How do Relative Performance Evaluation and Auditors' Social Bonds Influence Auditors' Peer-to-Peer Knowledge Sharing?

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ABSTRACT

We examine whether auditors limit the knowledge they share with peers when they face relative performance evaluations (RPE) and whether this effect depends on the strength of auditors' social bonds with their peers. Knowledge sharing is critical in today's auditing landscape, since the diffusion of audit quality enhancing technologies (e.g., data analytics) depends on auditors sharing their skill set with their peers. Drawing on economic and social identity theories, we predict that more expert auditors who face RPE protect their competitive advantage by reducing their knowledge sharing. However, we expect that stronger social bonds among auditors will increase knowledge sharing and curb the counterproductive effect of RPE. Using an abstract laboratory experiment, we provide evidence in support of our predictions. We also find that auditors facing RPE reduce knowledge sharing more when the information at hand is more threatening to their competitive advantage, providing additional support for our theory.

Keywords: Audit quality; data analytics; knowledge sharing; relative performance evaluation; social bonds; social identity theory

I. INTRODUCTION

During performance evaluations, audit supervisors rank audit subordinates relative to one another and make compensation decisions according to these rankings (Berger, Fiolleau, and MacTavish 2019; Maier 2016; Newquist 2015). Audit subordinates with distinctive skills have a competitive advantage in this type of relative performance evaluation and are incentivized to protect their competitive advantage. For instance, in the current audit environment, data analytic skills are valued by audit firms (Austin, Carpenter, Christ, and Nielson 2020), and auditors with expertise in this distinctive skill (hereafter, expert auditors) may benefit from protecting their competitive advantage. One way these expert auditors can protect their competitive advantage is to restrict the skill-related knowledge that they share with their peers. That is, while auditors commonly *seek* knowledge from their peers (Griffith, Kadous, and Proell 2020; Kadous, Leiby, and Peecher 2013), auditors with distinctive skills may not be willing to weaken their competitive advantage by *sharing* knowledge with their peers. This is troubling because curbing knowledge sharing slows the diffusion of audit quality enhancing technologies like data analytics (Austin et al. 2020) and because auditors both learn from and trouble-shoot with their peers, making knowledge sharing a critical component of successful audits (Bobek, Daugherty, and Radtke 2012; Vera-Muñoz, Ho, and Chee 2006). Notably, these types of interactions between peers can bond auditors to their peers, potentially reducing auditors' willingness to keep knowledge from their peers in spite of relative performance evaluations.

We investigate whether auditors hoard knowledge in an effort to protect their competitive advantage during relative performance evaluations and whether this depends on auditors' social bonds with their peers. Relative performance evaluation features relative performance information, which is feedback about employees' work relative to their peers, as well as compensation decisions based on peers' relative performance. We specifically investigate whether expert auditors (i.e., those with distinctive skills like data analytic know-how) protect their competitive advantage by restricting their peer-to-peer knowledge sharing to a greater extent when they receive relative performance evaluations than when they do not. Further, we assert that sharing knowledge *about a distinctive skill*, which we call "process knowledge sharing," results in a more persistent threat to competitive advantage than sharing knowledge *about solutions derived using a distinctive skill*, which we call "solution knowledge sharing." Thus, we expect that when auditors face relative performance evaluations, they will reduce their process knowledge sharing more than their solution knowledge sharing. Finally, we investigate whether knowledge hoarding is mitigated when auditors have stronger social bonds with their peers. We expect that auditors with stronger social bonds will increase their knowledge sharing, and the knowledge hoarding induced by relative performance evaluations will be mitigated when auditors have stronger social bonds compared to weaker social bonds. In supplemental analyses, we investigate the effect of relative performance information on its own (i.e., without compensation tied to peers' performance) on peer-to-peer knowledge sharing.

We build on theories of economics and social identity to develop our expectations. Relative performance evaluations yield monetary incentives that economic theory suggests encourage competitive behavior. Competitive behavior generally improves employees' performance but can also curb knowledge sharing (Berger et al. 2019; Hannan et al. 2013, 2008; Nordstrom, Lorenzi, and Hall 1990). Expert auditors gain a competitive advantage in their relative performance evaluations when they hoard knowledge from their peers. We expect that in environments with relative performance evaluations, expert auditors will protect their competitive advantage and increase their expected financial reward by hoarding process knowledge. However, work based on social identity theory finds that stronger social bonds between peers leads to improved transfer of complex knowledge between work teams, as well as prioritizing collectively preferable outcomes, rather than individually preferable outcomes (Mahlendorf et al. 2014; Chen and Li 2009; Hansen 1999). Thus, we expect stronger social bonds between audit peers improves knowledge sharing and, in particular, curbs the counterproductive knowledge hoarding behaviors induced by relative performance evaluation.

We conduct an abstract laboratory experiment investigating how relative performance evaluation and social bonds affect experts' peer-to-peer knowledge sharing. To do so, student participants assume the role of either expert or novice. Expert participants practice a new skill and are paired with novice peers who do not practice a new skill. We manipulate relative performance evaluation, between-participants, such that relative performance evaluation is present, relative performance evaluation is absent, or an intermediary condition in which relative performance information is present but participants' compensation does not depend on peer performance. We also manipulate the strength of peers' social bonds as stronger or weaker. As our primary dependent variables, we measure the extent to which experts share process and solution knowledge with paired novices.

In our experimental task, participants first answer trivia questions, and we use this part of our task to manipulate the strength of participants' social bonds. In the stronger social bonds condition, expert and novice participant pairs work together to answer trivia questions. In the weaker social bonds condition, participants answer these trivia questions on their own. Next, participants perform a decoding task. Expert participants receive the code and use the code to practice decoding words, while novice participants do not receive this code or practice. After experts practice, all participants work to decode a 15-word sentence, one word at a time. Thus, there are 15 decoding rounds. After each word, expert participants have the opportunity to share a hint with their paired novice. Specifically, experts choose whether to provide a helpful hint, a deceptive hint, or no hint, and if they provide either a helpful or deceptive hint, they specify whether they want to provide a process hint, a solution hint, or both. We use these decisions to measure our primary dependent variables. Then, after decoding each word, participants in the relative performance evaluation present and relative performance information present conditions receive information about their decoding performance compared to a peer, while auditors in the relative performance evaluation absent condition receive information about only their own decoding performance. Participants were paid based on their performance, and for only those participants in the relative performance evaluation present condition, a portion of the payment was based on participants' decoding performance relative to their paired peer.

Consistent with our predictions, we find that relative performance evaluations reduce peer-to-peer knowledge sharing, and this is true for both process and solution knowledge sharing. Further, we find that expert auditors who face relative performance evaluations reduce their process knowledge sharing more than their solution knowledge sharing, relative to expert auditors who do not face relative performance evaluations. We also find that stronger social bonds improve expert auditors' peer-to-peer knowledge sharing and counteract the negative process and solution knowledge sharing effects induced by relative performance evaluations. That is, the decreases in experts' process and solution knowledge sharing in relative performance environments are less pronounced when peers have stronger, relative to weaker, social bonds. Still, even experts with stronger social bonds share less process knowledge, in particular, when relative performance evaluations are present than when they are absent. Additionally, we find that expert auditors' knowledge sharing decisions are mediated by their sense of competition and social bond perception.

Supplemental analysis reveals three additional, important insights. First, although relative performance evaluations motivate experts to sabotage their peers (i.e., share inaccurate, unhelpful knowledge), stronger social bonds reduce this effect. Second, our analyses show no evidence that relative performance information, on its own, reduces experts' peer-to-peer knowledge sharing. We posit that this is because expert auditors reasonably expect and, in our setting, receive *positive* relative performance information feedback, and distinctly positive feedback yields maintained, or sometimes even reduced, performance levels (see Kluger et al. 1996 for a review of feedback). Third, we find that novices' performance improves when they receive process, but not solution, knowledge from experts, which suggests that encouraging peer-to-peer *process* knowledge sharing improves audit outcomes.

We contribute in several ways. First, we answer calls for research on factors that affect knowledge sharing in auditing (Vera-Muñoz et al. 2006) and in accounting more broadly (Argote and Fahrenkopf 2016). We find that knowledge sharing decreases in relative performance evaluation environments, knowledge sharing increases when peers have stronger social bonds, and the increase in knowledge sharing induced by stronger social bonds partially compensates for knowledge sharing decreases in relative performance evaluation environments. These findings are of particular importance in auditing because auditors' professional development depends on peer-to-peer knowledge sharing (Bobek et al. 2012; Vera-Muñoz et al. 2006). Further, the current hybrid working environment inhibits auditors' ability to bond, suggesting that the current environment likely exacerbates auditors' tendency to hoard knowledge. We also add to the knowledge sharing literature by investigating differences in auditors' willingness to share process knowledge and solution knowledge. We find that when expert auditors face relative performance evaluations, they reduce their process knowledge sharing more than their solution knowledge, consistent with these expert auditors determining that sharing process knowledge is more detrimental to their competitive advantage than sharing solution knowledge.

Second, we contribute to both the relative performance evaluation literature, as well as to practice. We find that relative performance evaluations reduce peer-to-peer knowledge sharing, and this is true of process knowledge sharing even when expert auditors are more strongly bonded with their peers. As audit firms consider updating their evaluation protocols (see Maier 2016), they can consider the impact of relative performance evaluations on peer-to-peer knowledge sharing. Further, we find that relative performance evaluations reduce the strength of auditors' perceived social bonds with their peers, suggesting that auditors psychologically distance themselves from those with whom they are compared. To the extent that audit firms' team-building opportunities strengthen auditors' social bonds, these efforts could improve auditors' peer-to-peer knowledge sharing and, ultimately, audit quality.

Third, we contribute to the literature on the diffusion and use of emerging technologies in the auditing profession. Audit firms are investing unprecedented resources into emerging technologies, like data analytics (Deloitte 2019; EY 2018; KPMG 2019a) and assert that auditors' data analytic skills are valuable (Austin et al. 2021). The spread of these new technologies depends on interactions between those technologies and their auditor users as well as between auditors themselves (Austin et al. 2021). Thus, our findings suggest that the spread of new technologies like data analytics will be constricted by relative performance evaluations and weaker social bonds, since these factors limit auditors' peer-to-peer knowledge sharing. This is troubling since the spread of these new technologies is purported to enhance audit quality (Austin et al. 2021).

The remainder of this paper is organized as follows: section II discusses the theory and hypothesis development, section III discusses research method, section IV discusses results, and section V concludes.

