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Can Strategic Reasoning Prompts Improve Auditors' Sensitivity to Fraud Risk?

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Can Strategic Reasoning Prompts Improve Auditors' Sensitivity to Fraud Risk?

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Dedication

To Lisbeth and Mae Mae

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Can Strategic Reasoning Prompts Improve Auditors' Sensitivity to Fraud Risk?

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The basic premise of risk-based auditing is that more (fewer) audit resources should be allocated to accounts that are more (less) likely to be misstated. However, financial reporting managers can exploit such allocations by intentionally misstating balances that are less likely to draw auditor attention. If auditors do not recognize this strategic implication of risk-based auditing, undetected misstatements among ostensibly low-risk accounts could be much more common than traditional risk assessment procedures suggest. The purpose of this study is to examine whether prompting auditors to form beliefs about managers' expectations of, and responses to, audit strategies can enhance auditors' sensitivity to the strategic risk of fraud among accounts typically considered low-risk. Using a multi-account audit game, I find that auditors do not naturally attune to strategic risks but instead tend to focus resources on "high-risk" accounts. However, when auditors are prompted to reason strategically, they utilize more resources and devote that increase almost entirely to "low-risk" accounts. I also find that, although increasing available resources does result in an overall increase in the amount of utilized resources, the relative effect of the strategic prompt is robust to the level of available audit resources.

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Chapter 1: Introduction

1.1 Background

The basic premise of risk-based auditing is that auditors should focus more resources on accounts that are likely to be misstated and fewer resources on balances that are less likely to be misstated (Bell et al. 2005; Rittenberg and Schwieger 2005; Knechel 2007). Proponents of risk-based auditing claim that such a strategy leads to more efficient and more effective audits (e.g., Bell et al. 2005; PCAOB 2007a). However, others point out that if auditors do not accurately assess misstatement risk, audit resources will be misallocated, resulting in more undetected misstatements (e.g., Goelzer 2003; Weil 2004; Kinney 2005; O'Donnell and Schultz 2005).

One reason auditors could misallocate resources is by focusing on observable non-strategic risk factors that, on the surface, indicate certain accounts are more, and other accounts are less, likely to be misstated (e.g., quality of the accounting system and internal controls, frequency and complexity of transactions and prevalence of management judgments). To the extent auditors fixate on such risk factors, they are less likely to appreciate the implications for less observable *strategic* (or endogenous) risks that arise when financial reporting managers anticipate auditors' resource allocations. Specifically, if auditors focus their attention and resources on accounts with high non-strategic (or exogenous) risks and away from accounts that appear to be less risky, they create opportunities for fraud among the ostensibly low-risk accounts.

The HealthSouth audit failure is a striking example of such an outcome. Having assessed fixed assets as a low-risk account, HealthSouth's auditors devoted relatively few resources to the audit of fixed assets, particularly to vouching smaller fixed asset additions. This strategy created an opportunity for fraud, which HealthSouth's management anticipated and exploited by capitalizing expenses into the fixed asset accounts (Weil 2004).

1.2 RESEARCH QUESTIONS AND CONTRIBUTIONS

The purpose of this study is to test whether prompting auditors to consider the strategic nature of managers' reporting choices affects auditors' allocation of audit resources between accounts that observably differ only in their non-strategic risk. In addition, I examine whether the effect of such a prompt is moderated by the level of resources available to the auditor. Figure 1 conceptually illustrates these questions.

Much of the prior research regarding risk-based auditing focuses on the propriety of top-down risk assessment methods, often referred to as business risk auditing (O'Donnell and Schultz 2005; Knechel 2007) or strategic-systems auditing (Peecher et al. 2007), which focus auditors' attention on higher level economic and business risk factors that ultimately affect non-strategic risk at the account level. In addition, a number of studies specifically examine the auditor's sensitivity to fraud risk factors as well as circumstances and audit procedures that could enhance that sensitivity (e.g., Phillips 1999; Wilks and Zimbelman 2004; Carpenter 2007). Similar to the current study, Phillips (1999) examines auditor sensitivity to the possible presence of fraud in a multi-account setting, where misstatement risk differs between accounts. However, Phillips (1999) focuses on the eventual evaluation of audit evidence in a single-person decision-making setting, whereas the current study is concerned with auditor sensitivity to strategic risk during the risk assessment and planning phases of the audit. Wilks and Zimbelman (2004) investigate whether decomposing fraud risk into attitude, opportunity and incentive risks heightens auditors' sensitivity to fraud risk red flags, while Carpenter (2007) examines whether the audit team brainstorming sessions required by SAS 99 result in better fraud risk assessments. While these two studies are similar to this dissertation in that they test interventions designed to enhance auditors' sensitivity to fraud risk, the tested interventions are not designed to enhance auditors' sensitivity to strategic risk. Because fraud is a strategic choice (Shibano 1990; Wilks and Zimbelman 2004), it is important that auditing research also examine ways in which audit guidance could help auditors view the audit from the manager's perspective so that they can better understand the risk of intentional misstatement (Wilks and Zimbelman 2004).

