditors in a deliberative mindset will be more critical of the client’s fair value analysis than auditors in other conditions because they will be more likely to identify the seeded issues.

We find evidence consistent with our predictions. Auditors in a deliberative mindset assess the client’s biased fair value as less reasonable than do auditors in control and implemental mindset conditions. Auditors in a deliberative mindset are also more likely to choose a next action step that reflects more urgent concern that the fair value is unreasonable. Finally, auditors’ explanations for their decisions are more likely to include the seeded issues and more valid issues with the estimate, generally, when they are in a deliberative mindset than when they are not.

Additional analyses demonstrate that auditors in a deliberative mindset are not less trusting of management in general, but they target the specific assumptions with seeded errors. They also appear to evaluate evidence about the appropriateness of the aggressive discount rate more critically than do auditors in other conditions. Mediation analyses and structural equation modeling confirm the posited mechanism is at work. That is, deliberative mindset auditors’ identification of the seeded inconsistencies and their evaluations of the appropriateness of the discount rate jointly fully mediate the relationship between the deliberative mindset and the

\(^2\) The key to understanding auditor performance, and thus audit quality, in a complex setting is identification of the cognitive mechanisms, and experiments have a comparative advantage in abstracting critical elements of real world settings and controlling for non-critical elements, allowing them to isolate relevant mechanisms (Libby and Luft [1993], Bonner [1999]).
assessed reasonableness of the fair value. Thus, the deliberative mindset intervention facilitates the identification of the seeded issues and critical analysis of the discount rate, which increases concern about the reasonableness of the fair value.

Our study provides new direction for improving audits of complex estimates, and it adds to growing evidence that improved critical thinking, rather than increased doubt or increased demand for evidence, is key for improving audit quality. Our view that improved critical thinking is key to improved audit quality is consistent with demonstrations in the area of fraud detection that increased doubt can increase the amount of planned audit work without increasing audit quality (Hammersley [2011], Hammersley, Johnstone, and Kadous [2011]), whereas auditor identification of the specific problems underlying the numbers and targeted collection of additional evidence does increase audit quality (Hammersley et al. [2011], Simon [2012]). Further, audit quality in these areas is improved by interventions designed to directly address auditors’ critical thinking (Hoffman and Zimbelman [2009], Brewster [2011], Simon [2012]).

The decision problems that auditors experience with complex estimates, including overreliance on management’s process, failure to notice discrepancies and inconsistencies, and failure to gather sufficient evidence, are generally viewed as resulting from insufficient professional skepticism (e.g., PCAOB [2011], see also Hurtt, Brown-Libur, Earley, and Krishnamoorthy [2013]). While auditing standards define professional skepticism at a conceptual level as an attitude that includes a questioning mind and a critical assessment of evidence (AU 230.07, American Institute of Certified Public Accountants (AICPA) [1997]), this often translates operationally into the amount of evidence demanded (e.g., see Glover and

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3 Another view is that an increasingly difficult task, caused by environmental and task factors, is largely to blame for auditors’ poor performance (e.g., Christensen et al. [2012]; Bell and Griffin [2012]; Braten et al. [2013]). This view is consistent with our own, insofar as it suggests that a solution lies in changing the task (or at least the approach to the task), rather than changing decision maker characteristics.
Indeed, the academic literature defines professional skepticism as a propensity to defer reaching a conclusion until sufficient evidence is accumulated or as a propensity to view the risk of misstatement as heightened (Nelson [2009], Quadackers, Groot, and Wright [2013]). While these views vary in their starting positions (i.e., neutral belief versus presumptive doubt), they both view a more skeptical auditor as needing more evidence to be convinced that management’s estimates are accurate (e.g., Hurtt [2010]).

We demonstrate that a focus on the critical assessment of evidence is crucial for improving audits of estimates. That is, our view is that in auditing complex estimates, auditors tend to collect enough evidence, but they do not approach the evidence in a manner conducive to critical thinking. We show that changing auditors’ mindsets through a brief intervention allows them to make better use of the available information.

2. Background and Hypothesis Development

2.1 BACKGROUND

The majority of research attempting to improve auditor skepticism has focused on auditors’ skeptical judgment (an understanding that additional work or effort is needed), and does not test whether skeptical judgment translates into skeptical action (a change in behavior based on the skeptical judgment) (Hurtt et al. [2013]). We view critical thinking as a key determinant of whether auditors know what skeptical action to take, and so whether they can take appropriate skeptical action. Concurrent research has started to examine methods aimed at increasing auditors’ critical thinking. For example, Plumlee, Rixom, and Rosman [2012] train auditors to be more skeptical by thinking critically. This method has not yet been applied to audits of estimates, but could be productive there. In the area of auditing estimates, Maksymov, Nelson, and Kinney [2013] show that the framing of audit procedures affects how much time
auditors allocate to less verifiable procedures, such as those involved in auditing assumptions underlying estimates. While Maksymov et al. [2013] stop at skeptical judgment, we expect this type of framing to be beneficial in encouraging skeptical actions, as well, as it changes how auditors think about procedures.

Closer to our own research, Backof et al. [2013b] and Rasso [2013] impose judgment frameworks (task-specific instruction) to change auditors’ responses to evidence. This is an important step—judgment frameworks can effectively instruct auditors to perform a task in a specified way and to document various considerations. However, it is unclear whether these frameworks affect auditors’ critical thinking about the available evidence or simply provide them with specific cues to a desired answer. Thus, it is unclear whether auditor judgments are really improved (or are merely more conservative) and, if improved, whether the improvement generalizes to other situations and whether it can be sustained. Our mindset intervention conveys no task-specific instruction, requires no extra work of auditors, and so is general. We designed our experimental task to allow insight into the critical thinking mechanisms at work.

We focus our examination on a critical judgment problem that has been a frequent topic of PCAOB inspection comments on complex estimates—auditors’ failure to notice and incorporate into their analysis inconsistencies among the assumptions, other internal data, and external conditions. For example, the PCAOB noted in one inspection report that when determining the fair value of a business unit for two different purposes, management and the audit firm’s specialist generated two very different values, and there was no evidence that the auditors considered the difference between the two measures (PCAOB [2010c], p. 10). Other reports note auditors failing to reconcile values used in management’s models with industry data.

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4 Rasso [2013] uses mindset terminology to describe his manipulation; however, the manipulation does not possess the two essential characteristics of a mindset (e.g., Gollwitzer [1990]). His manipulation best fits the description of a judgment framework, so we refer to it as such.
(PCAOB [2010b], p. 4), failing to consider customer growth and retention data and the feasibility of forecasted changes in cost levels in evaluating revenue projections for a goodwill impairment analysis (PCAOB [2010a], p. 10), and failing to reconcile a company’s capital needs projections with the contradictory capital projections used in a goodwill impairment analysis (PCAOB [2010d], p. 6-7).

2.2 MINDSET THEORY AND HYPOTHESIS DEVELOPMENT

We argue that a change in auditor mindset can improve auditors’ identification of such inconsistencies among pieces of evidence and thus audit quality in the area of complex estimates. A mindset is a set of judgmental criteria and cognitive processes and procedures that produce a disposition or readiness to respond in a certain manner (Gollwitzer [1990], Hamilton et al. [2011]). For example, auditors might find themselves in a mindset that encourages a broad consideration of information in order to make the best choice from a set of alternatives, or they might find themselves in a mindset that encourages a linear processing of obviously task-relevant information in order to complete a task quickly.