II. THEORY AND HYPOTHESIS DEVELOPMENT

Relative Performance Evaluations and Knowledge Sharing

In audit firms, supervisors commonly evaluate subordinates' performance relative to their peers' performance and determine subordinates' raises based on these relative performance evaluations (Berger, Fiolleau, and MacTavish 2019; Maier 2016; Newquist 2015). Relative performance evaluations incentivize people to compete for financial reward. Competitive behavior between employees generally has positive effects like amplifying people's motivation and improving their performance (Hannan et al. 2013, 2008; Tafkov 2013; Kerr et al. 2007; Nordstrom, Lorenzi, and Hall 1990). However, competitive behavior induced by relative performance evaluations can also lead to negative effects like employees feeling as if they are treated unfairly (Chun, Brockner, and De Cremer 2018). Supervisors and subordinates share more information with one another when they are compensated based on their team performance rather than their individual performance (Haesebrouck, Cools, Van den Abbeele 2018). Most relevant to our study, Berger et al. (2019) find that when employees receive performance information relative to their peers, they share less helpful knowledge with their peers and may even intentionally share inaccurate knowledge with their peers; however, these employees' sharing behavior does not affect their own compensation or the compensation of their peers. Employees may or may not be willing to sabotage peers' compensation. Thus, the extent to which economic incentives included in relative performance evaluations affects peer-to-peer knowledge sharing is an open question.

Knowledge sharing is particularly critical to successful audits (Vera-Muñoz, Ho, and Chee 2006). Auditors work in teams, and each auditor is responsible for only a portion of the audit. This silo structure makes garnering a comprehensive understanding of the audit difficult. Theoretical and survey evidence suggest that audit team knowledge sharing can compensate for this feature of the audit environment (Bobek et al. 2012; Vera-Muñoz et al. 2006). The audit environment is more apt for hierarchical knowledge sharing (i.e., with supervisors) when there is team-oriented leadership and subordinates' concerns are aligned with their supervisors' concerns (Nelson, Proell, and Randel 2016). However, less is known about conditions that affect knowledge sharing between peers. As an exception, auditors are more willing to *accept* contrary advice from peers when it comes from a liked peer or is well-justified (Kadous et al. 2013). Importantly, research has yet to investigate the factors that influence auditors' willingness to *share* knowledge across their silos, that is with their peers.

Auditors' willingness to share knowledge with peers is becoming both increasingly important and uncertain as some, but not all, auditors enter the workforce with data analytics know-how.[1] Data analytics are beginning to diffuse across audit firms and result in improvements to audit quality (Austin et al. 2021). When new technologies disrupt an environment, the expert team members who know how to use these new technologies become more powerful than their peers, and this leads to promotion opportunities (Chen, Li, Chen, and Ou 2018). Per John Hudson of the AICPA, knowledge is power and, as such, relative

[1] While some universities incorporate data analytics into their curriculums to varying extents, others offer only traditional accounting courses, without emphasizing data analytics. For example, nine universities across the United States have teamed with KPMG to develop and offer masters programs that integrate data and analytics throughout the curriculum (KPMG 2019b). However, KPMG lauds these programs as exceptional, rather than the norm.

performance evaluations contribute to accountants hoarding knowledge about their competitive advantage (Vera- Muñoz et al. 2006).[2] Since auditors with distinctive skills like data analytic know-how have a competitive advantage, these expert auditors are incentivized to hoard knowledge related to their skills from their peers when they face relative performance evaluations. However, this knowledge-hoarding behavior is destructive for these employees' firms (Argote and Fahrenkopf 2016; Vera-Muñoz et al. 2006), as well as for the diffusion of technologies like data analytics (Austin et al. 2021).

Expert auditors can hoard knowledge in two ways. Employees seek information related to either (1) the process to address a challenge or (2) a solution to that challenge (Brooks, Gino, and Schweitzer 2015; Komissarouk and Nadler 2014; Nadler 2002). Thus, expert auditors can hoard either process knowledge, solution knowledge, or both. We define process knowledge as information about the way (i.e., process) by which experts perform activities related to their distinctive skill. Expert auditors can protect the distinctiveness of their skill by limiting their process knowledge sharing. For example, expert auditors may be unwilling to teach novice auditors how to perform data analytics.[3] We define solution knowledge as information about outcomes obtained from activities related to experts' distinctive skill. For example, expert auditors may be unwilling to share mutually relevant solutions from their data analytics with their novice peers.[4]

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[2] Hudson notes, "If I know something that a peer does not know, all things being equal, that gives me a competitive advantage. Since I am measured against my peers, this can impact my advantage and my salary. It sort of implicitly encourages individuals in an organization not to share what they have." (as quoted in Vera- Muñoz et al. 2006, 140).
[3] Auditors could be unwilling to teach others about extracting, transforming (i.e., cleaning), and loading data; how to use certain popular data analytic programs like IDEA; and how to interpret and present data analytic output.
[4] Both of these knowledge hoarding techniques are passive methods (i.e., auditors do not share knowledge). Auditors could also more actively hoard knowledge by sharing inaccurate process or solution knowledge with their peers and keeping accurate knowledge to themselves (see Berger et al. 2019).

Hoarding process and solution knowledge negatively affects peers' relative performance and, thus, peers' compensation, and knowledge hoarding may violate auditors' social norms (see Wang 2004). However, evidence suggests that auditors often prioritize their own benefit over the common good.[5] Therefore, we expect that when expert auditors receive relative performance evaluations, it will induce a sense of competition and impede these auditors' process and solution knowledge sharing with their peers. Formally:

> **H1:** Expert auditors will share less helpful knowledge with their peers when they face relative performance evaluations than when they do not face relative performance evaluations.

People view process and solution knowledge as fundamentally different from one another (Haesebrouck, Van den Abbeele, and Williamson 2021). Sharing process knowledge puts expert auditors' competitive advantage at risk because novice peers are able to learn and, potentially, become experts. While hoarding solution knowledge hinders novice auditors from obtaining helpful information, sharing solution knowledge may not put the distinctiveness of the experts' skill at as great of a risk as sharing process knowledge. For example, expert auditors may be unwilling to share mutually relevant solutions from their data analytics with their novice peers but sharing these solutions would not give the novice any additional data analytic skill. Additionally, expert auditors who are unwilling to share process knowledge can protect their positive self-view, or identity, by sharing solution knowledge instead. That is, sharing solution knowledge allows experts to retain positive self-views, even while novices remain dependent on these experts (Nadler, ben-David, and Gorodeisky 2009; Nadler 2002). Thus, we expect that

[5] For instance, audit subordinates try to stylize their work so that supervisors do not recognize potential concerns and request more work (Bennett and Hatfield 2013; Rich, Solomon, and Trotman 1997); audit supervisors penalize subordinates for spending time on skeptical investigation, if that investigation does not yield a misstatement (Brazel, Jackson, Shaefer, and Stewart 2016); and auditors become defensive when they receive advice from peers about their area of expertise and are less likely to take justifiable advice under these conditions (Kadous, Leiby, and Peecher 2013).

expert auditors will reduce their process knowledge sharing more than their solution knowledge sharing when they face relative performance evaluations, compared to when they do not face relative performance evaluations. Formally:

H2: When expert auditors face relative performance evaluations, they will reduce their helpful process knowledge sharing more than their helpful solution knowledge sharing, relative to when they do not face relative performance evaluations.

This prediction is not without tension. To the extent that expert auditors' knowledge sharing is motivated by status seeking (see Bol and Leiby 2021) rather than competitive advantage protection, auditors may prefer to share process knowledge over solution knowledge. Sharing process knowledge allows experts to "show off" their generosity but does not jeopardize whether the expert receives the credit in the way that sharing solution knowledge does.

Auditors' Social Bonds with their Peers

We expect strong social bonds between audit peers will improve expert auditors' knowledge sharing. Social identity theory suggests that peoples' sense of self is rooted in their group identity, and group identity is the foundation for developing a social bond (Tajfel 1974; Tajfel and Turner 1979). A natural consequence of this is that people favor their own group over the outgroup; that is, social bonds can lead to ingroup favoritism (Brewer 1999; Goette, Huffman, and Meier 2006; Hewstone, Rubin, and Willis 2002; Mullen, Brown and Smith 1992). Ingroup favoritism drives knowledge sharing within groups (Zhu 2016). This is specifically true within the accounting context; Burt (2016) finds that employees are more willing to share internal control weakness information with internal auditors with whom the employees identify rather than external auditors.[6] Accordingly, when audit peers develop stronger social bonds, we expect auditors to share more knowledge with their peers.

Further, we expect strong social bonds between audit peers will curb the counterproductive sharing behaviors that stem from relative performance evaluations. Relative performance evaluations lead employees to feel competitive, and competitiveness weakens social bonds (Kouchaki, Smith-Crowe, Brief, and Sousa 2013). However, when social bonds between employees and their firms are maintained in competitive environments, employees experience positive relational effects, like higher levels of perceived organizational support (Mahlendorf et al. 2014). Additionally, stronger social bonds lead to people to prioritize behaviors that are best for others within their group over behaviors that are best for the individual (Chen and Li 2009). Thus, we expect that expert auditors with stronger social bonds will share more knowledge with their peers, and the knowledge hoarding induced by relative performance evaluations will be reduced for expert auditors with stronger social bonds compared to expert auditors with weaker social bonds. Thus, we formally predict:

H3: Expert auditors with stronger social bonds will share more helpful knowledge with peers than expert auditors with weaker social bonds, and the knowledge sharing reduction induced by relative performance evaluations will be tempered for expert auditors with stronger social bonds as compared to expert auditors with weaker social bonds.

III. RESEARCH METHOD

Experimental Setting

To address our research question and following prior experimental accounting studies (e.g., Berger et al. 2019; Kachelmeier and VanLanduyt 2017), we conduct an experiment

[6] Further, using archival and survey data, Hansen (1999) finds that stronger social bonds between work teams speeds up the transfer of complex knowledge between teams. Additionally, Moorman and Blakely (1995) find that people who characterize themselves as more collective-oriented exhibit more interpersonal helping than people who characterize themselves as more individual-oriented.

according to the traditions of the experimental economic methodology. We design an abstract setting in which participants assume the role of either expert or novice and interact to share knowledge. We choose this methodology because it allows us to examine the theory underlying our predictions. Specifically, our theory relies upon economic incentives, which we incorporate into our setting and describe below. Furthermore, our abstract setting reduces the possibility of demand effects associated with a contextually rich setting in which audit teams interact (Haynes and Kachelmeier 1998).