Prior research suggests that the level of available audit resources can affect the way in which auditors respond to risk (Houston 1999); thus, I also investigate the relative effectiveness of strategic prompts over different levels of overall audit resources. While a number of prior studies have examined the effect of resource constraints on auditor judgments and decisions (DeZoort and Lord 1997), only a small number have examined the impact of that pressure on auditor sensitivity to misstatement risk (e.g., Houston 1999 and Asare et al. 2000). Unlike the current study, none of those studies test the effect of resource constraints in strategic settings or on the allocation of audit resources among multiple financial statement accounts.

1.3 METHOD OF STUDY

I conduct a laboratory experiment to explore how strategic prompts affect auditor resource allocations and whether the level of available audit resources moderates that relationship. Participants assume the role of external auditor or financial reporting manager and interact in a multi-account audit game. The manager decides whether to override two financial statement accounts that differ in that one has a higher level of non-strategic risk of misstatement relative to the other (hereafter the "high-risk" and "low-risk" accounts). The auditor attempts to detect any misstatements by allocating a limited pool of resources between the two accounts.[1] Although these accounts differ in non-strategic risk, in Nash equilibrium, the auditor's optimal resource allocation strategy is much less extreme than the differential non-strategic risks would imply. That is, because of the low-risk account's lower non-strategic risk, the strategic manager views it as a ripe opportunity for intentional misstatement, creating differential (strategic) fraud risks that an auditor should take into account along with the exogenous non-strategic risks.

A 2×2 between-subjects experimental design manipulates whether auditors receive a strategic prompt and whether available resources are adequate or excessive. Auditors in the *no prompt* condition are informed of the non-strategic risk probabilities.[2] Auditors in the *prompt* condition are provided with that same information about non-strategic risk but are additionally prompted to consider the strategic implications of that

[1] Experimental materials do not use terms such as auditor, manager, audit, fraud, etc., but instead use neutral terminology so that participants' choices were not influenced by their beliefs about how auditors and managers ought to behave (Haynes and Kachelmeier 1998). However, for clarity, I use the more meaningful terminology in this dissertation.
[2] In practice, auditors likely learn of these probabilities (or base rates) from experience, auditing standards, firm guidance and analysis of client accounting systems.

information. Specifically, each auditor under the *prompt* condition is asked to report his or her beliefs about how the manager expects the auditor to allocate resources and how the manager is likely to respond to that expected allocation.

The amount of available audit resources is manipulated between *adequate* and *excess resources* conditions. In the *adequate resources* condition, auditors are restricted to an amount of resources that slightly exceeds the level required by the Nash equilibrium, whereas in the *excess resources* condition, the level of available resources is well above the equilibrium level.

1.4 SUMMARY OF RESULTS

I find that under the *no prompt* condition, auditors tend to adopt a strategy of allocating fewer resources to the low-risk account relative to the high-risk account and that the managers anticipate this allocation, responding by overriding the low-risk account more often than the high-risk account. However, in the *prompt* condition, auditors increase the overall amount of utilized resources, with most of that increase devoted to sampling the low-risk account. I further find that the relative effectiveness of the strategic prompt is robust to the amount of available resources, although auditors do utilize more overall resources under the *excess resources* condition, contrary to the game theoretic predictions. The results also indicate that providing strategic prompts and additional resources to auditors can lead to lower risk of undetected misstatements within the ostensibly low-risk account.