A critical feature of mindsets is that they are not specific to the task at hand (Gollwitzer [1990]), but instead represent a global readiness to respond (Hamilton et al. [2011]). Mindsets influence how individuals approach their tasks, including what aspects of the task they attend to and what their ultimate judgments will be. Thus, the influence of mindsets on judgments is profound. Moreover, once activated, a mindset persists for some time and across unrelated tasks without conscious awareness (Gollwitzer [1990], Wyer and Xu [2010]). This implies that mindsets that have been instantiated in service of a particular task in a particular setting can affect decision behavior in subsequent tasks, even though the goal and content of the tasks are very different (Wyer and Xu [2010]). For example, individuals who deliberate the pros and cons
of alternative possible decisions related to an unresolved personal problem apply a similar deliberative process when performing a subsequent unrelated task. When asked to write the ending to a fairy tale, they describe characters that are relatively ambivalent and unable to decide what to do (Gollwitzer, Heckhausen, and Steller [1990]). In contrast, individuals who describe how to implement a course of action related to an unresolved personal problem as their first task subsequently write fairy tales about characters that are more “implemental” in that they decide on and pursue courses of action (Gollwitzer et al. [1990]).

There are numerous ways of categorizing mindsets (Wyer and Xu [2010]), but we focus on the deliberative and implemental mindsets as described by Action Phase Theory (Gollwitzer [1990]; Gollwitzer et al. [1990]). Action Phase Theory asserts that deliberative and implemental mindsets are differentially helpful to different decision phases, and may arise naturally in response to certain tasks. Decision makers tend to adopt a deliberative mindset when deciding what action to take or whether an action should be taken. A deliberative mindset facilitates a broad consideration of the pros and cons of various alternatives before action. Once an action has been determined, decision makers tend to adopt an implemental mindset, which facilitates efficient processing of tasks without much consideration of higher goals. An implemental mindset facilitates planning how, rather than whether, to execute a task or reach a goal, which results in increased efficiency.

Mindsets affect the acquisition and processing of information. In general, mindsets promote the acquisition of mindset-consistent information (Gollwitzer et al. [1990]). Specifically, a deliberative mindset fosters a wide focus of attention that expands beyond information that is strictly relevant to a task (Gollwitzer and Bayer [1999], Heckhausen and Gollwitzer [1987]). It also increases recognition of incidentally presented information (Fujita et
al. [2007]) and promotes impartial information processing (Beckman and Gollwitzer [1987],
Taylor and Gollwitzer [1995]). In contrast, an implemental mindset fosters a narrow focus on
obviously task-specific information and biased information processing that only considers
information that supports the chosen goal or preference (Gollwitzer and Bayer [1999],
Heckhausen and Gollwitzer [1987], Henderson, De Liver, and Gollwitzer [2008]).

When auditing complex estimates, auditors appear to adopt a mindset well suited to the
goal of verifying accounts and ill suited to critical analysis and broad thinking. That is, auditors
appear to approach audits of estimates as verification tasks, with a goal of finding evidence to
support each element (assumption) of the estimate separately, then moving on to the next
element (Griffith et al. [2014]). We expect that this task framing causes auditors to adopt a
mindset more like the implemental, rather than deliberative, mindset. This makes it difficult for
them to notice and process external and internal information that is presented incidentally and is
inconsistent with management’s estimate. Consistent with this conclusion, PCAOB inspections
reveal that significant problems occur in audits of fair values in that auditors “failed to evaluate
the effect of contradictory evidence when concluding on the reasonableness of certain significant
assumptions” in such audits (PCAOB [2010e], p. 12).

The above suggests that auditors tend to default to a mindset that is more similar to the
implemental than to the deliberative mindset when auditing estimates. An implemental mindset
orients a person to quick, decisive action in order to complete a task. Thus, it facilitates efficient
completion of pre-programmed tasks, such as verification that evidence exists for a given
management assertion. When auditing estimates, an implemental mindset likely prompts
auditors to focus on the evidence obtained for the purpose of testing a particular assumption,
which can help auditors efficiently complete each step of evaluating an assumption individually,
then move on to evaluate the next assumption. However, we expect an implemental mindset is less well suited to tasks that require critical thinking and a broad consideration of information before taking action, such as incorporating relevant but incidentally presented information when evaluating the assumptions underlying estimates collectively (i.e., holding open the decision space) and evaluating assumptions critically (i.e., addressing “is this a good assumption?” rather than “is this assumption acceptable?”). Mindsets can be changed with external interventions (Gollwitzer et al. [1990]), and we propose that changing auditors’ mindset to one that encourages deliberative, critical thinking could improve the quality of audits of estimates.

In general, an implemental mindset causes attention to be centrally focused on the specific task at hand, and, particularly, to one-sided processing of that information, while a deliberative mindset increases open-mindedness to incidentally presented information and a more balanced view of that evidence. Since auditors approach audits of complex estimates as a series of verification tasks such as evaluating individual assumptions, a confirmatory focus on task-central information likely limits both auditors’ ability to consider relevant evidence when it appears outside the “task” (audit program step) of evaluating a particular assumption. In particular, this focus likely limits their ability to recognize contradictions and inconsistencies among different assumptions and between the assumption and the underlying evidence. We believe that it is common that key information for evaluating an assumption is not part of the management-provided information set for that assumption, and PCAOB inspection deficiencies are consistent with this belief (e.g., PCAOB [2010a], p. 10; PCAOB [2010b], p. 4). We hypothesize that a deliberative mindset will help auditors acquire and incorporate such incidentally presented information into their judgments about complex estimates. This implies that auditors in a deliberative mindset will be more likely to recognize seeded errors and
inconsistencies underlying complex estimates, and they will take these into account when assessing the reasonableness of the estimate, assessing a biased estimate as less reasonable. Because auditors in a deliberative mindset have specific ideas about the issues and problems underlying the estimate, they should recognize the urgency of the situation and be more likely to bring the estimate to their supervisor’s immediate attention. We present these hypotheses below.

**Hypothesis 1:** Auditors receiving a deliberative mindset prompt will evaluate a biased estimate as less reasonable than will auditors not receiving the prompt.

**Hypothesis 2:** Auditors receiving a deliberative mindset prompt are more likely to call a biased estimate to their manager’s attention immediately than are auditors not receiving the prompt.

**Hypothesis 3:** Auditors receiving a deliberative mindset prompt will identify more seeded inconsistencies and errors underlying a biased estimate than will auditors not receiving the prompt.

Although we expect a deliberative mindset prompt to facilitate identification and incorporation of incidentally presented information into one’s analyses, as well as unbiased information processing for complex estimates, we note that an implemental mindset prompt may also prove useful for some aspects of auditing complex estimates relative to the control condition. To the extent that auditors in the study are not already in an implemental mindset, an implemental mindset prompt may facilitate efficient task completion and provide a framework for taking action. To the extent that action steps are clear, an implemental mindset prompt will motivate auditors to efficiently engage in those steps (e.g., Freitas, Gollwitzer, and Trope [2004]) and will facilitate evaluation of information in a single direction (Henderson et al. [2008]). Further, by suppressing deliberation about whether the task is worth engaging in, it may increase persistence (Brandstätter and Frank [2002]) and performance (Armor and Taylor [2003]).
3. Method

We test our hypotheses in an experiment in which we manipulate mindset between participants at three levels (deliberative, implemental, and control/no mindset manipulation). We obtained 94 usable responses from experienced audit seniors who participated while attending national or local training sessions sponsored by their firms.\(^5\) Participants come from three Big 4 firms and their audit experience ranges from 30 to 72 months (average 39.3 months). Seventy-eight percent are CPAs. Evaluating assumptions related to complex estimates is most often performed by audit seniors (Griffith et al. [2014]), so these auditors are appropriate participants.