Participants

Participants are 202 undergraduate and graduate students enrolled at either a public or private university.[7] We exclude three participants who were doctoral students who stepped in to complete a session, and we exclude one expert-novice pair because their performance and responses suggested they did not take the task seriously. Of the remaining 197 participants, 99 were assigned to the expert role. Of these 99, we exclude nine participants for our primary analysis because they did not achieve at least 80% accuracy on the decoding task.[8] Thus, our final sample size consists of 188 participants where 90 (98) are in the expert (novice) role. Our task and setting are abstract and do not require background knowledge in accounting. Consequently, students are appropriate subjects for our study (Peecher and Solomon 2001; Libby, Bloomfield, and Nelson 2002). Participants are 20.7 years old on average, and 44% are males, 55% are female, and the remaining 1% did not disclose their gender. Fifty-seven percent

[7] Each university's Institutional Review Board approved the study prior to recruiting participants.
[8] Based on the training we provide to the experts, we believe that an expert should be able to accurately decode at least 80% of the words. Of the nine expert we exclude on this basis, one is in the Stronger Social Bond/RPE Absent condition, two are in the Weaker Social Bond/RPE Present condition, one is in the Stronger Social Bond/RPI Only condition, and the remaining five are in the Weaker Social Bond/RPI Only condition. The nine experts that we exclude report that the task was significantly more difficult (6.33) than the experts we keep (2.57; F = 21.08, two-tailed p-value < 0.01), which suggests that they did not pay attention to the training we provide. However, these experts do not report working significantly harder on the task (7.22) relative to the experts we keep (5.84; F = 1.68, two-tailed p-value = 0.20).

are accounting majors, and 19% are freshman, 16% are sophomores, 16% are juniors, 15% are seniors, and the remaining 34% are graduate students. Participants earned $26.63 on average—with earnings ranging from $11 to $41—for approximately 65 minutes of their time.

Experimental Procedures

We conduct 18 sessions in controlled computer labs. In each session, participants complete two experimental tasks, which we implement through z-Tree software (Fischbacher 2007) on networked computers. Sessions last approximately 65 minutes with the first ten minutes dedicated to instructions.

As participants enter the lab, we randomly assign them to a computer where they assume the role of either an expert or novice. We begin the sessions by reading the participant instructions aloud, and participants follow along with a hard copy. The instructions describe the experimental task and compensation scheme with neutral terminology to maintain the abstract nature of the setting. In particular, we label the expert-participants as "BLUE" players and the novice-participants as "GREEN" players. For the remainder of the paper, we use expert and novice for expository convenience.

After completing the instructions, but before beginning the first experimental task, participants complete a true-false quiz over the instructions. Participants must answer each question correctly before proceeding to the next question. For any question participants incorrectly answer, we provide an explanation for the correct answer and ask participants to answer the question again. The quiz covers key elements of the task and incentive structure.

At the start of the first experimental task, participants are assigned either the role of expert or novice. The first experimental task is a set of eight trivia questions, and as described below, we use this trivia quiz to manipulate the strength of participants' social bonds. We select our trivia questions from www.triviachamp.com, and questions cover a range of general knowledge. For each question participants answer correctly, they earn $0.50, and participants learn how they perform on the trivia set at the end of the session.

Immediately following the conclusion of the first task, participants are introduced to the second experimental task where participants work to decode a 15-word sentence, one word at a time. Each letter (number) in the coded word represents a decoded consonant (vowel) (i.e., "y" in the coded message always represents "c" in the decoded message, and “99” always represents “e”). Participants are randomly and anonymously paired together for the duration of this task. Participants in the stronger social bond condition continue with their same pairings from the first experimental task, while participants in the weaker social bond condition who were not part of a pairing in the first experimental task are placed into a new pairing.

Prior to receiving the first word of the sentence, the expert-participants receive training on the code and practice decoding three words. At the conclusion of their training, experts are provided with the solution to the practice words. During this time, the novice-participants are asked to wait, and we do not provide the novices with any details on the code. Once all experts complete their training, all participants receive the first coded word. Participants have 60 seconds to submit their solution. After submitting their solution for each word, participants learn whether their solution was correct.

Following this feedback, each novice can choose to request a hint from their expert partner. Additionally, each expert participant can choose to share a helpful hint, an unhelpful hint, or no hint with their novice partner. If the expert chooses to share either a helpful or unhelpful hint, the expert next chooses to provide a hint about the code (e.g., a helpful hint about the code might be "y" represents "c", while an unhelpful hint might be “y” represents “t”), a synonym for the previous coded word, or both. Sharing a hint about the code represents sharing knowledge about the distinctive skill (e.g., process knowledge) while sharing a hint about the meaning of the word represents sharing knowledge gained from using the distinctive skill (e.g., solution knowledge).[9] If the expert does not initially choose to share a hint, but the novice requests a hint, the expert is given a second opportunity to share a helpful or unhelpful hint or ignore the request. If the novice's request is ignored, the novice receives a message that the expert did not share a hint.

Participants repeat the process of decoding, feedback, and hint sharing for 15 rounds. At the conclusion of the second experimental task, participants complete a short, online post-experimental questionnaire, which we administer through Qualtrics. On the questionnaire, we measure participants' social bonds, sense of competition, and demographics.

In addition to a $10 show-up fee, participants earn compensation for their performance on each experimental task. First, participants earn $0.50 for every correct trivia question answered in the first task. Second, in the decoding task, we pay participants based on their individual performance. Participants earn points for each correctly decoded word, and we pay participants $0.02 for each point earned. Additionally, in the *Relative Performance Evaluation* condition, participants earn a proportion of a $20 bonus based on their performance relative to their partner. When participants can earn a relative portion of the $20 bonus, we reduce the number of points earned for each word so that the average total earnings for the second task remain consistent across conditions.

Experimental Design

[9] We hold the costs of sharing hints constant across process and solution knowledge (e.g., time required), which allows us to clearly test our theory; that is, we are able to attribute differences in participants' behavior to sharing strategies related to protecting their competitive advantage, rather than related to avoiding other costs.

We conduct an experiment with a 3×2 design. We manipulate the first variable, relative performance evaluation (hereafter "RPE"), between subjects at three levels: RPE present, RPE absent, and relative performance information (hereafter: "RPI") present. In the RPE present condition, participants receive information about their individual performance and the performance of the participant with whom they are paired, and they earn some portion of a $20 bonus based their performance relative to their partner. In the RPE absent condition, participants only receive information about their own performance. They do not receive information about the performance of the participant with whom they are paired, and their compensation does not include a relative portion of a $20 bonus. Finally, in the intermediary RPI present condition, participants receive information about both their individual performance as well as the performance of the participant with whom they are paired. Their compensation is only based on their individual performance and does not include any relative portion of a $20 bonus.

We also manipulate the second factor, social bond, between subjects at two levels: stronger and weaker. Following Kachelmeier and VanLanduyt (2017), in the stronger social bond condition, expert and novice participants complete the first experimental task (i.e., the trivia quiz) in pairs, can electronically chat for three minutes, and the expert participant submits the answers on behalf of the pair. In the weaker social bond condition, each participant completes the first experimental task alone and does not have the ability to electronically chat with any other participant.

Dependent Variables

All of our dependent variables of interest are the extent to which the expert shared certain types of helpful knowledge with their novice partner. During each round of the second task, the expert can share helpful knowledge. After choosing to share a helpful hint, the expert can choose to share process knowledge, solution knowledge, or both. For each of our primary dependent variables, described below, we calculate a single observation per expert participant by calculating the percentage of rounds in which the expert chose to share the specific type of knowledge captured by our dependent variable.

Our first dependent variable of interest, helpful hint sharing rate, is the extent to which experts share helpful knowledge, which includes both process and solution knowledge. The second variable of interest, helpful process hint sharing rate, is the extent to which experts share helpful process knowledge, which includes both instances in which experts share a hint with only process knowledge and instances in which experts share a hint with both process and solution knowledge. The third variable of interest, helpful vowel hint sharing rate*,* is the extent to which experts share the codes for vowels in particular. There are four instances in which process knowledge contains the code for a vowel, which unlike consonant process knowledge is randomly determined and cannot be systematically derived.[10] We use this variable to supplement our process knowledge analyses. Finally, our fourth variable of interest, helpful solution hint sharing rate, is the extent to which experts share helpful solution knowledge, which includes both instances in which experts share a hint with only solution knowledge and instances in which experts share a hint with both process and solution knowledge.

In the post-experimental questionnaire, we measure the strength of each participant's social bond. We use seven statements adapted from Kachelmeier and VanLanduyt (2017) and Bamber and Iyer (2007) and used by Hornok (2021).[11] We ask each participant to rate their

[10] Because the code for the vowels is randomly determined, the vowel hints represent the most valuable information the expert can share. This variable provides us with a strong test of our theory regarding expert's willingness to share valuable process knowledge.
[11] The seven statements are as follows: (1) "I feel the successes of the player I was paired with were my successes."; (2) "When referring to the player I was paired with, I think of 'we' rather than 'he or she'."; (3) "I feel like I was on a team with the player I was paired with."; (4) "I wanted the player I was paired with to succeed."; (5) "I feel close

agreement with the statement on an 11-point Likert scale anchored at "Strongly disagree" (0) and "Strongly agree" (10). We sum each participant's responses to calculate a social bond score such that a higher score indicates a stronger social bond. We use this to check whether our social bond manipulation was successful.

IV. RESULTS

Manipulation Checks

To investigate whether our relative performance evaluation (RPE) manipulation resulted in the anticipated variance in participants' sense of competition, we used a measure from our post-experimental questionnaire. Specifically, we used an 11-point Likert scale question, "When considering how competitive you felt with the person you were paired with, during the second task you felt…" anchored at "Not at all competitive" (0) and "Extremely competitive" (10). We conduct an ANOVA and find a significant effect of RPE on participants' sense of competition ($F = 5.55$, two-tailed $p < 0.01$). Moreover, we conduct a contrast test comparing only the RPE present (5.30) and RPE absent (2.81) conditions, and we continue to find a significant effect of our manipulation on participants' sense of competition ($t_1 = 3.01$, one-tailed $p < 0.01$). Thus, consistent with our expectations, RPE induces a sense of competition among our participants.