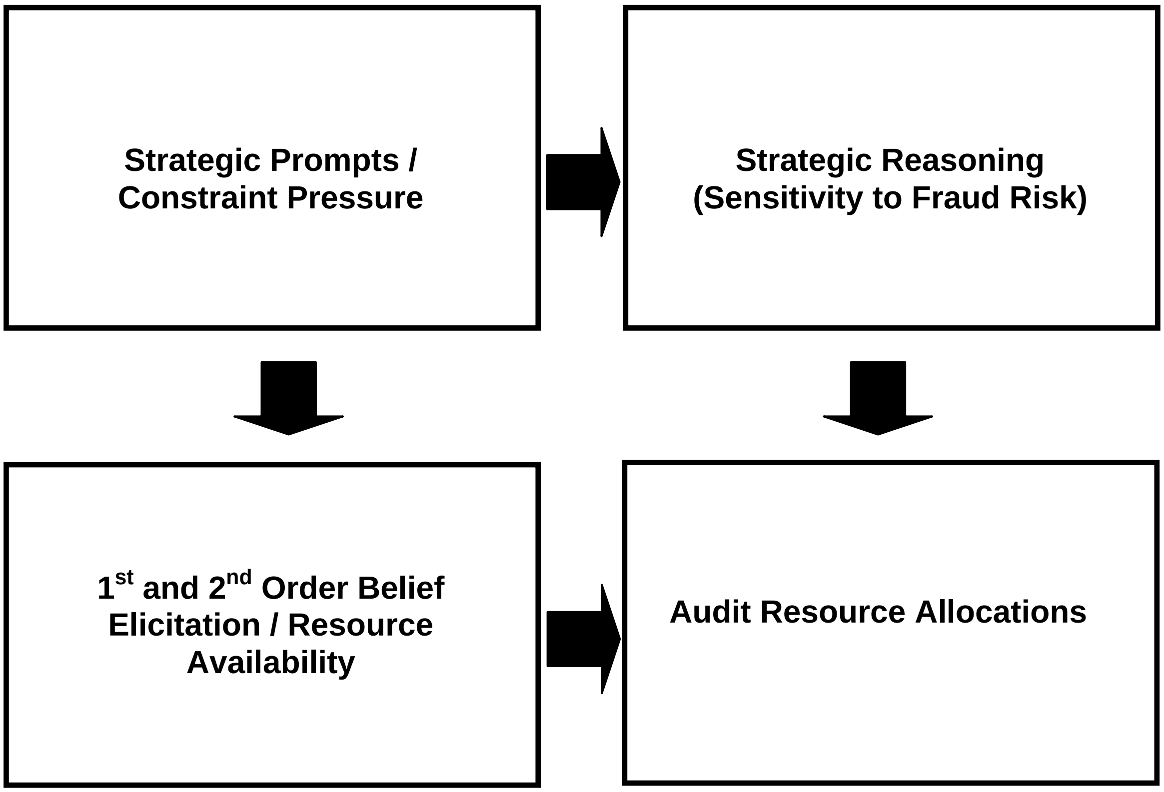
These results suggest that audit standards and firm guidance that prompt auditors to form beliefs about (1) reporting managers' expectations of which financial statement accounts are likely to draw relatively little auditor attention and (2) how those reporting managers are likely to respond to the expected audit strategies, could help auditors assess and respond to strategic risk. The results are particularly important for the Public Company Accounting Oversight Board (the "PCAOB"), which is currently developing risk assessment standards for auditors (PCAOB 2007b), encourages an integrated risk-based approach to the audits of internal controls and financial statements (PCAOB 2007a), and applies a risk-based approach to its own inspections of audit firms (PCAOB 2005).

1.5 OUTLINE OF DISSERTATION

The remainder of this dissertation proceeds as follows. Chapter 2 summarizes relevant prior research and includes an overview of the analytic and experimental literature on strategic auditing. The conclusions of that literature are contrasted with the decision theoretic perspective of the auditor's decision problem. Chapter 3 describes the multiple-account auditing game that is implemented in the experiment conducted for this dissertation and summarizes the game theoretic solution to that game. Hypotheses are developed in Chapter 4, and Chapter 5 describes the experimental methods including participants, research design and administration. Chapter 6 presents results, and Chapter 7 summarizes the dissertation and reflects on its implications. The mathematical support for the equilibrium summarized in Chapter 3 is presented in Appendix A. The experimental instructions, illustrations of the participants' computer interface, and the post-experimental questionnaires are included in Appendix B, Appendix C and Appendix D, respectively.

