A Habit Strength-Based Explanation for Auditors’ Use of Simple Cognitive Processes for Complex Tasks

Sarah Bonner
University of Southern California

Kathryn Kadous
Emory University

Tracie Majors
University of Southern California

October 2020

We thank Leo Barcellos, Lori Bhaskar, Scott Emett, Cassandra Estep, Lisa Gaynor, Emily Griffith, Ryan Guggenmos, Bright Hong, Justin Leiby, Eldar Maksymov, Chris Nolder, Mark Peecher, Truman Rowley, Adam Vitalis, Chris Wolfe, Wendy Wood, and workshop participants at Arizona State University, the European Network for Experimental Accounting Research (ENEAR) 2020 conference, the PCAOB’s Office of Economic Risk Analysis Seminar Series, Texas A&M University, and the 2019 Texas Audit Research Symposium for helpful feedback. We thank Erik Fujinami, Bright Hong, JungKoo Kang, Andrew Kim, Sharon Kim, Suteera Pongtepupathum, Taylor Reis, Michael Rezzo, Stacey Ritter, Meredith Schultz, and Fiona Wang for helpful feedback on the instrument. We also thank Nathaniel Young for the photographs used in the instruments, and Bright Hong, Ryan Kalaf, Molly Starobin, Genna Young, and Dana Zadeh for other research assistance. We also thank the four senior auditors with whom we conducted extensive interviews for giving their time. This study was supported by a Center for Audit Quality Research Advisory Board grant. We thank Margot Cella and Lauren Tuite of the CAQ for facilitating access to participants, members of the Research Advisory Board, especially John DeMelis, for helpful input, and participants for giving their time.

The views expressed in this article and its content are those of the authors alone and not those of the Center for Audit Quality.
A Habit Strength-Based Explanation for Auditors’ Use of Simple Cognitive Processes for Complex Tasks

We experimentally examine whether audit seniors’ use of simple cognitive processes for a complex task is affected by the strength of habits that they developed as staff. A habit is a mental association between a behavior and a specific context. We propose that, for seniors with stronger habits, the typical audit room context automatically activates the simple processes, making it harder to select task-appropriate processes. As predicted, in the typical context, seniors with stronger habits identify fewer issues with a complex estimate than weaker habits seniors. Seniors with stronger habits perform better in an alternative context that does not activate the simple processes, while those with weaker habits do not. We conduct additional analyses to validate that habit strength underlies our results and to further understand moderators and determinants of habit strength in the professional audit setting.

**JEL codes:** G10, M40, M41, M42, D80, D91

**Keywords:** habits, cognitive processing, accounting estimates, audit quality, goodwill impairment, fair value
I. INTRODUCTION

Accounting estimates are susceptible to misstatement due to management bias, making effective auditing critical for financial reporting quality (Bratten et al. 2013; Griffith, Hammersley, and Kadous 2015; Cannon and Bedard 2017). However, inspection reports continue to cite deficiencies in audits of estimates, particularly in evaluations of underlying assumptions (IFIAR 2017; IFIAR 2019). These reports and a growing body of research (e.g., Kadous and Zhou 2019; Joe, Wu, and Zimmerman 2020; Griffith, Hammersley, Kadous, and Young 2015; Austin, Hammersley, and Ricci 2020) suggest that these deficiencies are caused by auditors’ use of simple cognitive processes such as superficial processing, which impairs their ability to perform the task. Yet, we know little about why this is the case. We examine whether the extent to which seniors use simple cognitive processes when performing this complex task is affected by the strength of habits to use these processes they developed as staff auditors.

A habit is an association in memory between a behavior and a stable context in which that behavior is enacted. The association develops as the behavior is repeated in that context with rewards, and it facilitates future enactment of the behavior (e.g., Wood and Rünger 2016). Here, “behavior” refers to a physical or cognitive activity, and “context” refers to one’s surroundings, such as a place, other people who are present, etc. For example, people who frequently attend movies in a theater and repeatedly eat and enjoy popcorn while there can develop an “eat popcorn at the movies” habit (Neal, Wood, Wu, and Kurlander 2011).

We propose that staff auditors develop habits to use simple cognitive processes (hereafter, “habits”).¹ Staff auditors tend to work under conditions conducive to habit formation.

¹ All habits, whether they involve physical or cognitive behaviors, have a mental component and operate through similar mechanisms. Consistent with Fleetwood (2019), we rely on the simple, easy to understand habit of eating popcorn at the movie theater as an analogy to our proposed habit to facilitate reader understanding.
They typically work in a context that is fairly stable over time and across clients (i.e., a conference room at a client site housing multiple team members). Further, staff work includes simple tasks such as vouching prices from sales invoices to a price list, making it likely that many staff repeatedly use superficial, confirmatory, and piecemeal processes to complete their audit work. Because these simple processes are effective and particularly efficient for these tasks, some staff may feel rewarded for using the processes. For example, they may value praise they receive from superiors for completing their work efficiently (Nelson and Proell 2018).

Habits resist extinction (e.g., Wood and Neal 2016), implying that staff who develop habits will carry them forward when promoted to senior. However, we expect these habits will vary in strength, based on the extent to which seniors, as staff, used the simple processes and felt rewarded for doing so. Because people with stronger habits have stronger context-behavior associations in memory, when they experience the context, it is likely that the behavior will be automatically activated in memory, then enacted, even if the person is faced with a different task for which the behavior is undesirable (Wood and Rünger 2016). For example, people who have a strong “eat popcorn at the movies” habit eat the same amount of stale as fresh popcorn when in a theater context, despite disliking the stale popcorn (Neal et al. 2011). Thus, habit theory implies that seniors with stronger habits will use the simple processes when auditing an estimate in the typical audit room context, despite the processes being inappropriate for this task. Accordingly, our primary prediction is that, in the typical context, seniors’ simple process habit strength (hereafter “habit strength”) will have a negative effect on the identification of issues with the assumptions underlying an estimate.

An alternative context prevents the automatic activation of habitual behaviors, allowing people instead to act in line with task demands (e.g., Wood, Tam, and Witt 2005). For example,
Neal et al. (2011) observe that moviegoers with strong popcorn-eating habits, when in a meeting room context, eat significantly less stale than fresh popcorn. That is, they do not act “out of habit,” but instead allow the tastiness of the popcorn to guide their behavior. Likewise, habit theory implies that seniors with stronger habits, when placed in an alternative context, will be less likely to use the simple processes. Thus, we predict they will identify more issues in the alternative versus typical context. By contrast, weaker habits seniors should react less to an alternative context, as they are more likely to act based on task demands. Together, these expectations imply an interaction between habit strength and context, our second prediction.

We acknowledge that our application of the habit strength construct to auditing is somewhat exploratory. While most of the habits literature examines physical habits in everyday life, our proposed habit is cognitive and situated in a professional setting. These factors may make it both more and less likely that people develop and/or override unwanted habits. For example, cognitive habits may be more likely to develop, and also more difficult to override, than physical habits because the former are less likely to provide sensory feedback that can alert people to inhibit the behavior. Turning to the professional setting, habit studies generally focus on behaviors, such as running and eating popcorn, that individuals choose for themselves—likely based on personal preferences—while auditors are assigned their work. This may increase or decrease the extent to which auditors engage in the relevant behavior, which can in turn affect habit strength. Further, seniors gain knowledge through experience, and the effects of such knowledge may overcome the effect of strong habits on their behavior. Finally, seniors have strong incentives for effective task performance that may lead them to exercise self-discipline (e.g., Wood 2017) to override even strong habits. Yet, self-discipline is difficult to exercise when individuals are depleted (e.g., Wood 2019), as auditors often are (e.g., Hurley 2015).
We test our predictions in a 2 x 2 between-participants experiment with 128 experienced audit seniors from two large audit firms. Auditors evaluate assumptions underlying a fair value estimate in a goodwill impairment case. We embed in the case issues reflective of management bias; the identification of the issues is impeded by the use of simple cognitive processes. Thus, our dependent measure is the number of issues related to assumptions that auditors identify.

We measure our first independent variable, *habit strength*, using reaction times: how fast auditors, after being primed with a photograph of the typical context, complete word fragments related to the simple processes relative to completion of control fragments. This implicit measure directly captures habit strength (Rebar, Gardner, Rhodes, and Verplanken 2018), defined as the strength of the association in memory between the typical audit room context and the simple processes. We use a median split to classify auditors as having stronger or weaker habits. We manipulate context by randomly assigning auditors to imagine working in the typical or an alternative context when auditing the estimate. Participants in the typical context view a photo of a typical audit room. This context is designed to activate, with differential probability depending on strength, auditors’ habits. Those in the alternative context view the same audit room, but with key cues altered, such that their habits should not be activated by this context.

Results support our predictions. In the typical context, seniors who have stronger habits identify significantly fewer issues than seniors with weaker habits. We also find the predicted interaction between habit strength and context. In support of habits being at play, stronger, but not weaker, habits seniors identify significantly more issues in the alternative versus typical context. While our hypotheses are supported, we observe that weaker habits seniors, instead of showing little reaction to context, identify marginally *fewer* issues in the alternative context. This finding highlights the value of future research focusing on auditors with weaker habits.
We conduct additional analyses to validate that habit strength drives our results and to explore how the audit setting influences the development and enactment of habitual behaviors. First, we find that our habit strength measure is predicted by theoretical determinants of habit strength. Specifically, the extent to which seniors, as staff, repeated the simple processes and felt rewarded for doing so predicts habit strength. We further find that repetition of the processes depends on exposure to simple tasks. However, and possibly unique to the audit setting, auditors’ effectiveness preferences (as proxied by professional identity) reduce this relationship, highlighting that some staff choose not to use the processes when performing simple tasks. Second, consistent with habit theory, we find that a subset of stronger habits auditors override the negative effect of habit strength by exerting self-discipline. However, knowledge, as proxied by months of experience, number of goodwill audits, and comfort with goodwill, does not allow auditors to overcome these negative effects. Finally, we demonstrate that our findings are not driven by the possibility the audit setting carries different meaning for auditors with stronger versus weaker habits. Specifically, the former are not more likely to experience differential thoughts of pressures (e.g., stress, time issues) in the typical versus alternative context.