To investigate the effectiveness of our social bond strength manipulation, we use the social bond scale included in our post-experimental questionnaire. As shown in Table 1, Panels A and B, we conduct an ANOVA and find a significant effect of our social bond strength manipulation on expert-participants' perceived social bonds (stronger social bond = 44.71, weaker social bond = 33.67, $F = 9.10$, two-tailed $p < 0.01$). Moreover, Panel C provides a contrast test comparing the stronger and weaker social bond conditions across only the RPE

to the player I was paired with."; (6) "I have positive feelings towards the player I was paired with."; and (7) "I feel like I was working together with the player I was paired with."

present and absent conditions (i.e., excluding the RPI present conditions), and we continue to find a significant effect of our social bond strength manipulation on participants' perceived social bond ($t_1 = 2.57$, one-tailed $p < 0.01$). Thus, participants perceived stronger social bonds in the stronger social bond condition than in the weaker social bond condition. Interestingly, we also find that participants' perceived social bonds vary based on whether RPE is present (27.91) or absent (41.69), such that facing RPE reduced participants' perceived social bonds ($t_1 = 3.15$, two-tailed $p < 0.01$). This suggests that the competition induced by relative performance evaluations led to weaker perceived social bonds, consistent with findings from Kouchaki et al. (2013). That is, those experts auditors who face relative performance evaluations psychologically distance themselves from their novice peers.[12]

Tests of H1

H1 predicts that expert auditors will share less helpful knowledge with their peers when they face relative performance evaluations than when they do not face relative performance evaluations. We examine this prediction by investigating differences across our fully crossed 3×2 experimental conditions. As shown in Table 2, Panels A and C, participants' helpful hint sharing was lower when RPE was present (0.62) than when RPE was absent (0.88, $t_1 = 4.07$, one-tailed $p < 0.01$). Helpful hint sharing includes process and solution knowledge sharing. As more refined tests, we also examine whether RPE specifically reduced participants' process knowledge sharing and solution knowledge sharing. As shown in Table 3, Panels A and C, we find that participants' helpful process hint sharing was lower when RPE was present (0.45) than when RPE was absent (0.81, $t_1 = 4.65$, one-tailed $p < 0.01$). For robustness, we also examine the extent

[12] While we use our social bond manipulation for our primary analysis of H3, we also reperform our analysis using the measured social bond to ensure that the influence of RPE on bond strength does not alter our results. We perform a median split on the expert's measured social bond and use this as our independent variable in place of the manipulated variable. We find that our results are consistent with our reported analysis.

to which expert participants shared vowel hints with novices, because this type of process hint was the most critical to novice success. As shown in Panels D and F, we find that participants' helpful vowel hint sharing was also lower when RPE was present (0.46) than when RPE was absent (0.83, $t_1 = 4.55$, one-tailed $p < 0.01$). Finally, as shown in Table 4, Panels A and C, we find that participants' helpful solution hint sharing was lower when RPE was present (0.52) than when RPE was absent (0.63, $t_1 = 1.54$, one-tailed $p = 0.06$). Thus, H1 is supported.

Tests of H2

H2 predicts that when expert auditors face relative performance evaluations, they will reduce their helpful process knowledge sharing more than their helpful solution knowledge sharing, relative to when they do not face relative performance evaluations. To test H2, we use a repeated measures maximum likelihood estimation, with helpful hint type (process or solution) as the repeated measure; with RPE, social bond, the RPE by hint type interaction, and the RPE by hint type by social bond interaction as additional independent variables; and with the extent of experts' helpful hint sharing as the dependent variable. Specifically, we calculate our dependent variable as the percentage of rounds in which experts chose to share process hints for the process helpful hint type or solution hints for the solution helpful hint type. Since H2 predicts a difference in slopes between environments with and without RPE, we test a planned contrast that models a standard interaction between RPE and hint type and removes the effect of the RPI conditions from our contrast (i.e., these two conditions receive contrast weights of 0).

As shown in Table 5, Panel D, RPE and hint type significantly interact ($t_{180} = 2.33$, one-tailed $p = 0.01$), supporting H2. Importantly, Panels A and B provide visual evidence that the pattern in this interaction is consistent with the pattern specified in H2. Contrasts in Panel D provide additional evidence for H2. Experts share significantly less process and solution knowledge when they are in RPE environments than when they are not, though the decline is greater for process hint sharing than solution hint sharing (t_{180} = 4.86, one-tailed $p < 0.01$ vs. t_{180} = 1.57, one-tailed $p = 0.06$). Additionally, Panel C shows that experts share fewer helpful hints when they are in RPE environments ($F = 17.94$, one-tailed $p < 0.01$) and when they have weaker social bonds ($F = 16.11$, $p < 0.01$, one-tailed). This evidence supports H2 and our theory more broadly.

As shown in Panel C, we also find a significant three-way interaction between RPE, hint type, and social bond strength ($F = 2.31$, two-tailed $p = 0.05$). In untabulated analyses, we probe this interaction to provide additional insight. For experts with stronger social bonds, process hint sharing declines significantly between RPE present and absent environments (t_{180} = 2.89, two-tailed $p < 0.01$), but solution hint sharing does not significantly differ between RPE present and absent environments (t_{180} = -0.82, two-tailed $p = 0.42$). For experts with weaker social bonds, process hint sharing and solution hint sharing both decline significantly between RPE present and absent environments (t_{180} = 3.99, two-tailed $p < 0.01$ and t_{180} = 3.05, two-tailed $p < 0.01$, respectively). This evidence indicates that experts with stronger social bonds drive our findings that expert auditors reduce their process hint sharing more than their solution hint sharing when they face RPE.

Tests of H3

H3 predicts that expert auditors with stronger social bonds will share more helpful knowledge with peers than expert auditors with weaker social bonds, and the knowledge sharing reduction induced by relative performance evaluations will be tempered for expert auditors with stronger social bonds as compared to expert auditors with weaker social bonds. We examine this prediction by investigating differences across our fully crossed 3×2 experimental conditions. As shown in Table 2, Panels A and B, participants' helpful hint sharing is higher when they have stronger social bonds (0.88) than when they have weaker social bonds (0.72, $F = 8.38$, two-tailed $p < 0.01$). Further, to investigate whether stronger social bonds mitigate the knowledge hoarding induced when RPE is present, we test a planned contrast that indicates main effects of both RPE and social bonds, and an ordinal interaction such that knowledge hoarding is incrementally mitigated when social bonds between peers in RPE environments are stronger.[13] As shown in Panel C, our planned contrast is significant ($t_1 = 5.58$, one-tailed $p < 0.01$), supporting H3.[14]

Further, untabulated simple effects suggest that more socially bonded experts share more helpful hints in both RPE present ($t = 3.77$, two-tailed $p < 0.01$) and RPE absent ($t = 1.26$, two-tailed $p < 0.01$) environments, but the effect is larger in RPE present environments. Further, while experts with stronger ($t = 1.70$, two-tailed $p < 0.01$) and weaker ($t = 4.06$, two-tailed $p < 0.01$) social bonds share fewer hints when RPE is present, this effect is smaller when social bonds are stronger. Overall, this evidence suggests that stronger social bonds mitigate, but do not eliminate, the knowledge sharing reduction induced by RPE.

As with H1, we also examine more refined tests of social bond strength on participants process knowledge sharing and solution knowledge sharing. As shown in Table 3, Panels A and B, participants' helpful process hint sharing was higher when they had stronger social bonds (0.78) than when they had weaker social bonds (0.63, $F = 5.62$, two-tailed $p = 0.02$). Further, as

[13] Specifically, our contrast weights were RPE present / stronger social bonds (1), RPE present / weaker social bonds (-4), RPE absent / stronger social bonds (2), and RPE absent / weaker social bonds (1). RPI conditions received contrast weights of 0.

[14] To directly test whether our results are fully captured by our predicted interaction, we also run our contrast on only the RPE present and absent conditions, excluding the relative performance information (RPI) conditions. When we do so, we continue to find that our planned contrast is significant ($F = 24.63$, $df = 1$, one-tailed $p < 0.01$). Importantly, we also find that the residual variance between conditions is insignificant ($F = 0.15$, two-tailed $p = 0.86$; see Guggenmos, Piercey, and Agoglia 2018). When we run our planned contrast on our full data set, including the RPI conditions, we assign weights of 0 to the RPI conditions since they are not part of our theoretical prediction. Thus, when we test the full dataset, the effects of RPI are included in our residual, we, not surprisingly, find a significant residual variance between conditions ($F = 2.81$, two-tailed $p = 0.03$).

can been seen in Panel C, our planned contrast is significant ($t_1 = 5.10$, one-tailed $p < 0.01$). Moreover, as shown in Panels D and F, participants' helpful vowel hint sharing was higher when they had stronger social bonds (0.79) than when they had weaker social bonds (0.65, $F = 4.51$, two-tailed $p = 0.04$), and our planned contrast is significant ($t_1 = 4.45$, one-tailed $p < 0.01$). Finally, as shown in Table 4, Panels A and B, participants' helpful solution hint sharing was higher when they had stronger social bonds (0.70) than when they had weaker social bonds (0.49, $F = 9.75$, two-tailed $p < 0.01$), and as can been seen in Panel C, our planned contrast is significant ($t_1 = 4.13$, one-tailed $p < 0.01$). This evidence provides additional support for H3.[15]

Untabulated simple effects suggest that stronger social bonds mitigate, but do not eliminate, the decrease in process and vowel knowledge sharing induced by RPE. For instance, experts with stronger social bonds continue to provide fewer helpful process hints ($t = 2.76$, two-tailed $p < 0.01$) and vowel hints ($t = 3.04$, two-tailed $p < 0.01$) when RPE is present relative to when RPE is absent. However, stronger social bonds eliminate the decrease in solution knowledge. In fact, experts with stronger social bonds provide more helpful solution hints when RPE is present than when RPE is absent ($t = -0.80$, two-tailed $p < 0.01$).