FIGURE 1

Libby Boxes



Chapter 2: Review of Prior Research

2.1 THE AUDIT AS A GAME AGAINST NATURE

Traditional heuristic (e.g., Elliott and Rogers 1972; AICPA 1984) and decision-theoretic models (e.g., Kinney 1975) of the auditor's decision problem treat the risk of misstatement, including the risk of *intentional* misstatement (or fraud), as exogenous and independent of the auditor's strategy. Elliot and Rogers (1972) suggest that auditors should assess the misstatement risk in general and the risk of intentional misstatement, specifically, by analyzing factors such as the nature of the client firm and the nature of the specific account under audit. In Kinney's (1975) comprehensive decision-theoretic representation of the auditor's problem, misstatement risk is a function of the quality of internal controls and of the exogenous probability that the manager will override those controls. In that model, the probability of override is assessed by the auditor and, consistent with Elliot and Rogers (1972), is not conditional on the auditors' testing strategy.

The view of misstatement risk as exogenous is implied within the practitioners' audit risk model, which treats the components of audit risk – inherent risk, control risk and detection risk – as individual risks that each exist independently of the other two (AICPA 1984). This independence is reinforced in AU 312A, which explicitly states that "inherent risk and control risk exist independently of the audit of financial statements (paragraph 28)". As such, the audit risk model does not allow for financial reporting managers' anticipation or exploitation of the auditor's strategy.

The assumption that the components of audit risk are independent of each other has also been incorporated into PCAOB internal controls audit guidance. For example, the PCAOB staff suggests that auditors:

> …may eliminate from further consideration (unless the auditor later identifies indications of a higher level of risk) those accounts and disclosures that have only a remote likelihood of containing misstatements that could cause the financial statements to be materially misstated…(PCAOB 2005, page 2)

An implication of this comment is that risk and the auditor's response to it are independent and that the risk of misstatement is not affected by an auditor's strategy.

Some prior research does point out that relationships are likely to exist among the audit risk model's individual components. For example, Cushing and Loebbecke (1983) point out that when internal controls are of high quality and control risk is consequently low, misstatements are less likely to occur due to the disciplining effect of those controls. That is, to the extent misstatements are intentional or due to a cavalier attitude toward accounting quality, improving the internal control system, and thereby lowering control risk, could result not only in the detection of a larger portion of misstatements that do occur but also in a reduction to the inherent risk, or the tendency for misstatements to occur at all. However, Cushing and Loebbecke (1983) do not acknowledge that the relationship between inherent risk and the auditor's testing strategy, as captured in detection risk, could be similarly related.

2.2 MODELING THE AUDIT AS A NON-COOPERATIVE GAME

Though the widely accepted audit risk model assumes that its component risks are independent, the strategic auditing literature takes a different view with respect to the relationship between misstatement risk and detection risk. This literature draws on principles of non-cooperative game theory (e.g., Fudenberg and Tirole 1991) and characterizes the audit as a strategic interaction between a self-interested auditor and a self-interested client manager (e.g., Fellingham and Newman 1985; Fellingham et al. 1989; Newman and Noel 1989; Shibano 1990; Bloomfield 1995). In these settings, and consistent with the decision-theoretic framework, the auditor's optimal strategy depends on his or her beliefs about the manager's honesty in financial reporting along with the auditor's understanding of other institutional features of the audit environment. However, unlike the heuristic and decision theoretic approaches, in these strategic settings, the manager's choices similarly depend on his or her beliefs about the auditor's strategy. Therefore, whereas misstatement risk is assumed to be determined by nature under the more traditional approaches, it is determined endogenously in the models developed in the strategic auditing literature.

Fellingham and Newman (1985) were among the first to point out that decision-theoretic approaches to the audit problem are incomplete because they do not allow for the endogenous determination of misstatement risk. They argue that game theory provides a more complete framework for describing and analyzing interactions between auditors and managers in that it allows the manager and, therefore, misstatement risk to be influenced by the presence and quality of the audit itself. To demonstrate implications of this point, Fellingham and Newman (1985) analyze a stylized audit game in which an auditor chooses whether to extend his or her costly audit procedures and, depending on the results of those procedures, the auditor chooses whether to qualify his or her audit report. The manager similarly chooses an amount of costly effort to devote toward improving internal controls and reducing the probability of an error.