3.1 TASK

Participating auditors evaluated the reasonableness of the fair value of a business unit of an electronics manufacturer. The fair value is used in the client’s step one analysis of the goodwill impairment test on the current year audit. The client used a discounted cash flow model to estimate the fair value. Projections of future revenue, operating expenses, and capital expenditures, and the discount rate are important inputs into the discounted cash flow model. Auditors were told that their team had already evaluated the appropriateness and mathematical accuracy of the model, and that their job was to evaluate these four assumptions and form a preliminary conclusion about the reasonableness of the fair value.

The case, which was adapted from a firm’s training materials, included background information about the company, followed by the goodwill impairment test that had been prepared by the client, including the step one analysis and the discounted cash flow model supporting the analysis. The case also included four sections with summaries of the audit evidence related to each of the four key assumptions: revenue projections, expense projections, capital expenditures

\(^5\) We received 103 complete instruments from auditors meeting our predetermined criteria of having at least 30 months of audit experience. We eliminated data from 9 participants who indicated that they did not give the materials sufficient attention.
projections, and the discount rate. We seeded four issues indicating problems with the fair value throughout the case. These issues and their potential impacts on the fair value are summarized in Table 1. Importantly, a key piece of information necessary to identify each seeded issue appears as part of the evidence related to an assumption other than the assumption implicated by the issue. This setting requires auditors to recognize the incidentally presented information as relevant to the other, targeted assumption to identify the seeded problems. It also requires them to incorporate the information into their analysis, even though it contradicts information presented that is labeled as relevant for the targeted assumption. For example, identifying the seeded issue related to capital expenditures requires noticing and incorporating a piece of information presented among the evidence supporting management’s operating expense projections that contradicts the capital expenditures assumption.

[Insert Table 1 here]

After reading the case, auditors assessed the reasonableness of the fair value, decided what they would like to do next regarding the fair value, and gave reasons for their decision. Next, they put away the case and opened a packet containing additional questions, including evaluations of the individual assumptions and demographic information.

3.2 INDEPENDENT VARIABLE

We manipulated mindset at three levels: deliberative, implemental, and control. In the deliberative and implemental mindset conditions, a mindset intervention preceded the case materials described above. Auditors assigned to the deliberative mindset condition were instructed to consider the possibility of doing an international rotation with their firm and to list three pros and three cons of doing such a rotation, thus encouraging them to deliberate about the merits of such a rotation. Auditors assigned to the implemental mindset condition were
instructed to assume that they had decided to pursue a one-year international rotation and were asked to list six steps that they would take to obtain a rotation, thus encouraging them to think about how they would implement a strategy to obtain such a rotation. Auditors assigned to the control condition started immediately on the case materials described above. They completed the implemental mindset intervention after completing the case materials in order to equalize timing across all three conditions.

Our mindset intervention instructions are briefer than those used in the prior psychology literature (e.g. Gollwitzer and Kinney [1989], Taylor and Gollwitzer [1995], Gollwitzer and Bayer [1999]); however, they retain the essential features of those instructions. In particular, participants in the deliberative mindset condition were asked to list the pros and cons of achieving a potential goal (specifically, three pros and three cons of going on an international rotation), whereas participants in the implemental mindset condition were asked to list the steps they would take to accomplish a goal (specifically, six steps to obtain an international rotation). While prior research has participants choose their own dilemma (in the deliberative condition) or goal (in the implemental condition), we used the international rotation to establish these for them. This procedure considerably reduces the duration of the task, as participants don’t have to contemplate which goal to consider, while ensuring the goal is relevant to them as auditors yet unrelated to the primary audit task.6

6 We validated our manipulation in a pilot study. Prior research finds that deliberative and implemental mindsets affect attitude strength in that participants in a deliberative mindset are more ambivalent about issues and less likely to express a one-sided attitude towards a particular issue (Henderson et al. [2008]). Therefore, to validate our international rotation version of the mindset manipulation, we gave senior-level auditing students the international rotation manipulation (modified to “international internship”) and measured their attitude ambivalence using the same 29 questions used in Henderson et al. [2008]. Results indicated the abbreviated manipulation was effective: the deliberative mindset group evidenced a significantly higher amount of ambivalence (mean (SD) = 3.34 (0.62) than the implemental mindset (mean (SD) = 2.87 (0.67), \( t_{39} = 2.36, p = 0.024 \)) and control (mean (SD) = 2.96 (0.73), \( t_{41} = 1.84, p = 0.073 \), two-tailed) groups.
Importantly, our mindset intervention differs from the various auditor judgment frameworks that also draw upon mindset theories in concurrent work (e.g., Rasso [2013], Backof et al. [2013a, b]). These judgment frameworks include task-specific instructions to auditors to document certain considerations, and they provide an explicit structure for auditors to follow as they perform and document the assigned task. Thus, they do not have either of the essential features of mindsets (i.e., being more general than required by the task and carrying over from a prior task). In addition, these judgment frameworks confound distinct types of mindsets (e.g., the deliberative/implemental mindsets are conflated with construal level and counterfactual reasoning mindsets). In contrast, our mindset intervention references a deliberative or implemental mindset only, is unrelated to the task content, and it does not change the task instructions, structure, or documentation requirements as judgment frameworks necessarily do.

We use this intervention to isolate the effects of deliberative and implemental mindsets on auditors’ cognition and processing of information in this setting and their subsequent judgments about estimates.

To confirm that participants internalized the assigned mindset (deliberative or implemental), a research assistant who was blind to experimental condition and hypotheses categorized the items written about international rotations as either identifying pros and cons or listing specific steps. Of the items participants in the deliberative (implemental) condition wrote, 97.2% (98.6%) were coded as identifying pros and cons (listing specific steps). This indicates that participants attended to our mindset manipulation.

3.3 DEPENDENT VARIABLES

We measured three primary dependent variables: reasonableness of the fair value, decision about what action auditors would take next, and the specific reasons or issues
supporting this decision. Auditors assessed the reasonableness of the fair value on an 11-point Likert scale anchored by 0 (not at all likely to be reasonable) to 10 (extremely likely to be reasonable). Because we seeded issues that bias the estimate upward, lower values represent better judgments. Table 1 shows that, based on the case information, any one of the four seeded issues has a potentially material impact on the fair value, and any two or more of the issues in combination have a highly material impact. We use this dependent measure to test Hypothesis 1.

Auditors next chose from four options about what to do next: (1) conclude that the fair value is reasonable; (2) continue audit work under the assumption that the fair value is reasonable but delay forming a final conclusion until talking to the manager about one or more issues the next time s/he is on site; (3) do not make a conclusion but call the manager immediately regarding issues that may indicate the fair value is not reasonable; or (4) conclude that the fair value is materially overstated. No participants chose the fourth option, and only four chose the first option. For analysis purposes, we recoded this variable as contact the manager immediately (option 3) or not (options 1 and 2). We use this dependent measure to test Hypothesis 2.