Test of Theorized Judgment Process

Next, we examine our theorized judgment process. As shown in Figure 1, our theory predicts (a) that the relative compensation included in RPE leads to a greater sense of competition, which leads to a reduction in knowledge sharing and (b) that an intentional strengthening of social bonds leads to greater perceived social bonds, which leads to an increase in knowledge sharing, and (c) that an intentional strengthening of social bonds moderates the

[15] We replicate these contrast tests on only the RPE present and absent conditions, excluding the RPI conditions, and our results are inferentially identical. For each of these contrasts, our residual test is insignificant (helpful process hints: $F = 1.35$, two-tailed $p = 0.27$; helpful vowel hints: $F = 2.04$, two-tailed $p = 0.14$; helpful solution hints: $F = 1.55$, two-tailed $p = 0.22$)

negative effect of RPE on knowledge sharing. As such, in our analysis we specifically examine the conditions specified in our theorized judgment process: RPE, present and absent, and social bonds, stronger and weaker.[16] To test our judgment process, we use a combination of two regression-based, PROCESS models (Hayes 2017). We report the results in Figure 2.

The results of our first model, reported in Panel A, demonstrate that our social bond manipulation indeed strengthens perceived social bonds ($t = 1.35$, one-tailed $p = 0.09$), and though RPE does not moderate this relationship ($t = 0.41$, one-tailed $p = 0.68$), it does weaken social bonds ($t = -2.36$, one-tailed $p = 0.01$, untabulated). Stronger perceived social bonds, in turn, increase knowledge sharing ($t = 5.84$, one-tailed $p < 0.01$). Consistent with our theorized judgment process, we find that experts who face RPE exhibit a significant positive indirect effect of intentional social bond strengthening on helpful knowledge sharing, through perceived social bonds (coeff = 0.13, 90% CI, Lower Limit: 0.02, Upper Limit: 0.24).[17] However, we do not find this indirect effect among experts who do not face RPE, indicating that these experts share helpful knowledge with novices regardless of social bond strength.

The results of the second model, reported in Panel B, demonstrate both the effect of RPE on knowledge sharing and how perceived social bonds moderate this effect. Importantly, we use perceived social bonds rather than the social bond manipulation in our model because we are interested in how the varying strength of social bonds rather than the ability to strengthen social bonds moderates the effect of RPE on knowledge sharing.[18] We find that RPE increases experts' feelings of competition ($t = 3.58$, one-tailed $p < 0.01$) and competition reduces knowledge

[16] We do not include the RPI present conditions in our theorized judgment process analysis.
[17] For PROCESS analyses, a coefficient is considered statistically significant, equivalent to a one-tailed $p < 0.05$, if the 90% confidence interval does not contain 0 (Hayes 2017).
[18] We also perform our analysis using our manipulated social bond conditions, and we find that results are directionally consistent. However, the difference in the conditional indirect effects of RPE on knowledge sharing between our strong and weak social bond conditions is not different.

sharing ($t = -4.82$, one-tailed $p < 0.01$). Further, we find that this indirect effect of RPE on knowledge sharing, through feelings of competition, weakens as perceived social bonds strengthen (CIs exclude 0 for experts with weaker perceived social bonds, coeff = -0.13, and average perceived social bonds, coeff = -0.04, but includes 0 for experts with stronger perceived social bonds, coeff = 0.01; all pairwise contrasts reported in Panel B are significant[19]). That is, social bonds moderate the effect of RPE on helpful knowledge sharing. Together, our PROCESS analyses provide evidence of both our predicted judgment paths – one from our social bond manipulation to perceived social bond to helpful hint sharing and another from RPE to sense of competition to helpful hint sharing – and our hypothesized interaction between RPE and social bond strength.

Supplemental Analysis

In supplemental analysis we examine whether relative performance information (RPI) affects experts' knowledge sharing, whether experts who face RPE sabotage novices, and whether novices' performance is affected by RPE and social bonds.

Experts: Relative Performance Information

First, we examine whether RPI affects experts' knowledge sharing. RPI is information that people receive about their performance compared to other peoples' performance, and RPI is one component of RPE. People can receive RPI without their compensation depending on their performance relative to their peers' performance (i.e., the other component of RPE). Economic theory does not predict performance differences based on RPI alone, since compensation is unaffected. However, social comparison theory posits that under conditions of uncertainty,

[19] To test the conditional effect of the perceived social bond, we use the mean value of the social bond for the "average". We use one standard deviation above and below the mean for the "stronger" and "weaker" values, respectively.

people evaluate their own ability by comparing themselves to others, which spurs them to perform competitively in order to attain positive self-image and, thus, leads to improved performance (Hannan et al. 2013; Festinger 1954; Hoffman, Festinger, and Lawrence 1954). Prior research finds that relative performance information induces social comparison and improves performance (Hannan et al. 2013, 2008; Kerr et al. 2007). Moreover, Berger et al. (2019) find that when employees receive RPI, they share less helpful knowledge with their peers and may even intentionally share inaccurate knowledge with their peers.[20]

Notably, distinctly *positive* feedback yields maintained, or sometimes even reduced, performance levels (Shang, Abernethy, and Hung 2020; Kluger et al. 1996), and experts protect their competitive advantage because they reasonably expect to receive positive feedback. Participants in Berger et al. (2019) receive a mix of positive and negative feedback, whereas experts in our study receive distinctly positive feedback.[21] That is, our study incorporates this important characteristic of feedback to the auditing setting and to our research question, which reduces the likelihood that RPI leads to higher levels of social comparison and competitive behavior.

As shown in Tables 2 through 4, we find no evidence that the experts in our study reduce their helpful hint sharing–either process or solution hint sharing–when RPI is present (helpful hint sharing: $t_1 = 0.78$, two-tailed $p = 0.44$; helpful process hint sharing: $t_1 = 1.14$, two-tailed $p = 0.26$; helpful solution hint sharing: $t_1 = 0.24$, two-tailed $p = 0.81$). In fact, we find that when RPI is present, experts perceive marginally stronger social bonds with their peers (untabulated:

[20] Berger et al. (2019) do not distinguish between process and solution knowledge sharing, though the type of knowledge sharing specified in their study is most akin to solution knowledge sharing.

[21] Berger et al's (2019) participants are ranked in groups of 5 and do not have a competitive advantage in the task on which their performance is ranked. By comparison, we compare experts' performance only to their single novice counterpart's performance, and our experts have a competitive advantage in the performance-ranked task.

F = 3.40, two-tailed p = 0.07). These results are interesting when considered in conjunction with our primary analyses, which find that RPE (i.e., RPI partnered with relative compensation) leads to a *reduction* in perceived social bond strength and knowledge sharing.

Experts: Unhelpful Hint Sharing

Next, we examine whether experts go beyond hoarding helpful knowledge, such that they intentionally sabotage their novice counterparts by sharing incorrect, unhelpful information. Recall that experts who share hints can choose to share either helpful or unhelpful information. We find in untabulated analyses that RPE increases the rate at which experts share unhelpful hints with novices (RPE Present = 0.19 v. RPE Absent = 0.06, F = 2.92, two-tailed $p < 0.01$). Additionally, when experts face RPE, those with stronger social bonds share unhelpful hints at a lower rate (0.14) than those with weaker social bonds (0.24, t = 1.73, two-tailed p = 0.09). That is, we find that performance-based incentives motivate expert auditors to sabotage their peers' productivity, but an intentional strengthening of social bonds among audit team members counteracts this problem.

Novices: Performance

Finally, we examine how RPE and social bonds affect novices' performance. First, to investigate the effectiveness of our manipulations, we examine differences in novices' reported sense of competitiveness and perceived social bond strength. We find that novices feel more competitive when RPE is present (6.61) than when it is absent (3.90; F = 13.50, two-tailed $p < 0.01$, untabulated), consistent with our expectation. We also find that novices perceive stronger bonds when we intentionally strengthen social bonds (37.63 v. 22.47; F = 22.24, two-tailed $p < 0.01$, untabulated), indicating that our social bond strength manipulation was successful. Further, facing RPE suppresses novices' perceived social bond strength. Thus, our manipulations have similar effects for both the novices and experts in our study.

In untabulated analyses, we next examine the performance of novices on the decoding task. We find marginally significant direct effects of both social bond strength and RPE on novices' performance. Novices perform marginally better when they have stronger social bonds (stronger: 0.34 v. weaker: 0.25, $F = 2.43$, two-tailed $p = 0.12$) and when they face RPE (RPE present: 0.33 v. RPE absent: 0.22, two-tailed $p = 0.11$). Consistent with prior literature, these results suggest that RPE and stronger social bonds lead to improved novice performance.[22]

Finally, because information sharing affects decision quality (e.g., Kelly 2010), we investigate whether the help that experts provide to novices has a meaningful effect on the novices' performance. Additionally, because we find that experts share types of knowledge differently such that they believe process knowledge will be more helpful to novices than solution knowledge, we separately examine how process and solution knowledge influence novice performance. To do so, we perform two PROCESS analyses (untabulated), following Hayes (2017), and we estimate two different moderated mediation models (model 8). In each model, RPE is the primary independent variable, novice performance is the final outcome variable, and our social bond manipulation is the moderator, which we interact both with the effect of RPE on our mediator and with the direct effect of RPE on novice performance. The mediator in the first (second) model is experts' helpful process (solution) hint share rate. Also,

[22] We also examined the rate at which novices request hints from experts and find that it is not influenced by either the strength of their social bond or by RPE independently (two-tailed p-values > 0.5). Interestingly, we find that novices with stronger social bonds request marginally fewer hints when they receive RPE (0.68) than when they do not receive RPE (0.82, $t = 1.63$, two-tailed $p = 0.11$). This may suggest that these more socially bonded novices are less willing to ask for help, knowing that it would reduce their counterpart's payment.

because novices receive no information prior to the start of the task, we perform our analyses on the final ten periods of the task, after novices have become familiar with the task structure.

In our first model, we find that RPE decreases the rate at which experts share helpful *process* hints with novices ($t = -3.81$, one-tailed $p < 0.01$), but the process hints shared positively influence the novice's performance ($t = 1.90$, one-tailed $p = 0.03$). Additionally, the indirect effects of RPE on novice performance, through helpful hints shared, is significant at the 90% confidence level, regardless of social bond strength.[23] In our second model, while we find that RPE does reduce expert's solution hint sharing, as expected, ($t = -3.15$, one-tailed $p < 0.01$), the solution hints shared do not help the novice's performance ($t = -0071$, two-tailed $p = 0.48$). Taken together, the results are consistent with theory and our main analysis—RPE reduces knowledge sharing, but when certain knowledge is shared, it improves performance.