The assumed costs of these actions and the relative costs to the auditor and manager of possible outcomes result in a Nash equilibrium solution that suggests auditors do not always choose to extend their procedures nor do they choose to never extend procedures.[3] Similarly, the auditor does not choose to either always issue a qualified report or to always issue an unqualified report. Instead the auditor will choose a mixed strategy that randomizes among those "pure" strategies. Likewise, in equilibrium, managers choose to randomize between high and low effort.[4] Fellingham and Newman (1985) point out that while such randomization is consistent with practitioners' tendencies, for example, to choose random samples and to randomly determine client locations to audit, such a strategy is never dominant under the decision-theoretic approach to the auditor's problem, which further illustrates the limitations of that approach for describing the audit environment.

[3] In Nash equilibrium, each player's strategy is an optimal response to the other player's strategy (Fudenberg and Tirole 1991).
[4] Fellingham and Newman (1985) show that, in their setting, randomization is optimal for both the auditor and the manager when the manager's level of effort has a significant effect on the probability of an error. However, if the manager's effort level has a sufficiently small effect, both the auditor and the manager will play "pure" strategies rather than a randomized mixture of those strategies.

Fellingham, Newman, and Patterson (1989) build on the reasoning of Fellingham and Newman (1985) and investigate the use of *strategic* sampling in interactive audit settings. Consistent with Fellingham and Newman (1985), these authors characterize the auditee as choosing a level of effort that determines the error rate within a financial statement account characterizing the auditor as deciding whether to accept or reject that account as being without error. Under their model, the auditor is also allowed to sample the account under audit in order to gather more information about the likelihood of errors before making his or her accept/reject decision. The authors demonstrate the value of *strategic* sampling and, consistent with the findings of Fellingham and Newman (1985), show that deterministic sample sizes (as specified under decision-theoretic frameworks) are not optimal in strategic settings. Instead randomized sample sizes are appropriate, preventing auditees from predicting and, thereby, exploiting, the auditor's strategy.

In a setting in which sample sizes are fixed and provide a normally distributed signal of the true account balance, Newman and Noel (1989) examine the effects of auditor and auditee payoffs on the auditee-influenced error rate and the auditor's detection rate. Their findings demonstrate that strategic models of auditing and decision-theoretic models produce different predictions of how the auditor's tendency to reject financial statements is affected by information and by auditor and auditee payoffs.

Whereas Fellingham and Newman (1985), Fellingham, Newman and Patterson (1989) and Newman and Noel (1989) characterize the client manager's choice as a choice among effort levels that affect the probability of accounting misstatements and not among financial reporting strategies *per se*, Shibano (1990) develops a more general model that allows for purposeful misstatement of financial reports. Shibano separately models "strategic" risk and "non-strategic risk," where strategic risk is the risk that an account will be misstated due to management override of the control system and non-strategic risk is the probability that accounts are misstated unintentionally. Shibano then maps these models into the standard audit risk model (AICPA 1984).

In Shibano's model, the strategic component of control risk arises out of a moral hazard problem, where, consistent with previous models, the auditee chooses an action that affects the distribution (or quality) of internal controls over the accounting and financial reporting processes. However, Shibano's primary contribution is in modeling inherent risk and detection risk as the product of a game of hidden information. In this portion of the model, the auditee produces an accounting report and chooses whether to materially misstate the accounting figures included in that report. After observing the report, the auditor chooses whether to accept the report as correct or to reject it as materially misstated based on the amounts reported and additional audit evidence collected. This model of the auditor's problem introduces the possibility of outright accounting fraud, which had not previously been included in strategic models of auditing.

Since the current research examines the allocation of audit effort across multiple financial statement accounts, it is important to point out that several analytic studies address this issue (e.g., Anderson and Young 1988; Newman et al. 1996; Newman et al. 1998). Anderson and Young (1988) were among the first to do so, demonstrating in a theft setting that rather than deterministically choosing to always concentrate resources on one location or to always disperse equal amounts of resources across two accounts, an optimal strategy will choose each of those two pure strategies with some positive probability. In a similar setting, Newman et al. (1998) show that audit resource allocations differ when theft is endogenous relative to when the risk of misappropriation is determined by nature. Whereas Anderson and Young (1988) and Newman et al. (1998) examine resource allocation in a theft setting, Newman et al. (1996) do so in a fraud setting and find that the characteristics of type of fraud and interdependencies between audited locations significantly affect audit strategies.