Finally, auditors provided specific reasons supporting their decision. Two research assistants with auditing experience who were blind to hypotheses and experimental condition independently coded the reasons and issues into one of four categories: target issues, other connected issues, other issues, and items supporting the fair value. Target issues include the four issues seeded in the case that indicate problems with the fair value. These issues can only be identified by combining information about one assumption with information presented incidentally as part of the information ostensibly about another assumption. Other connected

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7 Of these four, three participants were in the control condition and one participant was in the implemental condition.
issues are items other than the four seeded issues that also indicate problems with the fair value and that can only be identified by connecting different pieces of information presented within the section of the case related to the implicated assumption. For example, items questioning the appropriateness of current revenue growth assumptions based on optimistic past revenue growth assumptions are coded here. Other issues also indicate problems with the fair value, but they directly restate information from the case or evaluate information in isolation, without combination with other case information. Finally, items supporting the fair value indicate no problems with the fair value. The coders’ initial agreement rate was 93.8 percent and Cohen’s kappa, a measure of agreement above chance, was 0.90 (p < 0.01). The coders met to resolve their coding differences and the resolved coding is used in the analysis reported here. We use the number of target issues identified as our dependent measure in tests of Hypothesis 3.

4. Results

4.1 PRELIMINARY ANALYSIS

We estimated general linear models for each of our dependent measures with experimental condition, firm, and the interaction of condition and firm as factors. None of the main or interactive effects involving firm was significant. Therefore, we combine observations across the three firms in the following analyses.

4.2 TESTS OF HYPOTHESES

Our primary tests of hypotheses contrast the deliberative mindset condition with the control condition and the implemental mindset condition, jointly. We also report comparisons of the deliberative mindset condition with each of these other conditions, singly, as well as comparisons of the implemental mindset and control conditions to each other, for further information. We expect that control condition auditors tend to be in a mindset comparable to the
implemental mindset condition, so we don’t anticipate large differences between the control and implemental mindset condition; however, this design allows us to establish whether the implemental mindset intervention also provides some judgment benefits over the control condition.

Hypothesis 1 examines whether auditors in a deliberative mindset are better able to recognize an unreasonable estimate than other auditors. Table 2 provides descriptive statistics (Panel A), an ANOVA model (Panel B), and contrasts, including the test of Hypothesis 1 (Panel C) for auditors’ assessments of how likely it is that the fair value estimate is reasonable. Panel A shows that mean reasonableness judgments appear to be lowest in the deliberative mindset condition, as expected. Panel B shows that experimental condition significantly influences assessed reasonableness (p = 0.0304).8

[Insert Table 2 here]

Planned contrasts in Panel C confirm that, as predicted, assessed reasonableness of the fair value is lower in the deliberative condition than in the other two conditions (t_{91} = 2.63, p = 0.0050). Examining the comparisons separately, both the difference in reasonableness assessments between the deliberative mindset and the control condition and between the deliberative and implemental mindset conditions are significant (t_{91} = 2.57, p = 0.0059 and t_{91} = 1.79, p = 0.0384, respectively). Also as expected, mean reasonableness assessments do not differ in the implemental mindset and control conditions (t_{91} = 1.06, p = 0.2925). These results support Hypothesis 1 and show that a deliberative mindset helps auditors to identify biased estimates as unreasonable.

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8 We report two-sided p-values for all tests other than tests of our directional predictions (comparisons of the deliberative mindset condition to other conditions, collectively and singly), for which we report one-sided p-values.
Hypothesis 2 predicts that auditors receiving the deliberative mindset intervention will be more likely to call attention to the problems they found in the fair value by contacting their manager immediately than will auditors in other conditions. This is important because a problematic fair value is more likely to be acted on in the audit if more senior team members are aware of the issue earlier. Table 3 shows descriptive statistics by condition (Panel A) and contrasts from a logistic regression model (Panel B) for the proportion of auditors choosing to contact their manager immediately. Untabulated analyses show that experimental condition significantly influences decision ($X^2 = 10.52, p = 0.0052$). The descriptive values show the highest value for the deliberative mindset and the lowest for the control condition, with the value for the implemental mindset condition falling between the two.

[Insert Table 3 here]

Planned contrasts confirm that auditors in the deliberative mindset condition are more likely than auditors in the implemental mindset and control conditions to contact their manager immediately (74% versus 46%, $Z = 2.96, p = 0.0015$), supporting Hypothesis 2. The contrast between the deliberative mindset and control conditions is highly significant ($Z = 3.23, p = 0.0006$). The proportion of auditors reporting they would contact their manager immediately in the implemental mindset condition lies between the proportions for the control and deliberative condition. That proportion is marginally significantly lower than the proportion in the deliberative condition ($Z = 1.64, p = 0.0505$), and it is marginally significantly higher than that in the control condition ($Z = 1.86, p = 0.0632$). Hypothesis 2 is supported in that the deliberative mindset intervention is associated with a higher likelihood of contacting the manager immediately, though the implemental mindset intervention also appears to provide some benefit in this regard over the control condition.
Table 4 presents descriptive statistics and contrast tests for the categories of reasons auditors gave for their decisions. Target issues, the main dependent variable for testing Hypothesis 3, is in bold, as is total valid issues. Hypothesis 3 predicts that auditors in the deliberative mindset condition will identify more target issues than will those in the implemental mindset and control conditions. The means shown in Panel A generally support this pattern. These means also show that auditors in the deliberative condition identify more valid issues with the fair value, overall, than auditors in other conditions, and they identify fewer reasons in support of the fair value than auditors in other conditions.

[Insert Table 4 here]

Panel B provides the planned contrasts for the number of target issues identified. Recall that there were four seeded target issues. Across all conditions, participants listed 0 to 3 of these items, with the mean (standard deviation) being 0.65 (0.73) and the median 1. Given the nature of the distribution, we used a Poisson regression to generate our contrasts. The model fit is good ($X^2_{91} = 86.04, p = 0.6273$), and experimental condition is a weak predictor of the dependent measure ($X^2_{2} = 4.02, p = 0.1339$).

The contrasts reveal that auditors in the deliberative condition identified and incorporated into their analyses more critical issues than did auditors in other conditions ($Z = 1.90, p = 0.0287$). This result is driven by the contrast between the deliberative and control conditions ($Z = 1.97, p = 0.0244$), while the contrast between the deliberative and implemental conditions is not significant ($Z = 1.07, p = 0.2794$). As expected, the contrast between the implemental mindset and control conditions also is not significant ($Z = 1.09, p = 0.2794$). These results provide support for Hypothesis 3 in that the deliberative intervention facilitated auditors’
acquisition and incorporation of key incidental information that indicated the fair value was unreasonable into their analyses.