Across these tests, our findings provide converging evidence that habit strength can explain auditors’ use of simple processes where more complex processes are needed. Our findings also provide insight into the promise and limitations of applying habits theory to the professional audit setting. In terms of promise, habits are a form of Type 1 processing (Evans and Stanovich 2013) that, while garnering significant interest in psychology (Verplanken 2018), have not yet been examined in auditing. Conceiving of habits as an underlying cause of auditors’ use of simple processes illuminates why deficiencies in audits of estimates persist and provides new insights into solutions. Habits are “hardwired” in memory and, when strong, can resist
interventions such as instructions and education (Verplanken and Wood 2016), making traditional interventions such as revisions to standards or additional training ineffective.

To the extent that habit strength impairs auditor performance in complex tasks, our research is helpful in identifying new solutions. While habit theory suggests that solutions must alter the context or be targeted toward overcoming or breaking habits, such solutions likely are not practical in auditing. With the exception of unusual context changes forced by factors such as a pandemic, auditors likely will continue to work in something like the typical context in order to communicate with clients, so that habits developed in that context will come back into play if not currently operating in the home context. Overcoming or breaking habits requires the effortful exercise of a great deal of self-discipline. Indeed, our finding regarding self-discipline could appear to have promise (and also limit the importance of considering habits in auditing) insofar as incentives could be applied in the field to promote self-discipline. Our view is that such a strategy is not viable for the audit of estimates because auditors already are highly incentivized to avoid deficiencies (e.g., Johnson, Keune, and Winchel 2019) yet, as noted, deficiencies persist in this area (IFIAR 2019). Further, people are not able to continually exercise self-discipline in depleting environments (Itzchakov, Uziel, and Wood 2018; Wood 2019).

Instead, a better solution likely would be to prevent strong habits to use simple processes from forming in the first place. Our analysis of determinants suggests that firms could do so by reducing staff’s repetition of simple processes, potentially by encouraging seniors to “push down” complex tasks. Firms also could encourage staff to use complex processes even on simple tasks, possibly through seniors’ coaching or use of technology such as visualization, as well as by priming professional identity. Although some inefficiency may result, staff use of complex processes for simple tasks could lead to engagement-level benefits such as incidental detection of
fraud in low-risk areas and even development of complex process habits. The latter would be beneficial for many complex tasks seniors perform such as auditing revenues.

Finally, this study is the first to consider habits in an accounting setting. By examining how differences between the professional audit setting and those used in psychology affect habitual behavior, this paper also has the potential to advance theory on habits.

The rest of the paper is organized as follows. Section 2 provides theory and hypotheses. Sections 3 and 4 describe the design and results of the experiment. Section 5 concludes.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

In this section, we first develop theory that simple cognitive processes (superficial, confirmatory, and piecemeal processing) allow for effective and efficient completion of the simple tasks that staff frequently perform. Drawing from psychology theory on habits, we then argue that repetition of the simple processes in the typical audit room context, with rewards, can lead staff to develop habits of varying strength to use the processes. For seniors carrying forward stronger (versus weaker) habits, the typical context is more likely to activate use of those processes, even if they are not appropriate for the complex tasks they now perform. Thus, we predict that seniors’ habit strength will negatively affect their performance in the estimates task.

Simple Tasks Performed by Staff Auditors and Appropriate Cognitive Processes

Staff auditors’ work typically consists mostly of tasks that are relatively simple (e.g., Power 2003; Westermann, Bedard, and Earley 2015; Westermann, Cohen, and Trompeter 2019). We define simple tasks as those that involve unambiguous information cues and only a few cues to process, individually, at a time (Bonner 1994). For example, vouching prices from sales invoices to a price list is simple because it involves prices that are quantified and objective.

---

2 Seniors in our study reported spending a median of 70 percent of their time as staff doing simple tasks such as the vouching example that follows. An informal survey of ten current staff auditors indicates a median of 80 percent.
Further, vouching consists of a series of “micro-tasks” in that the auditor vouches prices for one invoice at a time; hence, there are only a few cues to process per audited “item” (Bonner 1994). Finally, staff can process each cue (price) individually because the necessary integration to project the likely misstatement in sales typically is performed later by software or a senior. We propose that at least some staff performing simple tasks will use simple cognitive processes, specifically superficial, confirmatory, and piecemeal processing, because these processes are appropriate for these tasks. That is, they lead to sufficiently effective, and far more efficient, performance than their complex counterparts (i.e., deep, nonconfirmatory, and integrative processing). Also, as argued below, we expect that some staff will feel rewarded for using these processes, for example because they receive positive reinforcement for exhibiting this tradeoff between efficiency and effectiveness.

*Superficial* processing is defined as focusing on obvious, surface features of information cues, and *deep* processing as analyzing their meaning and implications (Ajzen and Sexton 1999; Fonseca, Blascovich, and Garcia-Marques 2014). Superficial processing is sufficient for effective performance of simple audit tasks given their unambiguous cues. For example, when vouching sales prices, auditors need only glance at the price list to see if invoice prices are correct. While deeper processing, such as thinking about whether prices make sense under current economic conditions, also would lead to effective performance in this task, it is unnecessary to achieve the objective of testing the accuracy assertion for sales. Consequently, deeper processing during this simple task would lead to inefficiency.

*Confirmatory* processing is searching for evidence supporting, and/or interpreting evidence to be consistent with, what one expects or desires to see; *nonconfirmatory* processing entails searching for and accurately interpreting contradictory information (e.g., Kunda 1990).
Confirmatory processing also is sufficient for effective performance of simple audit tasks because of their unambiguous cues. For the vouching task, identifying incorrect prices requires only noting mismatches between invoices and the price list. Searching for contradictory evidence is not required because the evidence needed for drawing conclusions appears as part of the task; also, there is no interpretation needed to identify mismatches. While nonconfirmatory processing (e.g., scrutinizing each invoice with a price mismatch to ensure that there are no errors or fraud in other terms) also would lead to effective performance, again, it is unnecessary and inefficient.

Finally, *piecemeal* processing involves bringing one or a few cues into working memory, evaluating them, then “closing them out” by removing them from memory; *integrative processing* involves considering the implications of cues jointly, which necessitates returning to earlier cues for re-processing each time a new cue is introduced (e.g., Anderson 1981). Piecemeal processing is sufficient for effective performance of simple audit tasks, at least the “micro-task” part that is performed by staff. For the vouching task, staff compare the prices for one invoice to the price list, record any mismatches, and move to the next invoice knowing that information integration will be done later. Although integrative processing also could lead to effective performance, it is unnecessary and inefficient as integration would occur (again) later.

**Simple Cognitive Processes as Habits**

A habit is an association in memory between a specific behavior and a stable context in which that behavior is enacted.³ “Behavior” can refer to either a physical or cognitive activity, and “context” refers to one’s environment, including the place and people who may be present (Wood et al. 2005; Wood and Rünger 2016). The habit association develops and strengthens as people repeat and experience rewards for the behavior in the (stable) context (Wood and Rünger 2016).

---

³ Mental associations between items of various sorts, for example, the concepts “birthday” and “cake,” generally develop as those items are experienced together (Collins and Loftus 1975; McNamara 1992).
In turn, habit strength affects the probability the behavior is activated (and subsequently enacted) when a person experiences the context. We propose that auditors can develop habits to use simple cognitive processes that are activated, with differential probability depending on strength, when they experience the typical audit room context. We assume that audit staff experience the typical context as stable because, at most clients, auditors work in this kind of context; also, they tend to be assigned to the same clients over time. Therefore, we propose that auditors’ habit strength is a function of extent of repetition of the simple processes and rewards experienced for their use.

Initially, a given behavior may occur in response to a goal, the achievement of which is rewarded. For example, at first, a person may eat fresh popcorn at a movie theater because it tastes good. Similarly, at first, staff may use simple processes to perform simple tasks in an audit room because they feel rewarded for so doing. For example, they may receive positive reinforcement for trading off efficiency and effectiveness appropriately for their tasks. Over time, however, with rewarded repetition in a stable context, behaviors can become more strongly linked to the context than to the initial goal. In essence, behavioral control shifts to context, such that a behavior is automatically and unconsciously activated by the context rather than by task demands and the related anticipation of rewards (Wood and Neal 2007; Verplanken 2018). For example, moviegoers who repeatedly eat and enjoy popcorn can develop an “eat popcorn at the movies” habit, such that elements of the theater context (e.g., theater seats, the movie screen, lighting in the theater), rather than the desirability of the popcorn itself, activate the behavior (Wood, Quinn, and Kashy 2002; Wood 2017). The significance of this shift is underscored by

---

4 Similarly, research assumes that popcorn eating habits form in the stable theater context. We nevertheless verify that our participants experience the typical context as stable. Indeed, our seniors report spending a median of 70 percent of time working in such a context.
the finding that moviegoers with strong habits, in the theater context, eat distasteful stale popcorn in as high amounts as fresh (Neal et al. 2011). Following this theory, we expect that staff who repeatedly use simple processes to complete simple tasks in the typical audit room context can develop simple process habits, such that elements of the typical context (e.g., a conference table, multiple computers, snacks) automatically activate use of the simple processes. Activation of these processes makes it more difficult for auditors, when performing tasks requiring alternative processes for effective performance, to select the processes that are more appropriate.5

Habit strength is the strength of the context-behavior association in memory, here the typical audit room context and the use of simple processes. Stronger habits are formed with greater rewarded repetition in the context.6 Simple processes likely lead to rewards because they are sufficiently effective and particularly efficient for the simple tasks that staff tend to perform. Most audit teams face time and deadline pressures (Bobek, Daugherty, and Radtke 2012; Brown, Gissel, and Neely 2016; Westermann et al. 2019), such that superiors tend to reduce budgeted hours where possible, which likely is easiest in the lower risk areas where staff tend to work (e.g., Houston 1999; Bierstaker and Wright 2001, 2005). Therefore, staff also may use simple processes to manage to their superiors’ preferences to meet budgets while also being effective

5 While most previously studied habits are physical, both physical and cognitive habits have a critical cognitive component. A habitual behavior is initiated because the concept of the behavior (e.g., “eat popcorn”) is activated in memory when people experience the context (Wood and Rünger 2016; Neal, Wood, Labrecque, and Lally 2012). Habitual cognitive behaviors may be more likely to be enacted once activated than habitual physical behaviors, because physical behaviors require steps that involve sensory feedback that could alert an individual to stop the unwanted behavior. For example, habitual popcorn eaters may notice a bad smell or taste related to stale popcorn (Hagger 2019; Fleetwood 2019). By contrast, the steps involved in simple processing when auditing an estimate would be, for example, scanning through evidence and rapidly documenting conclusions; these steps provide minimal sensory feedback (e.g., only a vague feeling of typing quickly). Consistent with our assertion, recent studies identify other habits that are cognitive in nature, such as study habits (e.g., Galla and Duckworth 2015; Stojanovic, Grund, and Freis 2020) and mind-wandering habits (e.g., Wilmer, Sherman, and Chein 2017; Zedelius et al. 2018).