A number of analytic studies investigate the effects of an array of institutional features of the audit environment on the auditor's strategic interaction with the financial reporting manager and the quality of financial reporting (e.g., Morton 1993; Patterson 1993; Bloomfield 1995). Although these studies examine a variety of issues, they all share the same basic premise that misstatement risk is endogenous to the audit and the auditor's strategy and that deterministic audit strategies can be exploited by self-interested managers.

2.3 ASSESSING FRAUD RISK

The interdependence of the auditor's and manager's strategies implies that an auditor always choosing to perform a diligent audit or always choosing to perform a weak audit will not constitute a Nash equilibrium. That is, in equilibrium, neither the auditor nor the manager will choose a *pure* strategy. Instead, each will place positive probability on each available strategy such that the opponent is made indifferent between his or her own strategies, resulting in a unique equilibrium in mixed strategies (Fudenberg and

Tirole 1991). Prior research indicates that assessing fraud risk and choosing an appropriate audit strategy in such audit games is cognitively complex and requires a high degree of strategic reasoning (Wilks and Zimbelman 2004).[5]

Bloomfield (1995) formally demonstrates why assessing fraud risk can be difficult. He adapts Shibano's (1990) model and introduces the term "strategic dependence," the degree to which the auditor's optimal strategy is sensitive to the auditor's expectation of the manager's strategy. Bloomfield (1995) shows that in a setting that allows for unintentional errors as well as fraud, strategic dependence decreases as the probability of error increases. Additionally, when the risk of error is low (high), increasing (decreasing) the auditor's penalty for incorrectly accepting the manager's accounting report relative to the auditor's penalty for incorrectly rejecting that report increases strategic dependence.

Bloomfield (1995) reasons that when the non-strategic risk of error is very high, the manager will anticipate that the auditor will conduct a diligent audit, and the auditor will anticipate that the manager will respond by choosing to report honestly. However, the auditor's strategy must continue to be a diligent audit due to the high risk of unintentional error. Therefore, when the risk of error is very high, the auditor's strategy will not be sensitive to, or strategically dependent on, his expectation of the manager's strategy. Conversely, when the risk of error is near zero, a manager might anticipate a weak audit that could be exploited with fraudulent reporting. However, in this case, if the

[5] Wilks and Zimbelman (2004) define the auditor's strategic reasoning as the ability to anticipate the financial reporting manager's response to the auditor's strategy.

auditor anticipates the manager's fraud, he or she will respond with diligent auditing, in which case the manager will choose to report honestly.

Assuming that auditors rationally respond to their beliefs about the probability of misstatement, Bloomfield (1995) further demonstrates that when strategic dependence is low, a process of "rationalization" as described above will lead auditors toward optimal strategies. On the other hand, when strategic dependence is high, such a reasoning process will not lead auditors toward the equilibrium strategy, and consequently, auditors will have much greater difficulty assessing and optimally responding to the risk of fraud. In a follow-up study, Bloomfield (1997) conducts a laboratory experiment that supports these predictions.

Additional experimental research further explores cognitive limitations that can inhibit auditors' recognition of the strategic nature of their interactions with managers as well as their abilities to otherwise anticipate and efficiently respond to managers' reporting strategies. For example, Zimbelman and Waller (1999) find that when auditors receive relatively ambiguous prior information about the expected true value of an asset, they succumb to ambiguity aversion (Ellsberg 1961) and respond by conducting more extensive and costly audits. Managers seem to expect this increased auditor diligence and, accordingly, issue honest reports more often when auditors receive ambiguous prior information about asset value. However, auditors do not seem to anticipate that response and ultimately reject as many of the managers' financial reports as when they face no ambiguity, even though the quality of managers' financial reporting increases when auditors receive the ambiguous information.