As a supplementary test of Hypothesis 3, we also examined whether the total number of valid issues identified followed the same pattern as target issues. Relevant contrasts are in Table 4, Panel C. The total number of valid issues identified varies from 0 to 8, with a mean (standard deviation) of 2.45 (1.49) and a median of 4. When considering the total number of valid issues identified, auditors in the deliberative mindset condition identified significantly more problems with the fair value than did auditors in the implemental mindset and control conditions ($t_{91} = 2.28, p = 0.0125$). The contrast between the deliberative mindset and the control conditions is significant ($t_{91} = 2.20, p = 0.0139$), and the contrast between the deliberative and implemental mindset conditions is marginally significant ($t_{91} = 1.57, p = 0.0582$). Also as expected, auditors in the control and implemental mindset conditions did not identify different numbers of problems with the fair value ($t_{91} = 0.87, p = 0.3869$). These results largely support Hypothesis 3 and are consistent with the overall results for target issues.

4.3 ADDITIONAL ANALYSES—TESTS OF MECHANISM

Theory suggests that the deliberative mindset intervention can help auditors to make better judgments and decisions about an unreasonable estimate by facilitating recognition and incorporation into their analyses of incidentally presented information about problems with the fair value and by prompting unbiased (critical) evaluation of information. We provide additional analyses to demonstrate that these mechanisms are at work and that the deliberative mindset intervention makes auditors think differently, rather than simply making auditors work harder or behave more conservatively.
4.3.1. Evidence that auditors aren’t working harder, but thinking differently. First, we rule out the possibility that our deliberative mindset intervention causes auditors to work harder than they otherwise would. This is important because auditors, like other decision makers, have limited cognitive resources. This implies that having auditors work harder on one task is likely to impair their performance on the following task (e.g., see Hurley [2013]), and thus, solutions that do not increase cognitive load should be preferred over those that do.

We note that our deliberative and implemental mindset manipulations are based on the psychology literature, and thus, they are independent of the experimental task. We hold task instruction constant across conditions. In addition, there is no language in our manipulations that would be expected to influence how hard auditors work. Nonetheless, we asked participants to rate how hard they worked on the task on a scale from 0 (not at all hard) to 10 (extremely hard). The overall mean (standard deviation) was 6.18 (1.40), and it did not vary across experimental conditions ($F_{2,91} = 0.07, p = 0.9298$). Auditors in the deliberative mindset condition reported the same effort level as auditors in the other conditions ($t_{91} = 0.32, p = 0.7576$). In addition, we timed task performance for auditors from two of the three firms. We find no difference in effort duration across experimental conditions ($F_{2,66} = 0.71, p = 0.4954$). Auditors in the deliberative mindset condition took equally long to complete the task as did auditors in the other conditions ($t_{66} = 0.81, p = 0.4181$).

4.3.2 Evidence that auditors target the underlying assumptions with errors. Second, we demonstrate that deliberative mindset condition auditors’ assessments of the reasonableness of the specific underlying assumptions associated with management’s model were targeted to the assumptions with seeded errors, ruling out the possibility that the deliberative mindset prompt simply made auditors behave more conservatively across the board. As part of their assignment
to form an overall conclusion about the fair value, auditors in our study were asked to evaluate four specific assumptions underlying the fair value. The assumptions concerned five-year projections of revenue, five-year projections of operating expenses, five-year projections of capital expenditures, and the discount rate. Auditors assessed how likely management was to achieve their projections of each of the first three items and how likely it was that the discount rate was appropriate. Responses to all four items were measured on Likert scales ranging from 0 (not at all likely) to 10 (extremely likely).

As Table 1 shows, two incidentally presented seeded issues indicated that the revenue projections were biased upward because they did not consider important contradictory information, and one indicated that the projected capital expenditures were understated for a similar reason. The fourth incidentally presented issue related to the overall fair value. To the extent the deliberative mindset intervention facilitated consideration and incorporation of the seeded issues, we would expect auditors in the deliberative mindset condition to rate the revenue and capital expenditures assumptions as less reasonable than auditors in the other conditions. We would not, however, expect to find this pattern for operating expenses, for which no errors were seeded. (We discuss the discount rate assumption further below.)

Table 5 provides descriptive statistics for the evaluations of individual assumptions (Panel A), as well as p-values for contrast tests comparable to those reported for the overall reasonableness of the fair value. This table shows that deliberative mindset condition auditors rated the two assumptions for which errors were specifically seeded (revenue and capital expenditure projections) as less likely to be achieved than did auditors in other conditions ($p < 0.05$ in both cases). On the other hand, there were no significant differences across condition in assessments of the achievability of operating expense projections, for which there was no seeded
inconsistency or error. This evidence further supports the idea that the main results (lower assessed reasonableness of the fair value and a higher propensity to contact the manager immediately with a deliberative mindset intervention) occurred because the deliberative mindset intervention facilitates identification and incorporation of incidentally presented information into the analysis of the fair value, rather than causing an undifferentiated increase in doubt (i.e., conservatism).

[Insert Table 5 here]

We did not specifically seed any incidentally presented conflicting information about the discount rate; however, the instrument was clear that the company’s chosen discount rate was lower than the average rate used by its peers, and that this caused a higher fair value than would have been achieved with the peers’ discount rate. We found that auditors in the deliberative mindset intervention were less likely to find the aggressive discount rate appropriate than were auditors in other conditions ($p = 0.0029$). We expect this occurred because the deliberative mindset intervention, by priming a consideration of pros and cons, prompted auditors to more fully consider the implications of a lower discount rate, especially in light of our fourth seeded issue, that if management fell short on any of the other assumptions, the discount rate would become critical. Prior research establishes that auditors with low levels of valuation experience and knowledge are uncomfortable assessing the reasonableness of discount rates and, as a result, tend to ignore the issue in favor of relying on specialists (Griffith et al. [2014], Griffith [2014]). We conclude that the deliberative mindset prompted critical thinking about the discount rate in addition to helping auditors to identify and incorporate incidentally presented information.

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9 In an untabulated MANOVA, the effect of the interaction of the deliberative mindset condition with assumption type (seeded error versus no seeded error) yields $F_{2,92} = 3.19$, two-sided $p = 0.0784$. 

25
4.3.3. Evidence of mediation of the effect of the deliberative mindset intervention on reasonableness assessments. Third, we perform a mediation analysis to further test whether identification and inclusion in the analysis of incidentally presented information causes auditors to evaluate the overall estimate as less reasonable. Recall that the number of target issues identified was significantly impacted by the mindset manipulation (Hypothesis 3, Table 4, Panel B). We add target issues as a covariate to the ANOVA model for the reasonableness dependent measure. Table 2, Panel D reports the results of this ANCOVA. It shows that target issues is significant (F1,90 = 9.90, p = 0.0022), while experimental condition loses its prior significance (from p = 0.0304 to p = 0.1217). Contrasts based on this ANCOVA are presented in Table 2, Panel E. These results show that deliberative mindset condition participants assess the fair value as significantly less reasonable than do participants in other conditions, even when reasonableness assessments are adjusted for target issues (t90 = 2.05, p = 0.0216); however, as expected, the significance level declines from that of the model without the covariate. Thus, identification of target issues partially mediates between mindset condition and judgments of the reasonableness of the fair value.

Because auditors’ evaluations of the appropriateness of the discount rate appear to capture a separate effect of the deliberative mindset intervention on their judgment from that captured by target issues, we add this evaluation as an additional covariate to the above analysis. Table 2, Panel F shows that target issues remains significant for overall reasonableness ratings (F1,89 = 11.24, p = 0.0012), and that the new covariate, rated appropriateness of the discount rate, is also significant (F1,89 = 14.26, p = 0.0003), and experimental condition is no longer significant (F1,89 = 0.53, p = 0.5927). Contrasts based on this ANCOVA are presented in Table 2, Panel G. They show that deliberative mindset condition participants no longer assess the fair value as
significantly less reasonable than do participants in other conditions when these covariates are included in the model ($t_{89} = 0.96, p = 0.1690$). Thus, identification of target issues and evaluations of the appropriateness of the discount rate jointly completely mediate between mindset condition and judgments of the reasonableness of the fair value.