6 Habits can form quickly (Gardner and Lally 2018). For example, participants’ median days (repetitions) for exercise habit formation range from 66-154 (Lally, van Jaarsveld, Potts, and Wardle 2010; Fournier, d’Arrripe-Longueville, and Radel 2017). Audit staff have the potential to repeat simple processes 150 times in less than four months based on conservative assumptions of two simple tasks per day and a five-day workweek.
(e.g., Bagley 2010), receiving positive reinforcement for so doing (e.g., Nelson and Proell 2018). Importantly, however, repetition and rewards vary across staff, creating variation in habit strength. Moreover, staff also may vary in how much they feel rewarded. For example, staff with a high need for approval (Kelley 1984; Malone and Roberts 1996) may more highly value praise received from superiors.

Because habits are resistant to extinction (Wood and Neal 2016), we expect that staff will carry forward these habits (of varying strength) when promoted to senior. Importantly, auditors tend to stay in the typical audit room context when they move from staff to senior, but their work changes to include more complex tasks. Since habit strength determines the probability that habitual behaviors are automatically and unconsciously activated in memory when the context is experienced (Wood and Rünger 2016), seniors who carry forward stronger habits will be more likely to use the simple processes when in the typical audit room, irrespective of current task demands. When these processes are inappropriate for the task at hand and seniors are not able to override the habits to allow task demands to take precedence, their effectiveness will suffer.

**Effect of Habit Strength on Evaluation of Assumptions in Typical Context**

A robust stream of research supports that simple processes are ineffective for auditing an estimate and that at least some seniors use simple processes for this task. This research shows that seniors who receive interventions that encourage or facilitate use of complex processes, such as a deliberative mindset (Griffith et al. 2015b) or a goal-focused audit program (Hammersley and Ricci 2020), perform better than those who do not. Using simple processes impedes performance in the estimates task because it is complex. It involves ambiguous cues, such as predictions and qualitative information, that require interpretation and scrutiny to detect bias. This task also contains cues that have implications for other cues, including those that support
one assumption but contradict others. Thus, superficial and piecemeal processing can cause auditors to miss evidence indicative of problems. Confirmatory processing can lead auditors to fail to identify contradictory evidence or to “explain it away.” We suggest that one important reason for some auditors’ use of simple processes is that they have strong habits to do so.

Seniors with stronger habits are more likely to have the simple processes triggered by the typical context because they have a stronger link between this context and the simple processes in memory. Moreover, given that inhibiting a strongly habitual response requires a great deal of self-discipline (e.g., Wood 2017), we predict that seniors with stronger habits are likely to stick with the simple processes when in the typical context, irrespective of task demands. By contrast, the typical context is less likely to activate the simple processes for auditors with weaker habits; they also can more readily inhibit any habitual behaviors that are activated. Thus, we predict that auditors with weaker simple process habits will perform better than auditors with stronger habits in the typical context. As mentioned earlier, we capture the use of simple processes using the issues auditors identify with the assumptions underlying an estimate. Stated formally:

H1: In the typical audit room context, there will be a negative effect of habit strength on auditors’ identification of issues in an estimate’s assumptions.

How Context Moderates the Effect of Habit Strength

One way in which psychology research shows evidence of habits is by demonstrating that people classified as having stronger habits behave less habitually when placed in an alternative (compared to the typical) context (e.g., Neal et al. 2011; Neal et al. 2012). The alternative context is theorized to disrupt effects of strong habits because it alters key context cues that trigger habitual behaviors (e.g., Wood and Neal 2009). Since those cues are no longer present to activate the behavior in memory, people are free to consider which action is appropriate given task demands (Verplanken, Roy, and Whitmarsh 2018). Revisiting Neal et al. (2011), people
with stronger popcorn-eating habits who are given stale popcorn in a meeting room context eat less stale than fresh popcorn, and in fact, similar amounts of stale popcorn as people with weaker habits. Following this research, we predict that stronger habits seniors will be less apt to use the simple processes “out of habit” in the alternative context, and instead can select processes that are appropriate for the task. As a consequence, we predict that stronger habits auditors will identify more issues in the alternative context. By contrast, we expect weaker habits auditors are unlikely to react to context. These auditors are likely processing based on task demands regardless of context. This prediction is consistent with findings in psychology; for example, people with weaker popcorn-eating habits eat relatively little stale popcorn in both contexts (Neal et al. 2011). Collectively, our predictions imply the following interaction hypothesis:

\[ H2: \text{Auditors with stronger habits will identify more issues in assumptions in the alternative audit room context than in the typical audit room context, while auditors with weaker habits will not.} \]

We develop our hypotheses from habits theory, but we acknowledge that important features of the professional audit setting may limit the applicability of the theory to the setting. Although some seniors may have strong habits to use simple processes that could negatively affect their performance of complex tasks, they also have strong incentives to perform well. For example, auditors are highly motivated to avoid deficiencies arising from external inspections (Johnson et al. 2019) and internal reviews (Houston and Stefaniak 2013). These incentives could prompt auditors to consciously override unwanted habits, stopping themselves from using the simple processes. Indeed, the psychology literature often examines tasks for which the enactment of inappropriate strong habits leads to fairly benign consequences (e.g., a momentary bad taste from stale popcorn) so that people may be less motivated to override their habits in these settings. Additionally, auditors gain knowledge related to estimates tasks through experience,
and that knowledge could overcome habits and determine cognitive processing. As a consequence, habit strength could have no effect in the typical context. Further, if auditors with strong habits override those habits by exerting self-discipline or are guided more by task-related knowledge, then the alternative context also would not improve their performance, and our hypotheses would not be supported.

Despite these mitigating factors, we expect that simple process habit strength reduces auditor performance in an estimates task (and, therefore, that the alternative context can improve it) because there are formidable barriers to overcoming strong habits. First, overriding habits requires awareness that one is engaging in an undesirable behavior. Cognitive habits provide little sensory feedback, making this condition difficult to meet. That is, it may not be salient to auditors which cognitive processes they are using (Griffith et al. 2015a). Second, overriding strong habits using self-discipline requires a great deal of effort (e.g., Wood 2017), and many auditors may be unwilling or unable to exert such effort. Consistent with our view, research with other experienced (healthcare) professionals, who presumably face incentives to override unwanted habits, indicates that work-related behaviors such as taking a radiograph occur habitually (see, e.g., Potthoff et al. 2018; Bonetti et al. 2006, 2010; Grimshaw et al. 2011).

III. METHOD

Participants

Participants are 128 experienced senior auditors (mean experience of 40.3 months) from two large audit firms.7 Study administration was facilitated by the Center for Audit Quality, with participants completing the study during firm training sessions.8 The estimates task requires

---

7 We obtained Institutional Review Board approval for the study.
8 Firm significantly affects the dependent variable, but does not interact with the independent variables. Results of hypothesis tests including firm as a control remain significant at the same critical levels as reported.
participants to evaluate management’s assumptions related to a goodwill impairment test.

Seniors typically perform this task in practice (Griffith et al. 2015a).

**Design and Procedures**

Our study employs a 2 x 2 between-participants design. We measure (simple process) habit strength, classifying auditors as having stronger or weaker habits using a median split. We manipulate context by randomly assigning auditors to the typical audit room or an alternative audit room that removes many cues from the typical room. We manipulate context not to examine its effects *per se* but to validate that habit strength is driving our results, based on theory that the typical (alternative) context will (will not) activate habits. Observing theory-consistent effects of context also supports the validity of our habit strength measure (see Rebar et al. 2018).

The study proceeds as follows. Auditors first view a photo of their assigned context and write a paragraph to reinforce the manipulation. They then complete the estimates task, including listing any issues with the assumptions. Next, they answer post-experimental questions. Finally, all participants view a photo of the *typical* context when completing the habit strength measure. We use the typical context here because this is the context in which staff spend most of their time and, thus, likely develop habits. Use of the typical context for both the manipulation (to activate habits with differential probability based on strength) and during measurement of habit strength is consistent with prior research (e.g., Neal et al. 2011; Neal et al. 2012).

**Simple Process Habit Strength**

We measure habit strength using a reaction-time measure. Implicit measures are advantageous for capturing the strength of mental associations (De Houwer, Teige-Mocigemba, Spruyt, and Moors 2009), since strength affects not only the probability, *but also the speed*, of activation of the second item when the first item is activated. Given habits are defined as mental
associations between a context and behavior, this measure directly captures habit strength (Labrecque and Wood 2015; Mazar and Wood 2018; Rebar et al. 2018). While other measures such as frequency of past behavior in a stable context (Mazar and Wood 2018) capture single determinants of habit strength, the reaction-time measure captures the resulting association in memory, which incorporates all determinants, including experienced rewards. Other measures capture outcomes of habit strength, such as whether a behavior feels automatic (Verplanken and Orbell 2003). Our measure captures automaticity using speed, while overcoming limitations with outcome-based measures, such as that automaticity can resist conscious reflection (Hagger et al. 2015; Gardner 2015; Rebar et al. 2018) and does not capture the context-dependency of habits.