V. CONCLUSION

In this study we experimentally examine whether auditors hoard knowledge in an effort to protect their competitive advantage during relative performance evaluations and whether this depends on auditors' social bonds. Relative performance evaluations feature both feedback about employees' work relative to their peers and compensation decisions based on peers' relative performance. Drawing on theories of economics and social bonds, we posit that expert auditors (i.e., those with distinctive skills like data analytic know-how) share less information about their expertise when they face relative performance evaluations than when they do not. Further, we assert that when auditors receive relative performance evaluations, they will be less willing to share process knowledge (i.e., knowledge about a distinctive skill) than solution knowledge (i.e.,

[23] Additionally, we find that RPE has a significant, positive direct effect on the performance of novices with weaker social bonds ($t = 2.31$, two-tailed $p = 0.02$) but not of novices with stronger social bonds ($t = 1.01$, two-tailed $p = 0.32$). These results suggest novices with weaker social bonds perform better when they face RPE.

knowledge about solutions derived using a distinctive skill). Finally, we expect that expert auditors share more knowledge when they have stronger social bonds with their peers, and the increase in knowledge sharing induced by stronger social bonds compensates for knowledge sharing decreases in relative performance evaluation environments.

Consistent with our expectations, we find that expert auditors protect their competitive advantage by restricting their peer-to-peer knowledge sharing to a greater extent when they face relative performance evaluations than when they do not, and this is true for both process and solution knowledge sharing. Additionally, we find that expert auditors who receive relative performance evaluations are more willing to share solution knowledge than process knowledge, and this result is driven by expert auditors who are more strongly bonded with their peers. This finding suggests that expert auditors view sharing process knowledge as more detrimental to their competitive advantage than sharing solution knowledge. Further, we find that when expert auditors are more strongly bonded with their peers, they share more process and solution knowledge, and the negative knowledge sharing effects driven by relative performance environments are less pronounced. Still, even expert auditors with stronger social bonds share less process knowledge when relative performance evaluations are present than when they are absent. Additionally, we find that our results are mediated by experts' sense of competition and social bond perception.

We contribute to both academia and practice. First, we contribute to the knowledge sharing literature. While auditors commonly *seek* knowledge from their peers (Griffith et al. 2020; Kadous et al. 2013), the conditions affecting auditors' willingness to share knowledge with peers are unstudied. We answer calls for research about conditions affecting knowledge sharing (Argote and Fahrenkopf 2016; Vera-Muñoz et al. 2006) by examining two important factors:

relative performance evaluations and social bonds. The impact of these factors on knowledge sharing is of particular importance in auditing because auditors both learn from and trouble-shoot with their peers, making peer-to-peer knowledge sharing a critical component of successful audits (Bobek et al. 2012; Vera-Muñoz et al. 2006). Additionally, the current hybrid working environment likely exacerbates auditors' tendency to hoard knowledge because the current environment inhibits auditors' ability to bond with their peers. We also add to the knowledge sharing literature by distinguishing between process knowledge and solution knowledge and highlighting that expert auditors view process knowledge sharing as more detrimental to their competitive advantage than solution knowledge sharing.

Second, our examination of relative performance evaluations contributes to both academia and practice. We find that expert auditors facing relative performance evaluations constrict their peer-to-peer knowledge sharing, regardless of whether their social bonds with their peers are stronger or weaker. Further, we find for auditors with both stronger and weaker bonds, relative performance evaluations reduce the strength of auditors' *perceived* social bonds. This finding suggests that auditors psychologically distance themselves from those with whom they are compared. Audit firms can consider the impact of relative performance evaluations and social bonds on peer-to-peer knowledge sharing as they discuss updating their evaluation protocols (see Maier 2016) and consider planning team building opportunities. To the extent that these considerations improve auditors' peer-to-peer knowledge sharing, they should also improve audit quality.

Third, we contribute to the literature on the diffusion and use of emerging technologies in the auditing profession. Audit firms are investing unprecedented resources into emerging technologies like data analytics (Deloitte 2019; EY 2018; KPMG 2019a), and data analytic skills are valued by audit firms (Austin et al. 2020). Auditors with distinctive data analytic skills benefit from protecting this competitive advantage by restricting their related peer-to-peer knowledge sharing. This is troubling since the spread of emerging technologies, like data analytics, depends on interactions between those technologies and their auditor users (Austin et al. 2021), and curbing knowledge sharing is likely to slow the spread of audit quality enhancing technologies like data analytics (Austin et al. 2020).

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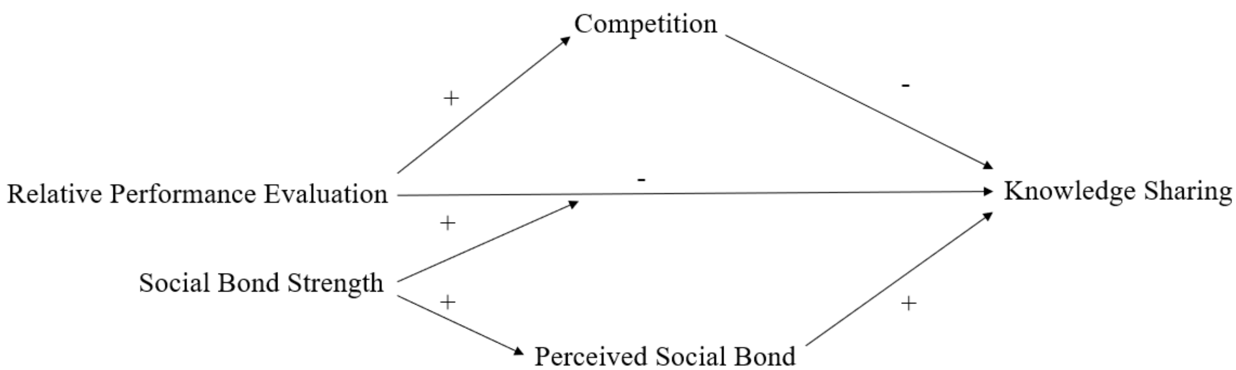
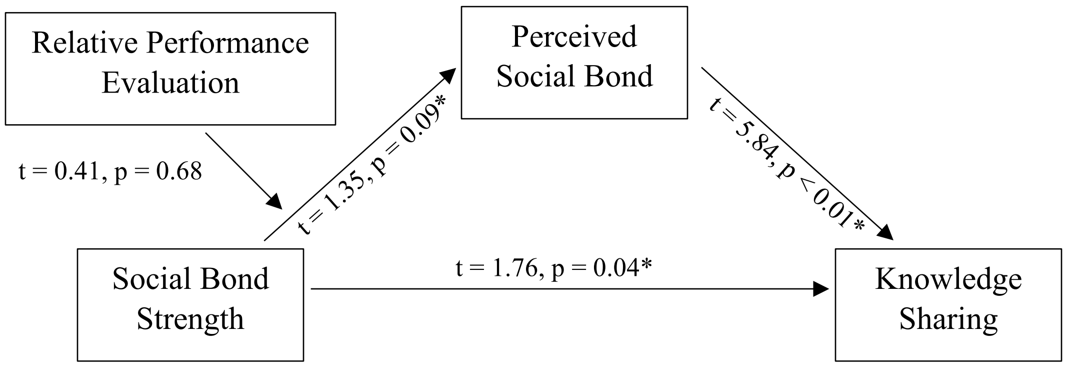
FIGURE 1
Theorized Judgment Process



Notes:
Figure 1 depicts our theorized judgment process. Specifically, it shows two paths in which, (a) relative performance evaluation (RPE) leads to a greater sense of competition, which leads to a reduction in knowledge sharing (path 1) and (b) our social bond strength manipulation leads to greater perceived social bonds, which leads to an increase in knowledge sharing (path 2), and (c) our social bond strength manipulation moderates the negative effect of RPE on knowledge sharing.

Figure 2

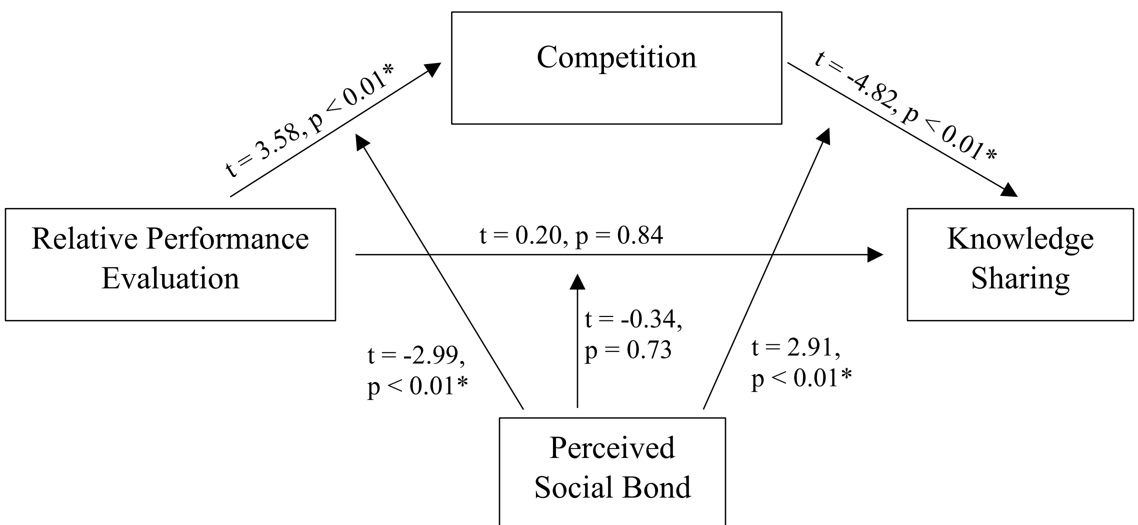
Panel A: Theorized Judgement Process of Social Bond Strength on Knowledge Sharing



<u>**Conditional Indirect Effects**</u>

RPE Present: coeff = 0.13, 90% CI, Lower Limit: 0.02, Upper Limit: 0.24
RPE Absent: coeff = 0.09, 90% CI, Lower Limit: -0.02, Upper Limit: 0.20

Panel B: Theorized Judgement Process of Relative Performance Evaluation on Knowledge Sharing



<u>**Conditional Indirect Effects**</u>

Weaker SB: coeff = -0.13, 90% CI, Lower Limit: -0.22, Upper Limit: -0.06
Average SB: coeff = -0.04, 90% CI, Lower Limit: -0.07, Upper Limit: -0.01
Stronger SB: coeff = 0.01, 90% CI, Lower Limit: -0.01, Upper Limit: 0.03

<u>Contrasts:</u>

Weaker SB v. *Average SB*: 0.09, 90% CI, Lower Limit: 0.04, Upper Limit: 0.16
Weaker SB v. *Stronger SB*: 0.14, 90% CI, Lower Limit: 0.06, Upper Limit: 0.23
Average SB v. *Stronger SB*: 0.04, 90% CI, Lower Limit: 0.02, Upper Limit: 0.07

Notes:

Figure 2 reports tests of our theorized judgment process. Our theory asserts that an intentional strengthening of social bonds increases perceived social bonds, which leads to an increase in knowledge sharing (Panel A). Meanwhile, RPE leads to a greater sense of competition, which leads to a reduction in knowledge sharing (Panel B). Moreover, stronger social bonds moderate the negative effect that RPE has on knowledge sharing (Panel B).