We provide a summary of the above analysis using a structural equation model in Figure 1. This model demonstrates that identification of target issues and the assessed appropriateness of the discount rate mediate the effect of the deliberative mindset intervention on assessed reasonableness of the fair value. That is, we model the independent variable as the deliberative mindset condition versus the other two conditions to match our hypotheses.

Overall, the model fits the data well. The traditional $\chi^2$ test shows a good fit ($\chi^2 = 0.80, p = 0.67$), as do other standard fit measures, including the Comparative Fit Index (1.00), which is above the generally accepted minimum value of 0.95 (Byrne 2013), and the Root Mean Square Error of Approximation (0.00), which is below the recommended maximum of 0.01. Examining the path coefficients, the relationship between the deliberative mindset condition and identification of target issues (Link 1) is positive and significant ($p < 0.05$), indicating that the deliberative mindset leads to greater identification of target issues (H3). The relationship between mindset condition and assessed appropriateness of the discount rate (Link 2) is negative and significant ($p < 0.01$), indicating that the deliberative mindset leads to a more critical evaluation of the discount rate. Finally, both identification of target issues (Link 3) and assessed appropriateness of the discount rate (Link 4) are associated with the assessed reasonableness of the fair value in the expected directions (negative, $p < 0.01$ and positive, $p < 0.01$, respectively). Both of the indirect effects of mindset condition on assessed reasonableness of fair value (through identification of target issues and assessed appropriateness of discount rate) are
significant ($p < 0.01$) by the product of Z-Scores test (Holbert and Stephenson [2003]), indicating that both paths are meaningful.\textsuperscript{10} In sum, these tests indicate that the deliberative mindset improves critical thinking, which improves auditors’ ability to identify an unreasonable estimate by facilitating identification and incorporation of conflicting data in their analyses.

[Insert Figure 1 here]

4.3.4. Evidence of effects of the implemental mindset intervention. We noted previously that our design allows us to detect whether an implemental mindset intervention may prove useful in facilitating efficient task completion. In this section, we examine whether the implemental mindset intervention improves performance relative to the control condition in our task. We expected that auditors in the implemental mindset condition would be no more likely than auditors in the control condition to identify the incidentally presented information, and our evidence supports this. Auditors in the implemental mindset and control conditions did not identify a different number of target issues focused on the incidentally presented information ($p = 0.2794$) or total valid issues concerning the estimate ($p = 0.3869$). Further, auditors in the implemental mindset and control conditions did not differently evaluate the assumptions about revenue projections ($p = 0.6058$) or capital expenditure projections ($p = 0.4398$), nor did they appear to more critically evaluate the discount rate ($p = 0.5079$). Finally, regarding the actions auditors would take in response to the case information, auditors in these two conditions did not evaluate the reasonableness of the fair value differently ($p = 0.2925$); however, implemental mindset condition auditors were marginally more likely to immediately contact their manager ($p = 0.0632$). We note that since implemental mindset condition auditors were not more likely to

\textsuperscript{10} Other recommended mediation tests, including the Preacher and Hayes INDIRECT test (Preacher and Hayes [2008]) and bootstrapping methods also support the significance of these indirect effects. The indirect test for identification of target issues yields $Z = -1.64$, $p = 0.05$, one-tailed and a 90% bias-corrected confidence interval of (-.495, -.037); and the indirect test for assessed appropriateness of the discount rate yields $Z = -2.39$, $p < 0.01$, one-tailed and a 90% bias-corrected confidence interval of (-.724, -.169).
identify the seeded issues, it is not clear how this consultation would lead to improved audit quality. Overall, we interpret this pattern of findings as evidence that when successful task completion requires recognition and incorporation of incidentally presented information, an implemental mindset does not facilitate audit quality. A deliberative mindset, on the other hand, does.

5. Discussion and Conclusions

To provide high audit quality in the area of complex accounting estimates, including fair values, auditors need to think broadly, incorporating evidence from a variety of sources into their analysis, and more critically. Our study provides theory predicting and evidence demonstrating that a deliberative mindset intervention facilitates the type of broad thinking that is required to identify inconsistencies and errors in a biased management estimate and to identify such an estimate as problematic. In our experiment, a brief deliberative mindset intervention caused audit seniors to evaluate a biased management estimate as less reasonable and to be more likely to call the estimate to their manager’s attention immediately when compared with auditors in other conditions.

Auditors in a deliberative mindset were not just more conservative—they were more discriminating. Auditors receiving the deliberative mindset intervention evaluated the individual assumptions with seeded errors as less likely to be achieved than did auditors in other conditions, but were not more likely to draw attention to assumptions without seeded errors. They were more likely to identify and incorporate seeded errors and inconsistencies into their analysis, and they were more likely to critically evaluate the discount rate. These two factors mediate the effect of the deliberative mindset on auditors’ evaluations and decisions. In other words,
auditors in a deliberative mindset made better use of the available evidence to identify a biased estimate.

Our study contributes to audit research and practice by identifying a key to improving audit quality in an area where audit quality is particularly problematic—complex accounting estimates. Auditors and regulators are concerned about auditors’ ability to provide high audit quality in this area. In particular, auditors have had difficulties recognizing and incorporating into their analyses inconsistencies among information in different parts of the audit. We identify a theory-based, yet simple intervention that allows auditors to make better use of the evidence they have available, particularly incidentally presented information, to recognize problems with management estimates.

One caveat is that auditor experience and knowledge may be an important boundary condition on the effectiveness of the deliberative mindset in improving audits of estimates. We limited our sample to auditors with at least 30 months of experience to ensure that all had some meaningful experience at the senior (in-charge) level. While the deliberative mindset helps auditors to hold open the decision space so that they can incorporate key evidence obtained incidentally while doing other tasks, auditors have to be able to recognize the relevance of the evidence in order for audit quality to be improved. Thus, we expect that auditors with more experience and knowledge are better able to take advantage of the deliberative mindset. Future research can explore this issue.

Our study contributes to psychology research on mindsets by demonstrating how the deliberative mindset, in particular, can influence judgments and decisions. A key aspect of mindsets is that they can influence judgments and decisions in subsequent tasks (e.g., Wyer and Xu [2010]), yet prior work has failed to demonstrate effects of deliberative and implemental
mindsets, in particular, on judgments. That is, while these mindsets have been shown to influence information acquisition and processing, judgment effects have been harder to demonstrate. We show that the deliberative mindset improves the quality of auditor judgments in a realistic audit task in which information that is incidental to auditing the assumption it is presented with is critical to performance of the overall task.

We also contribute a streamlined version of the implemental and deliberative mindset interventions. The manipulation most often used in the literature is time consuming and so is not practical for use with busy professionals. Our manipulation is easy to use and relevant to the audit context, yet it is independent of the audit task’s content so it is likely to be effective for a variety of audit tasks that may benefit from more deliberative mindsets.