Our habit strength measure assesses the speed of auditors’ recognition of words reflective of the simple processes after experiencing the context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).

We implement our measurement procedures as follows. Near the end of the study, we prime (i.e., activate in memory, see, e.g., Doyen, Klein, Simons, and Cleerman 2014) the typical context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).

We implement our measurement procedures as follows. Near the end of the study, we prime (i.e., activate in memory, see, e.g., Doyen, Klein, Simons, and Cleerman 2014) the typical context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).

We implement our measurement procedures as follows. Near the end of the study, we prime (i.e., activate in memory, see, e.g., Doyen, Klein, Simons, and Cleerman 2014) the typical context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).

We implement our measurement procedures as follows. Near the end of the study, we prime (i.e., activate in memory, see, e.g., Doyen, Klein, Simons, and Cleerman 2014) the typical context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).

We implement our measurement procedures as follows. Near the end of the study, we prime (i.e., activate in memory, see, e.g., Doyen, Klein, Simons, and Cleerman 2014) the typical context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).

We implement our measurement procedures as follows. Near the end of the study, we prime (i.e., activate in memory, see, e.g., Doyen, Klein, Simons, and Cleerman 2014) the typical context in which we expect most have developed their processing habits (i.e., the typical audit room). This general context-behavior reaction time approach has been used in psychology studies. For example, Neal et al. (2012) assess the speed of participants’ recognition of words reflecting running after viewing words reflecting the typical context in which they run (e.g., “gym”). Adriaanse et al. (2011) assess the speed of participants’ recognition of words reflecting habitual snacks after being primed with “home” and drinks after being primed with “bar.” Implicit measures also have been used to capture the strength of habits related to transportation (Danner, Aarts, and de Vries 2008) and hand hygiene (Hargadon 2017).
context by having all auditors complete a one-minute “spot the difference” exercise involving two photos: the typical room and the same room with five small differences (created using Photoshop).10 We then collect reaction times by having auditors complete word fragments that reflect the simple processes while the typical context remains activated (the photo remains displayed). We instruct auditors to type the entire word represented by each fragment as quickly as possible (see Figure 1, Panel A), tracking completion time in milliseconds.11 The simple process words (e.g., scan, glance) are shown in Figure 1, Panel B, and were chosen based on interviews with four seniors. Auditors for whom the simple processes are strongly habitual should, ceteris paribus, more quickly complete the related fragments. However, because reaction times also can be affected by idiosyncratic factors such as typing or reading speed, we subtract reaction times to non-audit control words (as in Neal et al. 2012) (e.g., bark; see Panel B).12 That is, we calculate the difference between each auditor’s average completion time for the simple process fragments and average completion time for the control fragments, then classify auditors with faster (slower) completion times relative to the median as having stronger (weaker) habits.

Audit Room Context

Our second independent variable is audit room context, which we manipulate using a photo. This approach is consistent with the habits literature. For example, Neal et al. (2012) examine habits to speak loudly in a sports stadium and place participants in that context using a

---

10 We measure habit strength after manipulating context to prevent hypothesis guessing. We do not expect the earlier manipulation to affect the habit strength measure because we take this measure after auditors’ memory for context-related behaviors in the estimates task has been cleared by answering post-experimental questions. Consistent with this, context condition is not associated with measured habit strength (two-tailed \( p = 0.562 \)).

11 We observe skewness for some fragment reaction times; thus, we transform each reaction time by taking its reciprocal (see Whelan 2008).

12 Reaction times for the simple process word fragments load on one factor (eigenvalue = 5.01) and have a Cronbach’s alpha of 0.89, consistent with their reliably capturing the single construct of simple process habit strength. Reaction times for the control words load on two factors. Multi-dimensionality is to be expected as these words are not thematically related.
picture of a prototypical sports stadium. Hargadon (2017) uses photos of prototypical hand-washing contexts (e.g., a sink with soapy water) to examine hand hygiene habits. Like these studies, participants in our typical context view a photo of a staged, prototypical audit room (Figure 2, Panel A). Following prior research (e.g., Hargadon 2017), we elicited elements of what seniors consider the “typical audit room” in the above-mentioned interviews. We included all elements on which there was clear agreement: a conference table and chairs, multiple laptops, a printer, office supplies, snacks, coffee cups, and water bottles. Our alternative context (Panel B) omits several cues while maintaining a realistic working environment.13 We staged the two contexts in a conference room of a participating firm’s office, and a research assistant photographed the rooms. After viewing the pictures, auditors in the typical (alternative) context condition are given the instructions shown in Panel C (D) of Figure 2. They are asked to “describe what you have imagined in 5-7 sentences,” to make them feel like they are in the room (MacInnis and Price 1987) and, thus, activate the context in memory. Once the context is activated, the probability with which the habitual behavior is activated when doing the estimates task should (should not) vary with habit strength in the typical (alternative) context.

Task, Dependent Variables, and Other Measures

Estimates Task

The task requires that auditors evaluate management’s assumptions underlying an estimate of goodwill as part of the client’s step-one analysis of an impairment test and is adapted

13 Neal et al. (2012) place participants in an alternative context using a picture of a prototypical kitchen (i.e., an entirely different context than a sports stadium). However, because we examine professionals’ performance of a task that is part of their job, we needed to establish an alternative context that omitted some cues of the typical context but also maintained realism. To ensure that we achieved equivalent realism across contexts, we asked participants the extent to which they imagined themselves in the room and found doing so natural. We confirm that there is no difference in these responses across contexts (smallest two-tailed \( p = 0.467 \)) or for auditors with stronger versus weaker habits (smallest two-tailed \( p = 0.638 \)). Additionally, because lower responses may reflect participants finding the context quite unrealistic or having another idiosyncratic reaction, we confirm that our results replicate when excluding data from participants responding below the midpoint on these questions.
from Kadous and Zhou (2019). The task includes background information, analysis, and evidence related to management’s assumptions. The client uses a discounted cash flow model to estimate the fair value of the reporting unit, which indicates that it passes the impairment test. The task includes sections for three key assumptions: five-year projections of revenue, operating expenses, and capital expenditures. We embed seven issues that, as in the real-world task, are less likely to be identified if auditors use simple cognitive processes (see the Appendix).

**Dependent Variable and Other Measures**

Because our focus is on how habit strength affects cognitive processing in the estimates task, our dependent variable is the number of embedded issues a participant identifies (*Issues Identified*). We ask participants to “list any specific concerns” they have about the estimate based on their evaluation, and we match these to the seven embedded issues.\textsuperscript{14} Auditors also complete a number of other post-experimental questions to capture determinants of habit strength, potential moderators, and potential noise variables.

**IV. RESULTS**

**Tests of Hypotheses**

Values for *Issues Identified* range from zero to six of the seven embedded issues. Descriptive statistics are tabulated in Table 1, Panel A. We test hypotheses using an Analysis of Variance (ANOVA) model with *Issues Identified* as the dependent variable and independent variables indicating whether the participant’s Habit Strength is stronger or weaker and whether the assigned Context is typical or alternative (see Panel B).\textsuperscript{15}

\textsuperscript{14} An author and a doctoral student, both with auditing experience and blind to experimental condition, independently coded participants’ listings for the presence of each embedded issue and reconciled any differences. Raw agreement was 98\% and Cohen’s Kappa is 0.92, which is significantly greater than chance (\(p < 0.001\)). We use the reconciled coding for our dependent variable.

\textsuperscript{15} The data meet the ANOVA assumptions. However, because our dependent variable involves count data, we verify that our results hold using a negative binomial regression model.
H1 predicts that, within the *typical context*, auditors with stronger habits will identify fewer issues than auditors with weaker habits. Simple effects analyses are displayed in Panel C of Table 1. In support of H1, there is a significant negative effect of *Habit Strength* on *Issues Identified* (one-tailed $p = 0.014$) in the typical context. In this context, seniors with stronger habits identify fewer issues than those with weaker habits (means = 1.09 vs. 1.91).

H2 predicts an interaction whereby auditors with stronger habits will identify more issues when in the alternative versus typical context, while auditors with weaker habits will not. In support of H2, the interaction between *Habit Strength* and *Context* is significant (two-tailed $p = 0.011$) (Table 1, Panel B). As shown in Panel C, among auditors classified as having high *Habit Strength*, there is a positive simple effect of *Context* on *Issues Identified* (one-tailed $p = 0.024$) (means = 1.09 and 1.83). Performance of stronger habits auditors in the alternative context is indistinguishable from that of auditors with weaker habits in the typical context (untabulated, two-tailed $p = 0.868$), suggesting that their behavior is no longer guided by simple process habits. Turning to auditors with weaker habits, we unexpectedly observe a marginally significant negative simple effect of *Context* (two-tailed $p = 0.096$) (means = 1.91 vs. 1.28).

This effect is inconsistent with these auditors selecting processes based on task demands across

---

16 We also examine auditors’ *Reasonableness Assessments* (rated likelihood that the fair value is reasonable on a scale from 0-10) and *Actions* (no current action vs. immediate action) in (untabulated) structural equations models. Model results show that our independent variables affect *Issues Identified*, which then affects *Reasonableness Assessment* (i.e., more issues lead to a lower reasonableness assessment), which then negatively affects *Action*.

17 Analysis using a continuous *Habit Strength* measure yields a significant *Context X Habit Strength* interaction (two-tailed $p = 0.022$). The Johnson-Neyman technique identifies two statistically significant inflection points. The negative effect of *Context* observed for weaker habits auditors in tests of H2 is significant for *Habit Strength* scores ranging from the minimum of -0.033 to -0.008. The effect of *Context* is insignificant until a *Habit Strength* score of 0.039, at which point the observed positive effect of *Context* for stronger habits auditors becomes significant, and then strengthens, persisting to the maximum of 0.089. This supports the theoretical prediction and demonstrates that our interaction is not dependent on our use of the median split. We also confirm that results for hypotheses tests are significant at the same critical levels if we drop or reclassify the one observation with the median measure of habit strength or drop the five observations closest to the median. Results for hypotheses tests are also robust to dropping data from an individual who identified 6 of the 7 issues (so is an outlier, falling three standard deviations above the mean performance). The only qualification is that the marginally significant, negative simple effect of *Context* for auditors with weaker habits falls below significance (two-tailed $p = 0.180$) when dropping this observation.
contexts. Thus, while our hypotheses are supported and our tests provide evidence of strong simple process habits impairing auditor performance, future research to examine whether weaker habits auditors are subject to processing habits of a different kind would be valuable.