This analysis is based on a 2×2 factorial model: RPE (present and absent) × Social Bond (stronger and weaker). That is, this analysis does not include RPI present conditions.

We use the PROCESS Macro (Hayes 2017) for both models; we use model 7 and model 59 in panels A and B, respectively. To test the statistical significance of indirect effects, we use bootstrap confidence intervals (Hayes 2017). Bootstrap confidence intervals are based on 10,000 bootstrap samples. Because we have directional predictions, we use a 90% confidence interval (i.e., bounded at 0.05 and 0.95) to test whether one-tailed p-values are less than 0.05. A coefficient is considered statistically significant, equivalent to a one-tailed $p < 0.05$, if the confidence interval does not contain 0. To test the conditional indirect effects in panel B, we used the mean value of the perceived social bond and one standard deviation above and below the mean.

P-values denoted with an * are one-tailed for our directional prediction; all other reported p-values are two-tailed.

Variable Definitions:

RPE = categorical variable to differentiate between *Relative Performance Evaluation* conditions. Variable equals 2 when RPE is present (i.e., both RPI is provided and participants are compensated on their relative performance), 0 when RPE is absent (i.e., neither RPI is given, nor are participants compensated on their relative performance), and 1 when only RPI is present (participants are not compensated on their relative performance).

Social Bond = dichotomous variable to differentiate between stronger and weaker social bond conditions. Variable equals 1 for the stronger social bond condition and 0 for the weaker social bond condition.

Sense of Competition = participants' response to an 11-point Likert scale question, "When considering how competitive you felt with the person you were paired with, during the second task you felt…" anchored at "Not at all competitive" (0) and "Extremely competitive" (10).

Perceived Social Bonds = the summation of participants agreement with seven statements on the post-experimental questionnaire. A higher score indicates a stronger bond. In panel B, weaker = one standard deviation below the mean; average = mean value; stronger = one standard deviation above the mean.

TABLE 1

EXPERTS' PERCEIVED SOCIAL BONDS

Panel A: Means (Std Err) of Experts' Perceived Social Bonds

	RPE Present	RPE Absent	RPI Present	Combined
Stronger Social Bond	34.47 (4.11) n = 17	46.64 (4.75) n = 14	55.21 (2.86) n = 14	44.71 (2.62) n = 45
Weaker Social Bond	20.94 (5.48) n = 16	37.07 (4.92) n = 15	44.57 (4.49) n = 14	33.67 (3.21) n = 45
Combined	27.91 (3.55) n = 33	41.69 (3.48) n = 29	49.89 (2.80) n = 28	

Panel B: 3×2 Analysis of Variance on Experts' Perceived Social Bonds

	df	SS	F	*p*-value
RPE	2	7,762.68	12.47	< 0.01
Social Bond	1	2,831.90	9.10	< 0.01
RPE × Social Bond	2	65.57	0.11	0.90
Error	84	26,149.11		

Panel C: Contrast Tests of RPE and Social Bond on Experts' Perceived Social Bonds

	t_1	SE	*p*-value
RPE Present and RPE Absent: Stronger Social Bond > Weaker Social Bond	2.57	8.99	< 0.01*
Stronger Social Bond > Weaker Social Bond	3.02	11.19	< 0.01
RPE Present v. RPE Absent	3.15	8.99	< 0.01

Notes:

Panel A of this table reports experts' reported social bond scores by *Relative Performance Evaluation* and *Social Bond*. Panel B of this table reports the analysis of variance for the social bond scores, and Panel C reports the contrast tests of *RPE* and *Social Bond*.

Contrast tests in Panel C are based on our fully-crossed factorial model.

P-values denoted with an * are one-tailed for our directional prediction; all other reported p-values are two-tailed.

Variable Definitions:

Perceived Social Bonds = the summation of participants agreement with seven statements on the post-experimental questionnaire. A higher score indicates a stronger bond.

RPE = categorical variable to differentiate between *Relative Performance Evaluation* conditions. Variable equals 2 when RPE is present (i.e., both RPI is provided and participants are compensated on their relative performance), 0 when RPE is absent (i.e., neither RPI is given, nor are participants compensated on their relative performance), and 1 when only RPI is present (participants are not compensated on their relative performance).

Social Bond = dichotomous variable to differentiate between stronger and weaker social bond conditions. Variable equals 1 for the stronger social bond condition and 0 for the weaker social bond condition.

TABLE 2

HELPFUL HINT SHARING

Panel A: Means (Std Err) of Helpful Hint Sharing

	RPE Present	RPE Absent	RPI Present	Combined
Stronger Social Bond	0.78 (0.08) n = 17	0.94 (0.03) n = 14	0.94 (0.04) n = 14	0.88 (0.04) n = 45
Weaker Social Bond	0.44 (0.09) n = 16	0.82 (0.08) n = 15	0.92 (0.05) n = 14	0.72 (0.05) n = 45
Combined	0.62 (0.07) n = 33	0.88 (0.04) n = 29	0.93 (0.03) n = 28	

Panel B: 3×2 Analysis of Variance on Helpful Hint Sharing

	df	SS	F	*p*-value
RPE	2	1.83	13.79	< 0.01
Social Bond	1	0.56	8.38	< 0.01
RPE × Social Bond	2	0.42	3.18	0.05
Error	84	5.58		

Panel C: Contrast Tests of RPE and Social Bond on Helpful Hint Sharing

	t_1	SE	*p*-value
H1: RPE Present v. RPE Absent	4.07	0.13	< 0.01*
H3: Weighted Contrast	5.58	0.31	< 0.01*
RPE Absent v. RPI Present	0.78	0.14	0.44
RPE Present v. RPI Present	-4.83	0.13	< 0.01

Notes:

Panel A of this table reports the rate of helpful hint sharing by *Relative Performance Evaluation* and *Social Bond*. Panel B of this table reports the analysis of variance for the rate of helpful hint sharing, and Panel C reports contrast tests.

Contrast tests in Panel C are based on our fully-crossed factorial model. Our weighted Contrast in Panel C is specified as: RPE present / stronger social bonds (1), RPE present / weaker social bonds (-4), RPE absent / stronger social bonds (2), RPE absent / weaker social bonds (1), RPI present / stronger social bonds (0), and RPI present / weaker social bonds (0).

P-values denoted with an * are one-tailed for our directional prediction; all other reported p-values are two-tailed.

Variable Definitions:

Helpful Hint Sharing = the proportion of rounds in which the experts shared a helpful hint. A value of 1 indicates the expert shared a helpful hint in all 15 rounds, and a value of 0 indicates the expert did not share a helpful hint in any of the rounds.

RPE = categorical variable to differentiate between *Relative Performance Evaluation* conditions. Variable equals 2 when RPE is present (i.e., both RPI is provided and participants are compensated on their relative performance), 0 when RPE is absent (i.e., neither RPI is given, nor are participants compensated on their relative performance), and 1 when only RPI is present (participants are not compensated on their relative performance).

Social Bond = dichotomous variable to differentiate between stronger and weaker social bond conditions. Variable equals 1 for the stronger social bond condition and 0 for the weaker social bond condition.

TABLE 3

HELPFUL PROCESS HINT SHARING

Panel A: Means (Std Err) of Helpful Process Hint Sharing

	RPE Present	**RPE Absent**	**RPI Present**	**Combined**
Stronger Social Bond	0.58	0.89	0.91	0.78
	(0.10)	(0.06)	(0.05)	(0.05)
	n = 17	n = 14	n = 14	n = 45
Weaker Social Bond	0.31	0.73	0.89	0.63
	(0.09)	(0.08)	(0.06)	(0.06)
	n = 16	n = 15	n = 14	n = 45
Combined	0.45	0.81	0.90	
	(0.07)	(0.05)	(0.04)	
	n = 33	n = 29	n = 28	

Panel B: 3×2 Analysis of Variance on Helpful Process Hint Sharing

	df	**SS**	**F**	***p*-value**
RPE	2	3.61	19.18	< 0.01
Social Bond	1	0.53	5.62	0.02
RPE × Social Bond	2	0.24	1.28	0.28
Error	84	7.92		

Panel C: Contrast Tests of RPE and Social Bond on Helpful Process Hint Sharing

	t_1	**SE**	***p*-value**
H1: RPE Present v. RPE Absent	-4.65	0.16	< 0.01*
H3: Weighted Contrast	5.10	0.36	< 0.01*
RPE Absent v. RPI Present	1.14	0.16	0.26
RPE Present v. RPI Present	-5.78	0.16	< 0.01

Panel D: Means (Std Err) of Helpful Vowel Hint Sharing

	RPE Present	RPE Weaker	RPI Present	Combined
Stronger Social Bond	0.56 (0.10) n = 17	0.91 (0.06) n = 14	0.95 (0.03) n = 14	0.79 (0.05) n = 45
Weaker Social Bond	0.36 (0.11) n = 16	0.75 (0.09) n = 15	0.88 (0.06) n = 14	0.65 (0.60) n = 45
Combined	0.46 (0.08) n = 33	0.83 (0.05) n = 29	0.91 (0.04) n = 28	

Panel E: 3×2 Analysis of Variance on Helpful Vowel Hint Sharing

	df	SS	F	*p*-value
RPE	2	3.62	17.60	< 0.01
Social Bond	1	0.46	4.51	0.04
RPE × Social Bond	2	0.06	0.31	0.73
Error	84	8.63		

Panel F: Contrast Tests of RPE and Social Bond on Helpful Vowel Hint Sharing

	t_1	SE	*p*-value
H1: RPE Present v. RPE Absent	-4.55	0.16	< 0.01*
H3: Weighted Contrast	4.45	0.38	< 0.01*
RPE Absent v. RPI Present	0.95	0.17	0.35
RPE Present v. RPI Present	-5.48	0.16	< 0.01

Notes:

Panel A of this table reports the rate of helpful process hint sharing by *Relative Performance Evaluation* and *Social Bond*. Panel B of this table reports the analysis of variance for the rate of helpful process hint sharing, and Panel C reports contrast tests.