Finally, our study adds to growing evidence that changing how auditors use evidence that they possess, particularly through interventions that facilitate critical thinking, is a promising route to improving audit quality. We note that interventions to directly prompt critical thinking have been shown to improve fraud planning judgments (Hoffman and Zimbelman [2009], Simon [2012]) and to facilitate detection of inaccurate management representations in analytical procedures (Brewster [2011]). Such interventions are likely to improve audits of estimates, as well. Concurrent work has begun applying similar prompts and decision frameworks to the area of estimates to identify instructions to encourage auditors to collect more information (Rasso [2013]) and to make more conservative judgments (Backof et al. [2013a, b]). Our work informs this related research on auditor judgment frameworks by demonstrating that a deliberative mindset changes the way auditors process and use the available information, absent the task-specific instructions and documentation requirements imposed by judgment frameworks.
Finally, audits of estimates entail specific problems for auditors, including the need to incorporate evidence from a variety of sources, such as information that one may encounter while performing a different step of an audit (Griffith et al. [2014]). We show that deliberative mindsets improve audit quality because they address this specific problem. We encourage other researchers to identify interventions that specifically address the particular judgment problems underlying audits of estimates.
REFERENCES


Figure 1. This figure summarizes how identification of target issues and assessed appropriateness of the discount rate mediate the effect of the mindset intervention on assessed reasonableness of the fair value using a structural equation model. The model fits the data well ($\chi^2 = 0.80$, $p = 0.67$, Comparative Fit Index = 1.00, Root Mean Square Error of Approximation = 0.00). All p-values are one-sided, reflecting directional predictions.
<table>
<thead>
<tr>
<th>Target issue</th>
<th>Relevant assumption</th>
<th>Location of incidentally presented information</th>
<th>Approximate effect of adjusting to address target issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a competing product for the new, innovative product that the company expects to drive future revenues, and this is not mentioned in the revenue projections analysis.</td>
<td>Revenue projections</td>
<td>Discount rate</td>
<td>Decreases fair value by $80 million</td>
</tr>
<tr>
<td>The company plans to reduce sales staff by 10% (and administrative staff by 3%) over three years while increasing revenues.</td>
<td>Revenue projections</td>
<td>Operating expense projections</td>
<td>Decreases fair value by $80 million</td>
</tr>
<tr>
<td>The company is building a new $14M office building but this is not included in the capital expenditures budget.</td>
<td>Capital expenditures projections</td>
<td>Operating expense projections</td>
<td>Decreases fair value by $11 – $40 million</td>
</tr>
<tr>
<td>Sensitivity analyses show that if two or more assumptions are wrong, impairment is likely.</td>
<td>N/A – overall fair value</td>
<td>Revenue, Operating expense, and Capital expenditures projections, Discount rate</td>
<td>Decreases fair value by $120 – $210 million</td>
</tr>
</tbody>
</table>

This table identifies the four seeded target issues, the assumption that it implicated, where the seeded information was located in experimental materials, and the approximate effect on the fair value of adjusting the assumption to address the seeded issue based on the information contained in the case. Recall that materiality in the case is set at $40 million, and a decrease in fair value of more than $40 million causes the client to fail step one of the goodwill impairment test.
TABLE 2
*Reasonableness of the fair value estimate*

Panel A. Descriptive statistics: Mean (Standard Deviation)

<table>
<thead>
<tr>
<th>Condition</th>
<th>n</th>
<th>Reasonableness of the fair value estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberative</td>
<td>38</td>
<td>4.76 (1.60)</td>
</tr>
<tr>
<td>Implemental</td>
<td>36</td>
<td>5.49 (1.78)</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>6.00 (1.92)</td>
</tr>
</tbody>
</table>

Panel B: Analysis of variance

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>2</td>
<td>21.998</td>
<td>10.999</td>
<td>3.63</td>
<td>0.0304</td>
</tr>
<tr>
<td>Error</td>
<td>91</td>
<td>275.611</td>
<td>3.029</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>93</td>
<td>297.609</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel C: Contrasts based on ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Hypothesis 1: Deliberative &lt; Control and Implemental</em></td>
<td>91</td>
<td>2.63</td>
<td>0.0050</td>
</tr>
<tr>
<td>Deliberative &lt; Control*</td>
<td>91</td>
<td>2.57</td>
<td>0.0059</td>
</tr>
<tr>
<td>Deliberative &lt; Implemental*</td>
<td>91</td>
<td>1.79</td>
<td>0.0384</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>91</td>
<td>1.06</td>
<td>0.2925</td>
</tr>
</tbody>
</table>

Panel D: Analysis of covariance (partial mediation by target issues)

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>2</td>
<td>11.899</td>
<td>5.950</td>
<td>2.16</td>
<td>0.1217</td>
</tr>
<tr>
<td>Target Issues</td>
<td>1</td>
<td>27.310</td>
<td>27.310</td>
<td>9.90</td>
<td>0.0022</td>
</tr>
<tr>
<td>Error</td>
<td>90</td>
<td>248.301</td>
<td>2.759</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>93</td>
<td>297.609</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Panel E: Contrasts based on ANCOVA with target issues as covariate

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 1: Deliberative &lt; Control and Implemental*</td>
<td>90</td>
<td>2.05</td>
<td>0.0216</td>
</tr>
<tr>
<td>Deliberative &lt; Control*</td>
<td>90</td>
<td>1.96</td>
<td>0.0265</td>
</tr>
<tr>
<td>Deliberative &lt; Implemental*</td>
<td>90</td>
<td>1.46</td>
<td>0.0739</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>90</td>
<td>0.75</td>
<td>0.4507</td>
</tr>
</tbody>
</table>

Panel F: Analysis of covariance (mediation by target issues and appropriateness of discount rate)

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>2</td>
<td>2.530</td>
<td>1.265</td>
<td>0.53</td>
<td>0.5927</td>
</tr>
<tr>
<td>Target Issues</td>
<td>1</td>
<td>27.039</td>
<td>27.039</td>
<td>11.24</td>
<td>0.0012</td>
</tr>
<tr>
<td>Appropriateness of Discount Rate</td>
<td>1</td>
<td>34.292</td>
<td>34.292</td>
<td>14.26</td>
<td>0.0003</td>
</tr>
<tr>
<td>Error</td>
<td>89</td>
<td>214.009</td>
<td>2.405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>93</td>
<td>297.609</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel G: Contrasts based on ANCOVA with target issues and appropriateness of discount rate as covariates

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 1: Deliberative &lt; Control and Implemental*</td>
<td>89</td>
<td>0.96</td>
<td>0.1690</td>
</tr>
<tr>
<td>Deliberative &lt; Control*</td>
<td>89</td>
<td>1.01</td>
<td>0.1562</td>
</tr>
<tr>
<td>Deliberative &lt; Implemental*</td>
<td>89</td>
<td>0.59</td>
<td>0.2774</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>89</td>
<td>0.75</td>
<td>0.5834</td>
</tr>
</tbody>
</table>

* We use a p-value from a one-tailed test for this directional prediction. All non-indicated p-values are two-sided.

The dependent variable measures auditors’ responses to “…how likely is it that the fair value of [Company’s] U.S. reporting unit is reasonable?” on a scale of 0 (not at all likely) to 10 (extremely likely). The estimate contained seeded errors; smaller numbers represent better decision quality.