**Habits in the Professional Audit Setting**

The habits we study differ from those typically studied in the psychology literature in that the former occur in a professional setting. Therefore, we conduct additional analyses to further strengthen our inferences that simple process habits are at work in our study and to illuminate how habits operate in our setting. We first examine theory-consistent determinants of habit strength. This analysis provides insight as to whether habits in auditing arise through the same mechanisms as other types of habits, as well as whether there are audit-specific determinants. Second, we examine whether a subset of auditors with stronger habits are able to overcome the effects of habits in the typical context by exploring potential moderating effects of self-discipline and knowledge. These analyses provide insight as to whether the incentives and knowledge inherent in the audit environment can create different findings than in psychology. Finally, we explore the possibility that auditors infer differential pressures from the typical vs. alternative context (and do so differentially based on habit strength) to examine whether such inferences affect our findings. This analysis is important because professional contexts may be imbued with meaning (including pressures) relative to the starker contexts examined in psychology.

**Determinants of Simple Process Habit Strength**

Our theory proposes that auditors build habits of varying strength as staff. Assuming a stable context, habit strength generally increases with rewarded repetition of behaviors (Mazar and Wood 2018). We use a structural equations model to examine determinants of habit strength (see Figure 3). We measure Repetition with four questions capturing seniors’ use of approaches.
to simple tasks, as staff, that reflect use of the simple processes.\textsuperscript{18} These questions are akin to those used in psychology research to proxy habit strength using repetition of past behavior (e.g., Neal et al. 2011; Neal et al. 2012). We capture Rewards using auditors’ agreement (from 1 “Strongly Disagree” to 7 “Strongly Agree”) that, as staff making day-to-day decisions on their engagements, they generally chose the option they thought their audit team would approve of.

We also measure audit-specific antecedents of Repetition. The first is Simple Task Exposure, measured by the percentage of time that auditors report having worked on simple versus complex audit tasks as staff; simple tasks provide opportunities for using the simple processes. The second is personal Effectiveness Preference, which could lead staff to use complex processes even for simple tasks. We use professional identity as a proxy for effectiveness preferences, as prior research finds that stronger professional identity predicts a focus on audit effectiveness (Bamber and Iyer 2007; Bauer 2015).

Standard measures show good model fit ($\chi^2$(22) = 24.57, $p = 0.318$; CFI = 1.00; RMSEA = 0.03). The four indicators of Repetition load on one latent factor (largest one-tailed $p = 0.047$). As expected, Repetition positively affects Habit Strength (one-tailed $p = 0.029$), as does Rewards (one-tailed $p = 0.003$). Turning to antecedents of Repetition, as expected, there is a positive, marginally significant effect of Simple Task Exposure (one-tailed $p = 0.060$); completing more simple tasks leads to greater repetition of simple processes. However, this effect is moderated by

\textsuperscript{18} The questions (on a scale from 1 “Never Used This Approach” to 9 “Always Used This Approach”) were: (1) “When checking invoice terms, searched to see that there was evidence that agreed to what I was looking for (e.g., if I was looking for a dollar amount of ‘38,’ looked on the invoice to see if there was a ‘38’ anywhere)” (2) “When reviewing terms of a transaction or item, closely examined the details (e.g., checked additional details outside of just the key terms)” (reverse-scored) (3) “When evaluating the findings of audit procedures, considered results from each procedure separately (i.e., did not think about connections among results)” and (4) “When performing an audit procedure, considered how my findings within this procedure related to each other (e.g., if there were issues with multiple invoices in the sample, I thought about whether the same problem could be causing the issues)” (reverse-scored). Two additional questions (seeking a reasonable explanation for exceptions and quickly moving through work) did not load on the latent factor, and are not included.
a negative Simple Task Exposure X Effectiveness Preference interaction (one-tailed $p = 0.033$), indicating that this relationship is less pronounced for auditors with higher effectiveness preferences. That the general mechanisms posited by habit theory predict our habit strength measure validates the measure. The findings also provide insight into potentially unique determinants of habit strength in a professional setting. Specifically, the finding that professional identity reduces the use of simple processes when staff are assigned simple tasks allows for modification of psychology theory to reflect the effects of task assignment versus choice, and also highlights a potential means to preventing the development of strong habits.

**Moderating Effects of Self-Discipline and Knowledge**

Next, our theory development highlighted two ways that auditors might overcome the ill effects of strong habits. First, incentives for good performance on complex tasks could prompt at least a subset of auditors with stronger habits to exert self-discipline to override their habits. Accordingly, we examine whether self-discipline moderates the effects of habit strength. Table 2, Panel A reports results of an ANOVA with Habit Strength and Self-Discipline (auditors’ agreement on a 7-point scale that they exerted self-discipline during the estimates task, using a median split) as independent variables, and Issues Identified as the dependent variable (within the typical context). The Habit Strength X Self-Discipline interaction is significant (one-tailed $p = 0.043$; Panel B). Simple effects reveal that the negative effect of Habit Strength is significant at low Self-Discipline (one-tailed $p = 0.003$); here, seniors with stronger habits identify fewer issues than seniors with weaker habits (means = 0.50 vs. 2.06). The effect of Habit Strength is not

---

19 Additional analysis among stronger habits auditors (untabulated) reveals a significant interaction between Context and auditors’ experience working in the alternative context ($p = 0.009$). The effect of Context is positive and significant for auditors with less experience in the alternative context ($p = 0.001$), but is not significant for auditors with more experience in this context ($p = 0.373$). This finding is consistent with theory that an alternative context will not disrupt habits if the person has formed habits in that context as well (Verplanken et al. 2018).
significant at high *Self-Discipline* (one-tailed $p = 0.312$) (means = 1.50 vs. 1.75). Further, the performance of stronger habits seniors exerting high self-discipline is indistinguishable from that of weaker habits seniors exerting low self-discipline (untabulated, two-tailed $p = 0.282$).

Second, we consider whether knowledge acquired through experience could dominate habits in determining cognitive processing. Table 2 reports results of similar ANOVAs instead examining three proxies for knowledge: *Months of Experience* (Panel B), *Number of Goodwill Audits* (Panel C), and auditors’ self-reported *Comfort with Goodwill* (Panel D). None of the proxies reduce the habit strength effect (interaction $p$’s > 0.500). Thus, it appears that the mental association between context and behavior may be stronger than the association between task demands and behavior. Interestingly, *Habit Strength* is negatively correlated with the latter two proxies (untabulated, both two-tailed $p < 0.050$). This could occur, for example, if auditors with weaker habits did not develop strong habits because they worked on more goodwill audits that reduced repetition of the simple processes (as complex processes are appropriate for this task).²⁰

Consistent with habits theory, our moderator analysis finds that some auditors can override stronger habits through effortful exertion of self-discipline. However, gaining additional knowledge does not appear to reduce the ill effects of stronger habits on auditor performance.

*Further Examination of Context Effects*

Finally, the audit room context may be more imbued with meaning than contexts used in psychology research. Our typical context may cause auditors to think about pressures they face when in such a room such as time and deadline pressures. In turn, thoughts of these pressures may affect auditors’ cognitive processing in a way that leads to the use of the simple processes. It is possible that, in removing cues relevant to activating habits, the alternative context also

---

²⁰ Substituting any of these proxies for *Habit Strength* in the primary ANOVA does not yield a significant interaction with *Context* (all $p > 0.500$).
removes thoughts of these pressures. Thus, we examine effects of our context on thoughts of pressures and whether such effects could explain our reported results.

We capture *Pressures* using two measures: (1) auditors’ thoughts in the paragraphs they wrote during the context manipulation, and (2) auditors’ answers to post-experimental questions that asked them to report their thoughts while imagining themselves working in the context. Table 3 reports descriptive statistics and related tests. For the first measure (see Panel A), we code paragraphs for thoughts related to stress (i.e., due to clutter or being cramped), interruptions, busy season, and time issues.\(^{21}\) These four thoughts load on one factor (all loadings > 0.40). For the second measure (see Panel B), we ask auditors about feeling stressed, interruptions, busy season, feeling cramped, and multi-tasking.\(^{22}\) These five thoughts load on one factor (all loadings > 0.40). We use the two factor scores as our *Pressures* measures.

To examine whether context affects auditors’ thoughts about pressures and whether such thoughts fully or partially mediate the hypothesized effects, we create a model (two versions, one with each measure of *Pressures*) using the Preacher and Hayes (2007) moderated-mediation technique, with *Context, Habit Strength*, and the interaction term as independent variables, *Issues Identified* as the dependent variable, and *Pressures* as the mediator. The model also allows for a direct effect of *Context, Habit Strength*, and the interaction term on *Issues Identified*, enabling examination of whether habit strength continues to be an explanation for our findings.

\(^{21}\) Two coders assessed the paragraphs for whether the auditor showed thoughts of each of these pressures (e.g., “I am feeling stressed”), showed thoughts *contradicting* the pressure (e.g., I am feeling relaxed”), or did not mention the pressure, as well as thoughts about the client coming in and supervising staff. We do not include thoughts related to the client and supervision in our measure because neither loaded on the primary factor. The coding was split up across two different pairs of coders. Cohen’s Kappa for each pair was 0.46 and 0.88, which are both significantly greater than chance (\(p < 0.001\)). Coding differences were reconciled.