Contrast tests in Panels C and F are based on our fully-crossed factorial model. Our weighted Contrasts in Panels C and F are specified as: RPE present / stronger social bonds (1), RPE present / weaker social bonds (-4), RPE absent / stronger social bonds (2), RPE absent / weaker social bonds (1), RPI present / stronger social bonds (0), and RPI present / weaker social bonds (0)

P-values denoted with an * are one-tailed for our directional prediction; all other reported p-values are two-tailed.

Variable Definitions:

Helpful Process Hint Sharing = the proportion of rounds in which the expert shared a helpful process hint. A value of 1 indicates the expert shared a helpful hint in all 15 rounds, and a value of 0 indicates the expert did not share a helpful hint in any of the rounds.

Helpful Vowel Hint Sharing = the proportion of rounds in which the expert shared a helpful vowel hint. A value of 1 indicates the expert shared a helpful hint in all 15 rounds, and a value of 0 indicates the expert did not share a helpful hint in any of the rounds.

RPE = categorical variable to differentiate between *Relative Performance Evaluation* conditions. Variable equals 2 when RPE is present (i.e., both RPI is provided and participants are compensated on their relative performance), 0 when RPE is absent (i.e., neither RPI is given, nor are participants compensated on their relative performance), and 1 when only RPI is present (participants are not compensated on their relative performance).

Social Bond = dichotomous variable to differentiate between stronger and weaker social bond conditions. Variable equals 1 for the stronger social bond condition and 0 for the weaker social bond condition.

TABLE 4

HELPFUL SOLUTION HINT SHARING

Panel A: Means (Std Err) of Helpful Solution Hint Sharing

	RPE Present	RPE Absent	RPI Present	Combined
Stronger Social Bond	0.73	0.64	0.71	0.70
	(0.08)	(0.07)	(0.07)	(0.04)
	n = 17	n = 14	n = 14	n = 45
Weaker Social Bond	0.29	0.61	0.59	0.49
	(0.07)	(0.07)	(0.10)	(0.05)
	n = 16	n = 15	n = 14	n = 45
Combined	0.52	0.63	0.65	
	(0.07)	(0.05)	(0.06)	
	n = 33	n = 29	n = 28	

Panel B: 3×2 Analysis of Variance on Helpful Solution Hint Sharing

	df	SS	F	*p*-value
RPE	2	0.34	1.89	0.16
Social Bond	1	0.88	9.75	< 0.01
RPE × Social Bond	2	0.73	4.02	0.02
Error	84	7.58		

Panel C: Contrast Tests of RPE and Social Bond on Helpful Solution Hint Sharing

	t_1	SE	*p*-value
H1: RPE Present v. RPE Absent	-1.54	0.15	0.13
H3: Weighted Contrast	4.13	0.36	< 0.01
RPE Absent v. RPI Present	0.24	0.16	0.81
RPE Present v. RPI Present	-1.77	0.15	0.08

Notes:

Panel A of this table reports the rate of helpful solution hint sharing by *Relative Performance Evaluation* and *Social Bond*. Panel B of this table reports the analysis of variance for the rate of helpful solution hint sharing, and Panel C reports contrast tests.

Contrast tests in Panel C are based on our fully-crossed factorial model. Our weighted Contrast in Panel C is specified as: RPE present / stronger social bonds (1), RPE present / weaker social bonds (-4), RPE absent / stronger social bonds (2), RPE absent / weaker social bonds (1), RPI present / stronger social bonds (0), and RPI present / weaker social bonds (0)

P-values denoted with an * are one-tailed for our directional prediction; all other reported p-values are two-tailed.

Variable Definitions:

Helpful Solution Hint Sharing = the proportion of rounds in which the expert shared a helpful solution hint. A value of 1 indicates the expert shared a helpful hint in all 15 rounds, and a value of 0 indicates the expert did not share a helpful hint in any of the rounds.

RPE = categorical variable to differentiate between *Relative Performance Evaluation* conditions. Variable equals 2 when RPE is present (i.e., both RPI is provided and participants are compensated on their relative performance), 0 when RPE is absent (i.e., neither RPI is given, nor are participants compensated on their relative performance), and 1 when only RPI is present (participants are not compensated on their relative performance).

Social Bond = dichotomous variable to differentiate between stronger and weaker social bond conditions. Variable equals 1 for the stronger social bond condition and 0 for the weaker social bond condition.

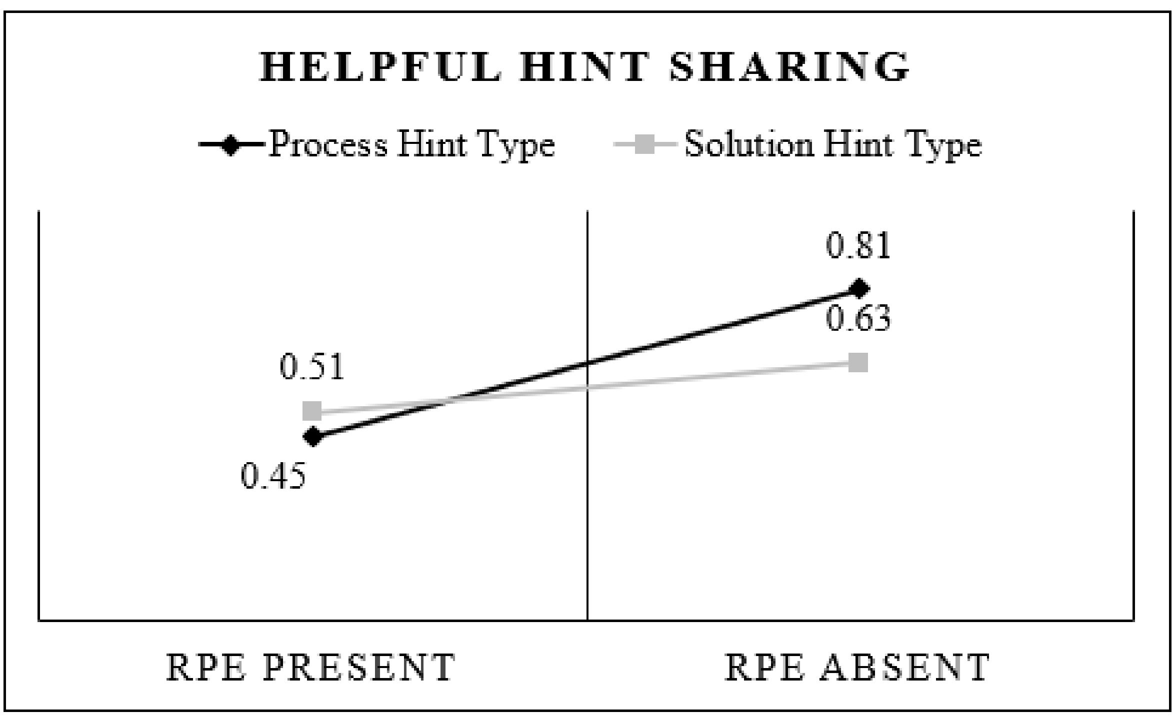
TABLE 5

HINT TYPE PREFERENCE

Panel A: Means (Std Err) of Helpful Hint Sharing

	RPE Present	RPE Absent	RPI Present	Combined
Process Hint Type	0.45 (0.06) n = 17	0.81 (0.06) n = 14	0.90 (0.06) n = 14	0.72 (0.03) n = 45
Solution Hint Type	0.51 (0.06) n = 16	0.63 (0.06) n = 15	0.65 (0.06) n = 14	0.60 (0.03) n = 45
Combined	0.48 (0.04) n = 33	0.72 (0.04) n = 29	0.77 (0.04) n = 28	

Panel B: Visual Representation of Hint Type (Process and Solution) and RPE (Present and Absent) on Helpful Hint Sharing



Panel C: Repeated Measures Maximum Likelihood Estimation for Helpful Hint Sharing

	Numerator df	Denominator df	F	*p*-value
RPE	2	180	17.94	< 0.01
Hint Type	1	180	8.29	< 0.01
Social Bond	1	180	16.11	< 0.01
RPE × Hint Type	2	180	5.05	< 0.01
RPE × Hint Type × Social Bond	5	180	2.31	0.05

Panel D: Contrast Tests of RPE and Hint Type on Helpful Hint Sharing

	t	SE	df	*p*-value
H2: RPE × Hint Type, Excluding RPI	2.33	0.11	180	0.01*
Process Hint Type: RPE Present =/= RPE Absent	4.86	0.08	180	< 0.01*
Solution Hint Type: RPE Present =/= RPE Absent	1.57	0.08	180	0.06*

Notes:

Panel A of this table reports the rate of helpful hint sharing by *Relative Performance Evaluation* and *Hint Type* (repeated measure). Panel B of this table provides a visual representation of helpful hint sharing by RPE (present and absent) and Hint Type (process and solution). Panel C reports the repeated measures maximum likelihood estimation, which is based on a 3×2 factorial model: RPE (RPE present, RPE absent, and RPI present) × Hint Type (process and solution). We also include main effects for RPE, Hint Type, and Social Bond, as well as a fully crossed interaction (RPE × Hint Type × Social Bond) in our model. Panel D reports contrast tests based on our 3×2 factorial model.

P-values denoted with an * are one-tailed for our directional prediction; all other reported p-values are two-tailed.

Variable Definitions:

Helpful Hint Sharing = the proportion of rounds in which the expert shared a helpful hint (process hint for process hint type or solution hint for solution hint type). A value of 1 indicates the expert shared a helpful hint in all 15 rounds, and a value of 0 indicates the expert did not share a helpful hint in any of the rounds.

RPE = categorical variable to differentiate between *Relative Performance Evaluation* conditions. Variable equals 2 when RPE is present (i.e., both RPI is provided and participants are compensated on their relative performance), 0 when RPE is absent (i.e., neither RPI is given, nor are participants compensated on their relative performance), and 1 when only RPI is present (participants are not compensated on their relative performance).

Hint Type = The type of helpful hint that participants provided: process or solution. This variable is the repeated measure in this analysis.

Social Bond = dichotomous variable to differentiate between stronger and weaker social bond conditions. Variable equals 1 for the stronger social bond condition and 0 for the weaker social bond condition.