Condition was manipulated as deliberative (an intervention asked participants to list the pros and cons of an unrelated course of action), implemental (an intervention asked participants to list steps they would take to attain a goal in an unrelated task), and control (participants received the deliberative or implemental manipulation after completing the dependent measures).
TABLE 3
Decision to contact manager

Panel A. Decision by condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Decision to contact manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberative</td>
<td>28/38 (73.68%)</td>
</tr>
<tr>
<td>Implemental</td>
<td>20/36 (55.56%)</td>
</tr>
<tr>
<td>Control</td>
<td>6/20 (30.00%)</td>
</tr>
</tbody>
</table>

Panel B. Contrasts based on logistic regression model with no covariates

<table>
<thead>
<tr>
<th>Source</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 2: Deliberative &gt; Control and Implemental*</td>
<td>2.96</td>
<td>0.0015</td>
</tr>
<tr>
<td>Deliberative &gt; Control*</td>
<td>3.23</td>
<td>0.0006</td>
</tr>
<tr>
<td>Deliberative &gt; Implemental*</td>
<td>1.64</td>
<td>0.0505</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>1.86</td>
<td>0.0632</td>
</tr>
</tbody>
</table>

Panel C. Contrasts based on logistic regression model with target issues as covariate

<table>
<thead>
<tr>
<th>Source</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 2: Deliberative &gt; Control and Implemental*</td>
<td>2.50</td>
<td>0.0062</td>
</tr>
<tr>
<td>Deliberative &gt; Control*</td>
<td>2.76</td>
<td>0.0029</td>
</tr>
<tr>
<td>Deliberative &gt; Implemental*</td>
<td>1.38</td>
<td>0.0838</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>1.61</td>
<td>0.1071</td>
</tr>
</tbody>
</table>

* We use a p-value from a one-tailed test for this directional prediction. All non-indicated p-values are two-sided.

The dependent variable is the proportion of auditors deciding to contact their manager immediately rather than either conclude that the estimate is reasonable or carry on with the normal audit process. The estimate contained seeded errors, so contacting the manager immediately represents better decision quality.

See Table 2 for independent variable descriptions.
### Panel A. Descriptive statistics: Mean (Standard Deviation)

<table>
<thead>
<tr>
<th>Condition</th>
<th>n</th>
<th>Target issues</th>
<th>Other connected issues</th>
<th>Other issues</th>
<th>Total valid issues</th>
<th>Reasons supporting estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberative</td>
<td>38</td>
<td>0.82 (0.80)</td>
<td>0.53 (0.69)</td>
<td>1.50 (1.18)</td>
<td>2.84 (1.48)</td>
<td>0.03 (0.16)</td>
</tr>
<tr>
<td>Implemental</td>
<td>36</td>
<td>0.61 (0.73)</td>
<td>0.33 (0.53)</td>
<td>1.36 (1.40)</td>
<td>2.31 (1.53)</td>
<td>0.28 (0.91)</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>0.40 (0.50)</td>
<td>0.50 (0.69)</td>
<td>1.05 (1.36)</td>
<td>1.95 (1.32)</td>
<td>0.25 (0.72)</td>
</tr>
</tbody>
</table>

### Panel B. Contrasts for target issues

<table>
<thead>
<tr>
<th>Source</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 3: Deliberative &gt; Control and Implemental*</td>
<td>1.90</td>
<td>0.0287</td>
</tr>
<tr>
<td>Deliberative &gt; Control*</td>
<td>1.97</td>
<td>0.0244</td>
</tr>
<tr>
<td>Deliberative &gt; Implemental*</td>
<td>1.07</td>
<td>0.1423</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>1.09</td>
<td>0.2794</td>
</tr>
</tbody>
</table>

### Panel C: Contrasts for total valid issues

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 3: Deliberative &gt; Control and Implemental</td>
<td>91</td>
<td>2.28</td>
<td>0.0125</td>
</tr>
<tr>
<td>Deliberative &gt; Control</td>
<td>91</td>
<td>2.20</td>
<td>0.0139</td>
</tr>
<tr>
<td>Deliberative &gt; Implemental</td>
<td>91</td>
<td>1.57</td>
<td>0.0582</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td>91</td>
<td>0.87</td>
<td>0.3869</td>
</tr>
</tbody>
</table>

* We use a p-value from a one-tailed test for this directional prediction. All non-indicated p-values are two-sided.

The dependent variable is auditors’ reasons given for their decisions about the reasonableness of management’s estimate and the action they would take (contacting their manager immediately or not). Two independent coders, blind to condition classified reasons as (1) target (seeded) issues with the fair value requiring combining information about one assumption with conflicting information presented incidentally with another assumption, (2) other connected issues with the fair value requiring connecting information presented within the section of the case related to the implicated assumption, (3) other issues with the fair value, (4) reasons supporting the fair value. Total valid issues is the sum of classifications #1 - #3.

See Table 2 for independent variable descriptions.
### TABLE 5
**Evaluation of assumptions**

#### Panel A. Descriptive statistics: Mean (Standard Deviation)

<table>
<thead>
<tr>
<th>Condition</th>
<th>n</th>
<th>Revenue Projections</th>
<th>Operating Expense Projections</th>
<th>Capital Expenditure Projections</th>
<th>Discount rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberative</td>
<td>38</td>
<td>4.32 (1.56)</td>
<td>5.00 (1.59)</td>
<td>5.16 (1.81)</td>
<td>5.82 (1.94)</td>
</tr>
<tr>
<td>Implemental</td>
<td>36</td>
<td>5.15 (2.02)</td>
<td>4.93 (1.76)</td>
<td>5.64 (1.73)</td>
<td>6.82 (1.73)</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>4.90 (1.55)</td>
<td>5.50 (1.28)</td>
<td>6.00 (1.21)</td>
<td>7.15 (1.53)</td>
</tr>
</tbody>
</table>

#### Panel B. P-values for contrasts

<table>
<thead>
<tr>
<th>Condition</th>
<th>Revenue Projections</th>
<th>Operating Expense Projections</th>
<th>Capital Expenditure Projections</th>
<th>Discount rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberative &lt; Control and Implemental</td>
<td><strong>0.0354</strong>*</td>
<td>0.5310</td>
<td><strong>0.0336</strong>*</td>
<td>0.0029</td>
</tr>
<tr>
<td>Deliberative &lt; Control</td>
<td><strong>0.1258</strong>*</td>
<td>0.2611</td>
<td><strong>0.0355</strong>*</td>
<td>0.0081</td>
</tr>
<tr>
<td>Deliberative &lt; Implemental</td>
<td><strong>0.0247</strong>*</td>
<td>0.8524</td>
<td><strong>0.1092</strong>*</td>
<td>0.0175</td>
</tr>
<tr>
<td>Implemental v. Control</td>
<td><strong>0.6058</strong></td>
<td>0.2053</td>
<td><strong>0.4398</strong></td>
<td>0.5079</td>
</tr>
</tbody>
</table>

* We use a p-value from a one-tailed test for this directional prediction. All non-indicated p-values are two-sided.

The dependent variable is auditors’ assessment of how likely it is that the individual assumption will be achieved in the case of projections, or is appropriate in the case of the discount rate. Assessments are measured on a scale from 0 (not at all likely) to 10 (extremely likely).

See Table 2 for independent variable descriptions.