\(^{22}\) Similar to coding of the thoughts, auditors had the option in these questions to select an alternative to the thought – that is, cramped vs. spacious, multi-tasking vs. one task at a time, stressful vs. relaxing, many vs. few interruptions, and busy season vs. not busy season – or that they did not have either thought. We also asked about the client coming in, but as with the paragraphs, this thought did not load on the factor so we do not include it.
Panel C and Panel D display the results for each version of the model. Context negatively affects Pressures (both $p > 0.001$), suggesting that auditors infer fewer pressures in the alternative versus typical context. However, the Context X Habit Strength interaction does not significantly affect Pressures for either measure (smallest two-tailed $p = 0.604$), and the confidence intervals do not support moderated-mediation (i.e., both include zero). These findings suggest that, while the typical context may invoke more thoughts of pressures, these thoughts do not occur differentially for stronger and weaker habits auditors, do not mediate the effect of Context X Habit Strength on Issues Identified, and cannot explain our findings. As further support, Pressures does not mediate the effect of Habit Strength on Issues Identified within either context and does not mediate the effect of Context for auditors with stronger or weaker habits (i.e., all confidence intervals include zero). Finally, and most important, the direct effect of Context X Habit Strength on Issues Identified is significant in both models (largest two-tailed $p = 0.013$), indicating that our results are robust to controlling for effects of Pressures.23

Together these findings from additional analyses focusing on the professional setting reveal theory consistent determinants and moderators of habit strength, strengthening our inference that habit strength is the construct captured by our measure. Our findings of audit-specific determinants and moderators and our investigation of context effects provide insight into how habits manifest in the professional audit setting. The findings suggest that habits can develop in this richer context just as in the starker contexts typically examined in psychology.

---

23 We also considered whether our habit strength measure could be capturing a general concern about pressures. Analyses do not support this idea. Our findings do not replicate if we substitute the Pressures measures (using median splits) for Habit Strength. Habit Strength is also not correlated with time spent working in the typical context ($p > 0.500$). Finally, Simple Process Repetition and Rewards do not predict Pressures.
V. DISCUSSION AND CONCLUSIONS

This paper examines simple process habit strength as a potential reason why some audit seniors use simple processes on complex tasks, including audits of estimates, despite that those processes do not meet the demands of these tasks. Using a reaction-time measure of habit strength and manipulating imagined context, we show that, in the typical audit room context, seniors with stronger habits identify fewer issues with a complex estimate than do seniors with weaker habits. Moreover, seniors with stronger habits who are placed in an alternative context identify more issues, while auditors with weaker habits do not. The observed interaction is consistent with theory and supports that habit strength is the causal construct. However, we strengthen this inference by reporting evidence of theory-consistent determinants of habit strength, reporting evidence that a subset of auditors override strong habits by exerting self-discipline, and ruling out incremental effects of context underlying our findings.

Prior research and PCAOB inspection reports have attributed difficulties in audits of complex accounts to auditors’ use of simple processes. Our study provides evidence that the strength of habits to use the simple processes may be a root cause. Habits are “hardwired” links between the context and processes in auditors’ memory. Because the context in which seniors work does not change, seniors with stronger habits may use the simple processes for complex tasks in spite of firm training and decision aids, changes in professional standards, and recurring audit deficiencies. For example, the requirement in both judgment frameworks and the standard on auditing estimates (PCAOB 2019) to search for contradictory evidence may be ineffective for seniors with stronger habits; although they likely would comply, their habits could lead them to explain away such information (e.g., Verplanken 2018). Instead, psychology theory suggests that
effective interventions must alter context or be targeted toward overcoming the effects of the habits. We do not view these as practical solutions in the audit setting.

With respect to altering context, auditors, like other professionals, recently experienced a change in context with the sudden shift to work from home. While such a change offers an opportunity to disrupt the use of old habits, it also provides opportunities to form new, nonbeneficial habits (Verplanken et al. 2018). Specifically, the work-from-home context, like the typical audit room, is very stable. Moreover, distractions and other depleting factors in the home context make it likely that auditors will not always be able to respond to task demands. These factors lead us to believe auditors would develop new mental associations between the home context and the use of simple processes (i.e., simple process habits) – unless firms were to take deliberate steps to encourage the formation of different habits to use complex processes. Indeed, accounting firms are discovering the power of building positive habits for their employees’ health and well-being (PwC 2020). Firms could help auditors build positive processing habits in their new context by finding methods to make repetition of complex processes enjoyable and rewarding (e.g., Gardner and Lally 2013). For example, complex processes could be made more rewarding through thoughtful design of firm technology (Carden and Wood 2018) or by making auditors feel that they have autonomy and self-direction (Lally and Gardner 2013). Firms also could reduce frictions that make complex processing difficult (Lally and Gardner 2013), such as by encouraging complex tasks to be performed during times when there are few distractions.

Regarding overcoming habits, while we do observe that some seniors with strong habits exert self-discipline to override their habits and act in line with the demands of the estimates task, this strategy would be difficult to initiate, as auditors likely are unaware of the details of their cognitive processing. It also would be difficult to sustain in practice due to the many
depleting factors auditors face (e.g., Hurley 2015). A more promising possibility is preventing staff from developing strong habits to use the simple processes in the first place. Our analysis of determinants suggests this could be accomplished by “pushing down” more complex tasks to the staff level. Increased use of data and analytics tools could facilitate this reshuffling in two ways: the tools could take over some simple tasks, allowing staff time to work on more complex tasks; moreover, the tools could encourage use of integrative processes by providing a holistic view of evidence. Finally, our finding that auditors with higher effectiveness preferences were less apt to use simple processes when performing simple tasks implies that priming or strengthening effectiveness preferences may be beneficial in preventing strong simple process habits from developing; future research could examine these issues.

Our study contributes to the auditing literature by demonstrating the importance of habit strength to auditor performance of a critical task. Our work also may contribute to the literature on auditor skepticism (see Nelson 2009; Nolder and Kadous 2018) by providing an alternative view that problems attributed to lack of skepticism could arise from habits. While we focus on audits of complex estimates, we expect that simple process habits impair auditor performance of other audit tasks that require complex processing as well. Future research could explore how strong habits to use simple processes could impede audit seniors in other critical audit tasks that require complex processing. Future research also could explore whether seniors develop habits for other tasks, such as coaching or reviewing staff’s work. Such habits could be beneficial or harmful. As just one idea, in light of research finding that depletion from multi-tasking impedes effective reviewing (Mullis and Hatfield 2018), research could examine whether some seniors have habits for effective reviewing, and, if so, whether such habits inoculate them from these harmful depletion effects.
Finally, our work also offers methodological insights. Our study provides a methodology for measuring cognitive processing habits. Given the ubiquitous nature of habits, we expect researchers in auditing and other areas of accounting could adapt and use our measure. Moreover, our findings suggesting that at least some auditor processing behaviors are habitual and are affected by context highlight the importance of the common methodological practice of asking auditors to imagine themselves in a real audit role when beginning the study. Alternatively, researchers could consider priming a typical audit setting.

Our study has limitations that offer ideas for future research. While our tests of hypotheses and additional analyses all support the inference that simple process habits are at work, we observe one unexpected result: the performance of weaker habits auditors is marginally lower in the alternative, versus typical, context. This finding suggests that future research that focuses on weaker habits auditors may be informative. For example, this research could explore whether some of these seniors have developed habits to use complex processes. If so, this could explain the unexpected result that weaker habits auditors perform marginally worse in the alternative context—the alternative context could have jarred them out of using beneficial habits, creating a need for them to “regroup.” This possibility is consistent with research showing that people with beneficial healthy eating habits who experience a context change make less healthy food choices in the alternative context (Lin, Wood, and Monterosso 2016). However, future research is needed to test this and other hypotheses about the behavior of auditors with weaker simple process habits.
References


Hargadon, D. 2017. Developing an Implicit Measure of Habit Strength: The Habit IAT. *Kingston, ON: Queen’s University*.


IFIAR. 2019. Survey of Inspection Findings. Available at: https://www.ifiar.org/?wpdmdl=10453


PricewaterhouseCoopers (PwC). 2020. Be Well, Work Well Habit Bank. Available at: https://habitbank.pwc.com/#tab=1


Panel A:

Instructions:
On the following screens, you will see a series of word fragments. The number of blanks indicates the number of missing letters.

For example, if there is one blank visible, this means there is one letter missing. As another example, if there are three blanks visible, this means there are three letters missing.

Please type the word (the entire word, not just the missing letters) as quickly as possible and then hit the arrow to continue to the next word fragment. As an example to get you started, view the two word fragments below:

**WO __ D**

**__ __ AGMEN __**

As soon as you figure out the word, you would type the word in the textbox below the word fragment. For example, once you realized the first word was “WORD,” you would type “WORD” in the textbox. As another example, once you realized the second word was "FRAGMENT," you would type "FRAGMENT" in the textbox.

Please remember to type in the word and hit the arrow button as quickly as possible. Please click the arrow below to begin.

Panel B:

<table>
<thead>
<tr>
<th>CONTROL WORD FRAGMENTS</th>
<th>STAFF PROCESS WORD FRAGMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• B __ RK (BARK)</td>
<td>• CHE __ LIST (CHECKLIST)</td>
</tr>
<tr>
<td>• __ HOC __ ATE (CHOCOLATE)</td>
<td>• GLAN __ E (GLANCE)</td>
</tr>
<tr>
<td>• FANC __ (FANCY)</td>
<td>• INSPE __ (INSPECT)</td>
</tr>
<tr>
<td>• MAGAZ __ ES (MAGAZINES)</td>
<td>• PROC __ D (PROCEED)</td>
</tr>
<tr>
<td>• MA __ SHMA __ OW (MARSHMALLO)</td>
<td>• __ __ ASONABLE (REASONABLE)</td>
</tr>
<tr>
<td>• PAINT __ USH (PAINTBRUSH)</td>
<td>• SC __ N (SCAN)</td>
</tr>
<tr>
<td>• __ __ TERMELON (WATERMELON)</td>
<td>• __ KIM (SKIM)</td>
</tr>
<tr>
<td></td>
<td>• SPREA __ __ EET (SPREADSHEET)</td>
</tr>
<tr>
<td></td>
<td>• VE __ __ FY (VERIFY)</td>
</tr>
</tbody>
</table>

Panel A displays the instructions that participants read prior to completing the word fragments. Panel B displays the word fragments that we use to measure Habit Strength. We calculate the average of each auditor’s completion times for the simple process fragments minus the average of each auditor’s completion times for the control, baseline (i.e., non-audit related) word fragments. We transform each reaction time by taking the reciprocal, which is a transformation commonly used in psychology studies using reaction-time measures to adjust for skewness (see Whelan 2008). We then classify auditors with completion times faster (slower) than the median as having stronger (weaker) simple process habits.
Panel A: Typical Audit Room Context

Panel B: Alternative Audit Room Context
Panel C: Instructions Read by Participants in the Typical Audit Room Context:

- Please imagine that you are working in this audit room today.
- You are working in here all day, and your intern and three staff are also all here today.
- Look around and take in the room. Imagine how the day would progress as you are working in this room.

For example:
- Imagine yourself sitting in the chair (yours is the gray one to the far right) and your staff and intern sitting in the other chairs.
- Imagine yourself using your laptop and other tools/supplies as you are doing your audit work.
- Imagine what might be happening throughout the day as you do your work in this room.

Please describe what you have imagined in 5-7 sentences in the box below.

Panel D: Instructions Read by Participants in the Alternative Audit Room Context:

- Please imagine that you are working in this audit room today.
- You are working by yourself in here all day, as your intern and three staff are all at a full day training in the local office today.
- Look around and take in the room. Imagine how the day would progress as you are working in this room.

For example:
- Imagine yourself sitting in the chair.
- Imagine yourself using your laptop and other tools/supplies as you are doing your audit work.
- Imagine what might be happening throughout the day as you do your work in this room.

Please describe what you have imagined in 5-7 sentences in the box below.

Panel A (Panel B) displays the photograph used to prime the typical (alternative) audit room context. Auditors assigned to the typical (alternative) audit room context view the picture displayed in Panel A (Panel B) and read the instructions displayed in Panel C (Panel D). After reading through the instructions, auditors then write a paragraph imagining themselves working in the context displayed in the photograph.
The above structural equations model examines determinants of auditors’ simple process habit strength. The chi-squared test for this model reveals good fit ($\chi^2(22) = 24.57, p = 0.318$), as do other standard measures (CFI = 1.00; RMSEA = 0.03). Figure 1 defines Habit Strength. We measure Simple Task Exposure using auditors’ self-reported percentage of time spent as a staff working on simple (versus complex) audit tasks (from 0 to 100 percent, in increments of 10). We measure Effectiveness Preference (mean-centered) using the professional identity measure from Bauer (2015). We measure Repetition with four questions that elicit the extent to which (when the seniors were staff and performing simple tasks), they used approaches that are indicative of the simple processes (on a scale from 1 “Never Used This Approach” to 9 “Always Used This Approach.”). Simple Process Indicator 1 is “When reviewing terms of a transaction or item, closely examined the details (e.g., checked additional details outside of just the key terms)” (reverse-scored). Simple Process Indicator 2 is “When performing an audit procedure, considered how my findings within this procedure related to each other (e.g., if there were issues with multiple invoices in the sample, I thought about whether the same problem could be causing the issues)” (reverse-scored). Simple Process Indicator 3 is “When checking invoice terms, searched to see that there was evidence that agreed to what I was looking for (e.g., if I was looking for a dollar amount of ‘38,’ looked on the invoice to see if there was a ‘38’ anywhere.” Simple Process Indicator 4 is “When evaluating the findings of audit procedures, considered results from each procedure separately (i.e., did not think about connections among results).” We measure Rewards using auditors’ agreement (on a scale from 1 “Strongly Disagree” to 7 “Strongly Agree”) that, when staff, and making day-to-day decisions on their engagements, they generally chose the option that they thought their audit team members would approve of. $P$-values are one-tailed for directional predictions.
TABLE 1: Auditor Performance (Issues Identified) by Simple Process Habit Strength and Context

Panel A: Descriptive Statistics

<table>
<thead>
<tr>
<th>Context</th>
<th>Simple Process Habit Strength</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stronger Habits</td>
<td>Weaker Habits</td>
<td></td>
</tr>
<tr>
<td>Typical Audit Room</td>
<td>1.09 (1.19) n=34</td>
<td>1.91 (1.84) n=32</td>
<td></td>
</tr>
<tr>
<td>Alternative Audit Room</td>
<td>1.83 (1.58) n=30</td>
<td>1.28 (1.30) n=32</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Analysis of Variance for Issues Identified

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Strength</td>
<td>1</td>
<td>0.57</td>
<td>0.57</td>
<td>0.25</td>
<td>0.615</td>
</tr>
<tr>
<td>Context</td>
<td>1</td>
<td>0.12</td>
<td>0.12</td>
<td>0.05</td>
<td>0.820</td>
</tr>
<tr>
<td>Habit Strength X Context</td>
<td>1</td>
<td>14.99</td>
<td>14.99</td>
<td>6.73</td>
<td>0.011</td>
</tr>
<tr>
<td>Error</td>
<td>124</td>
<td>276.09</td>
<td>2.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel C: Simple Effects Comparisons

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context for Stronger Habits Auditors</td>
<td>124</td>
<td>1.99</td>
<td>0.024*</td>
</tr>
<tr>
<td>Context for Weaker Habits Auditors</td>
<td>124</td>
<td>-1.68</td>
<td>0.096</td>
</tr>
<tr>
<td>Habit Strength in the Typical Context</td>
<td>124</td>
<td>-2.23</td>
<td>0.014*</td>
</tr>
<tr>
<td>Habit Strength in the Alternative Context</td>
<td>124</td>
<td>1.46</td>
<td>0.148</td>
</tr>
</tbody>
</table>

We conduct an ANOVA to test our hypotheses. Independent variables are defined in the notes to Figures 1 and 2. The dependent variable is Issues Identified, which is the total number of issues, out of seven embedded issues, that the auditor identifies in the goodwill impairment case. Descriptive statistics are reported in Panel A. Panel C reports our test of H1, that is, the simple effect of Habit Strength on Issues Identified, considering the typical audit room context. Panel B and Panel C report our test of H2, including the interaction between Habit Strength and Context on Issues Identified, as well as the simple effect of Context for auditors with stronger and weaker habits. P-values with * are one-tailed, and all other p-values are two-tailed.
TABLE 2: Moderating Effects of Self-Discipline and Knowledge within the Typical Context

Panel A: Analysis of Variance examining Self-Discipline

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Strength</td>
<td>1</td>
<td>13.33</td>
<td>13.33</td>
<td>5.80</td>
<td>0.010*</td>
</tr>
<tr>
<td>Self-Discipline</td>
<td>1</td>
<td>1.92</td>
<td>1.92</td>
<td>0.84</td>
<td>0.364</td>
</tr>
<tr>
<td>Habit Strength X Self-Discipline</td>
<td>1</td>
<td>6.99</td>
<td>6.99</td>
<td>3.04</td>
<td>0.043*</td>
</tr>
<tr>
<td>Error</td>
<td>62</td>
<td>142.44</td>
<td>2.30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Simple Effects Comparisons

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habit Strength</strong> for Low Self-Discipline</td>
<td>62</td>
<td>-2.82</td>
<td>0.003*</td>
</tr>
<tr>
<td><strong>Habit Strength</strong> for High Self-Discipline</td>
<td>62</td>
<td>-0.49</td>
<td>0.312*</td>
</tr>
</tbody>
</table>

Panel B: Analysis of Variance examining Months of Experience

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Strength</td>
<td>1</td>
<td>9.97</td>
<td>9.97</td>
<td>4.20</td>
<td>0.023*</td>
</tr>
<tr>
<td>Months Experience</td>
<td>1</td>
<td>4.15</td>
<td>4.15</td>
<td>1.75</td>
<td>0.191</td>
</tr>
<tr>
<td>Habit Strength X Months Experience</td>
<td>1</td>
<td>0.14</td>
<td>0.14</td>
<td>0.06</td>
<td>0.811</td>
</tr>
<tr>
<td>Error</td>
<td>62</td>
<td>147.22</td>
<td>2.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel C: Analysis of Variance examining Goodwill Audits

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Strength</td>
<td>1</td>
<td>9.59</td>
<td>9.59</td>
<td>4.02</td>
<td>0.025*</td>
</tr>
<tr>
<td>Goodwill Audits</td>
<td>1</td>
<td>0.60</td>
<td>0.60</td>
<td>0.25</td>
<td>0.619</td>
</tr>
<tr>
<td>Habit Strength X Goodwill Audits</td>
<td>1</td>
<td>0.86</td>
<td>0.86</td>
<td>0.36</td>
<td>0.551</td>
</tr>
<tr>
<td>Error</td>
<td>61</td>
<td>145.53</td>
<td>2.39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel D: Analysis of Variance examining Self-Reported Comfort with Goodwill

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Strength</td>
<td>1</td>
<td>10.84</td>
<td>10.84</td>
<td>4.67</td>
<td>0.018*</td>
</tr>
<tr>
<td>Comfort with Goodwill</td>
<td>1</td>
<td>7.27</td>
<td>7.27</td>
<td>3.13</td>
<td>0.082</td>
</tr>
<tr>
<td>Habit Strength X Comfort with Goodwill</td>
<td>1</td>
<td>0.21</td>
<td>0.21</td>
<td>0.09</td>
<td>0.766</td>
</tr>
<tr>
<td>Error</td>
<td>62</td>
<td>143.89</td>
<td>2.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We conduct ANOVAs (within the typical context) to examine whether self-discipline and three proxies for knowledge moderate the effect of habit strength. Issues Identified is defined in the notes to Table 1. Habit Strength is defined in the notes to Figure 1. Self-Discipline is measured as auditors’ agreement on a 7-point scale that they exerted self-discipline while working on the goodwill task. Months of Experience is measured as auditors’ self-reported number of months of audit work experience. Goodwill Audits is measured as auditors’ self-reported number of goodwill audits on which they have worked. Comfort with Goodwill is measured as auditors’ self-reported comfort with goodwill on a 10-point scale. P-values with * are one-tailed, and all other p-values are two-tailed. Simple effects are only reported for the ANOVA with a significant interaction (Panel A).
TABLE 3: Thoughts About Pressures in Response to Context

Panel A: Descriptive Statistics for Thoughts about Pressures Coded in Auditors’ Written Paragraphs (by Context) – Frequencies (Percentages)

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Mentioned the Presence of the Pressure</th>
<th>Mentioned the Absence of the Pressure</th>
<th>No Mention of the Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical Context</td>
<td>Alternative Context</td>
<td>Typical Context</td>
</tr>
<tr>
<td>Stress (i.e., due to clutter, cramped)</td>
<td>35 (53.0%)</td>
<td>1 (1.5%)</td>
<td>9 (14.5%)</td>
</tr>
<tr>
<td>Interruptions</td>
<td>33 (50.0%)</td>
<td>5 (7.6%)</td>
<td>33 (53.2%)</td>
</tr>
<tr>
<td>Busy Season</td>
<td>6 (9.1%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Time Pressure</td>
<td>4 (6.1%)</td>
<td>2 (3.0%)</td>
<td>14 (22.6%)</td>
</tr>
</tbody>
</table>

Panel B: Descriptive Statistics for Thoughts about Pressures in Post-Experimental Questions (by Context) – Frequencies (Percentages)

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Indicated the Presence of the Pressure</th>
<th>Indicated the Absence of the Pressure</th>
<th>No Indication of the Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical Context</td>
<td>Alternative Context</td>
<td>Typical Context</td>
</tr>
<tr>
<td>Stress</td>
<td>50 (75.8%)</td>
<td>4 (6.5%)</td>
<td>41 (66.1%)</td>
</tr>
<tr>
<td>Interruptions</td>
<td>58 (87.9%)</td>
<td>4 (6.5%)</td>
<td>54 (87.1%)</td>
</tr>
<tr>
<td>Busy Season</td>
<td>48 (72.7%)</td>
<td>1 (1.6%)</td>
<td>44 (71.0%)</td>
</tr>
<tr>
<td>Cramped</td>
<td>54 (81.8%)</td>
<td>3 (4.8%)</td>
<td>35 (56.5%)</td>
</tr>
<tr>
<td>Multi-tasking</td>
<td>38 (57.6%)</td>
<td>14 (22.6%)</td>
<td>33 (53.2%)</td>
</tr>
</tbody>
</table>
Panel C: Moderated-Mediation Model with Pressures Mediator Based on Auditors’ Written Paragraphs

Effects of Independent Variables on *Pressures* within Model

<table>
<thead>
<tr>
<th>Dependent Variable: Pressures</th>
<th>df</th>
<th>Coeff.</th>
<th>Std. Error</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>124</td>
<td>0.64</td>
<td>0.14</td>
<td>4.40</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Context</td>
<td>124</td>
<td>-1.25</td>
<td>0.20</td>
<td>-6.10</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Habit Strength</td>
<td>124</td>
<td>-0.13</td>
<td>0.20</td>
<td>-0.67</td>
<td>0.507</td>
</tr>
<tr>
<td>Context X Habit Strength</td>
<td>124</td>
<td>0.15</td>
<td>0.29</td>
<td>0.52</td>
<td>0.604</td>
</tr>
</tbody>
</table>

Complete Model (including Direct Effect)

<table>
<thead>
<tr>
<th>Dependent Variable: Issues Identified</th>
<th>df</th>
<th>Coeff.</th>
<th>Std. Error</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>124</td>
<td>1.74</td>
<td>0.28</td>
<td>6.16</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Context</td>
<td>124</td>
<td>-0.29</td>
<td>0.42</td>
<td>-0.68</td>
<td>0.495</td>
</tr>
<tr>
<td>Habit Strength</td>
<td>124</td>
<td>-0.78</td>
<td>0.37</td>
<td>-2.14</td>
<td>0.035</td>
</tr>
<tr>
<td>Context X Habit Strength</td>
<td>124</td>
<td>1.33</td>
<td>0.53</td>
<td>2.53</td>
<td>0.013</td>
</tr>
<tr>
<td>Pressures</td>
<td>124</td>
<td>0.27</td>
<td>0.16</td>
<td>1.66</td>
<td>0.100</td>
</tr>
</tbody>
</table>

Test for Whether Pressures Mediates Simple Effects

<table>
<thead>
<tr>
<th>Dependent Variable: Issues Identified</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context for Stronger Habits Auditors</td>
<td>(-0.64, 0.04)</td>
</tr>
<tr>
<td>Context for Weaker Habits Auditors</td>
<td>(-0.76, 0.04)</td>
</tr>
<tr>
<td>Habit Strength in the Typical Context</td>
<td>(-0.20, 0.04)</td>
</tr>
<tr>
<td>Habit Strength in the Alternative Context</td>
<td>(-0.10, 0.10)</td>
</tr>
</tbody>
</table>

Test for Whether Pressures Mediates Overall Interaction

<table>
<thead>
<tr>
<th>Dependent Variable: Issues Identified</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context X Habit Strength</td>
<td>(-0.08, 0.24)</td>
</tr>
</tbody>
</table>
Panel D: Moderated-Mediation Model with Pressures Mediator Based on Post-Experimental Questions

Effects of Independent Variables on Pressures within Model

<table>
<thead>
<tr>
<th>Dependent Variable: Pressures</th>
<th>df</th>
<th>Coeff.</th>
<th>Std. Error</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>124</td>
<td>0.90</td>
<td>0.09</td>
<td>10.15</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Context</td>
<td>124</td>
<td>-1.75</td>
<td>0.13</td>
<td>-13.92</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Habit Strength</td>
<td>124</td>
<td>-0.13</td>
<td>0.12</td>
<td>-1.08</td>
<td>0.281</td>
</tr>
<tr>
<td>Context X Habit Strength</td>
<td>124</td>
<td>0.05</td>
<td>0.18</td>
<td>0.30</td>
<td>0.763</td>
</tr>
</tbody>
</table>

Complete Model (including Direct Effect)

<table>
<thead>
<tr>
<th>Dependent Variable: Issues Identified</th>
<th>df</th>
<th>Coeff.</th>
<th>Std. Error</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>124</td>
<td>1.90</td>
<td>0.36</td>
<td>5.32</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Context</td>
<td>124</td>
<td>-0.62</td>
<td>0.60</td>
<td>-1.04</td>
<td>0.302</td>
</tr>
<tr>
<td>Habit Strength</td>
<td>124</td>
<td>-0.82</td>
<td>0.37</td>
<td>-2.21</td>
<td>0.029</td>
</tr>
<tr>
<td>Context X Habit Strength</td>
<td>124</td>
<td>1.37</td>
<td>0.53</td>
<td>2.58</td>
<td>0.011</td>
</tr>
<tr>
<td>Pressures</td>
<td>124</td>
<td>0.00</td>
<td>0.27</td>
<td>0.01</td>
<td>0.994</td>
</tr>
</tbody>
</table>

Test for Whether Pressures Mediates Simple Effects

<table>
<thead>
<tr>
<th>Dependent Variable: Issues Identified</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context for Stronger Habits Auditors</td>
<td>(-0.72, 0.82)</td>
</tr>
<tr>
<td>Context for Weaker Habits Auditors</td>
<td>(-0.76, 0.82)</td>
</tr>
<tr>
<td>Habit Strength in the Typical Context</td>
<td>(-0.07, 0.08)</td>
</tr>
<tr>
<td>Habit Strength in the Alternative Context</td>
<td>(-0.05, 0.07)</td>
</tr>
</tbody>
</table>

Test for Whether Pressures Mediates Overall Interaction

<table>
<thead>
<tr>
<th>Dependent Variable: Issues Identified</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context X Habit Strength</td>
<td>(-0.07, 0.09)</td>
</tr>
</tbody>
</table>

Panel A and Panel B display descriptive statistics for auditors’ thoughts about pressures in the typical and alternative contexts. The thoughts about pressures presented in Panel A are determined by coding auditors’ written paragraph as part of the context manipulation based on whether they mentioned the presence of the pressure, the absence of the pressure, or did not mention the pressure. The thoughts about pressures presented in Panel B are auditors’ indication in post-experimental questions that they had thoughts about the presence of the pressure, absence of the pressure, or did not think about the pressure. We develop two distinct measures of Pressures: one that combines auditors’ thoughts based on the written paragraphs into one factor and one that combines auditors’ thoughts based on their responses to the post-experimental questions into one factor (all loadings > 0.40). The analyses in Panels C and D tabulate moderated-mediation analyses using the Preacher and Hayes (2007) technique to examine whether Pressures mediates the results for our tests of hypotheses; Panel C (D) uses the Pressures measure developed from auditors’ written paragraphs (responses to post-experimental questions).
### APPENDIX – EMBEDDED ISSUES IN GOODWILL IMPAIRMENT CASE

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Description of the issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue projections</td>
<td>The company consistently over-projected growth in the past, which casts doubt on the accuracy of the current projections</td>
</tr>
<tr>
<td>Revenue projections</td>
<td>The projected revenue growth of Product C is not guaranteed due to uncertainties (a new competing product, delays in production, and/or reliance on synergies with existing product lines)</td>
</tr>
<tr>
<td>Revenue projections</td>
<td>There is an outlier in the benchmarking analysis for the projected revenue growth rate, so while the client’s rate is below the peer average, it would not be if this outlier were excluded</td>
</tr>
<tr>
<td>Revenue projections</td>
<td>Projected revenue growth is inconsistent with the overall market/economy/industry outlook</td>
</tr>
<tr>
<td>Operating expense projections</td>
<td>The company plans to increase sales staff by 10 percent in the next three years, resulting in a significant increase in employment expense. This is not factored into the client’s operating expense assumption</td>
</tr>
<tr>
<td>Capital expenditures projections</td>
<td>The company is building a new $14 million office building, which is not included in the capital expenditures forecast.</td>
</tr>
<tr>
<td>Capital expenditures projections</td>
<td>The company’s forecasted capital expenditures exhibit slower growth than industry analysts’ projections.</td>
</tr>
</tbody>
</table>