King (2002) finds that, because auditors prefer that managers will not misreport so that they can avoid incurring the high cost of audit effort, they are convinced by managers' non-binding promises to issue honest financial reports, but the negative effects of such "cheap talk" are mitigated when audit outcomes are made public to other auditors. King's study was one of the first to suggest that the strategic tension between an auditor and manager can be captured in a simple normal-form game, where the manager simply chooses to issue a truthful or fraudulent report and the auditor chooses whether to accept or reject that report.[6] Each player chooses a strategy based solely on the payoffs associated with each possible audit outcome. Because these payoffs drive incentives similar in nature to those modeled in prior analytic research, the unique equilibrium is in mixed strategies rather than playing either of the "pure" strategies with certainty.

Characterizing the audit as a 2×2 mixed strategy game is similar in some respect to the classic matching pennies game, in which each player chooses between heads or tails. In this game, the matcher prefers to play the same strategy as his or her opponent, and the mixer prefers to play the opposite of his or her opponent's strategy. In such a game, each player should choose a mixture of the two pure strategies that makes the opponent indifferent between his or her own pure strategies. In that case, neither player has an incentive to deviate from that mixture. This reasoning suggests that each player's mixed strategy will be based only on his or her opponent's payoff structure rather than on

[6] The manager's choice can similarly be characterized as choosing between a high and low quality accounting systems or between aggressive and cautious reporting, and the auditor's choice could similarly be characterized as a choice between conducting a diligent or lax audit.

his or her own payoffs, so, for example, increasing or decreasing the matcher's payoffs for any of the potential outcomes will not result in a change in the matcher's mixed strategy but will change the mixer's equilibrium strategy.

It should be noted that although the auditing game explored in this dissertation is similar to matching-pennies in its mixed strategies solution, the auditing game captures several institutional features of auditing that differentiates it from a simple matching pennies game. As further described in Chapter 3, the payoffs in the auditing game capture the relative incentives of real-world auditors and managers rather than incorporating the symmetric payoffs of the traditional matching-pennies game. Additionally, the auditor must audit two accounts, which individually represent single mixed strategy games, but are linked in my setting by a constraining audit fee that prevents an auditor from always fully auditing both accounts.

Despite the mixed-strategy equilibrium reasoning that suggests players' strategies will not be sensitive to changes in their own payoffs, prior experimental economics research suggests the contrary (e.g., Goeree and Holt 2001; Goeree et al. 2003). In auditing, Fischbacher and Stefani (2007) also find evidence of the "own-payoff" effect with respect to players in the auditor role. Bowlin et al. (2008) make similar findings with respect to financial reporting managers. Specifically, managers initially respond to high penalties for aggressive reporting by choosing to report cautiously more often than predicted by the equilibrium. Over time, however, managers tend toward an equilibrium mixture except when they have prior audit experience. These results further demonstrate the difficulty in predicting an opponent's strategy in mixed strategies setting such as an auditor-manager interaction.

2.4 Modeling Strategic Reasoning as a Hierarchy of Beliefs

Contrary to the assumptions of traditional game theory, the prior auditing and economics research summarized in Section 2.3 provides evidence that game players have limited strategic reasoning abilities or that they are boundedly rational. Economics researchers have accommodated such behavior by descriptively modeling strategic reasoning as a hierarchy of beliefs (e.g., Nagel 1995; Stahl and Wilson 1995; Camerer et al. 2004). In such models, strategic reasoning is categorized into *k* levels according to players' conjectures about their opponents' beliefs and behavior. For example, Level-0 (zero-order) players make no assumptions about other players and choose strategies at random. Players with Level-1 (first-order) beliefs assume that all other players are Level-0 types. Since these Level-1 players assume their opponents make choices randomly, Level-1 players in mixed strategy games are responsive to components of their own utility functions. Level-2 players form second-order beliefs and accordingly believe that all other players are a mixture of Level-0 and Level-1 players. Therefore, these players are more likely to be responsive to their opponents' utility functions, making them more strategically sophisticated. Generalizing this hierarchy, Level-*k* players assume that all other players reason at Level-(*k-1*) or lower (Stahl and Wilson 1995).

In addition to formalizing hierarchical models of bounded rationality, Nagel (1995), Stahl and Wilson (1995) and Camerer et al. (2004) validate their models with experimental data. Stahl and Wilson (1995) test their theory in 12 3×3 symmetric games that allow them to isolate the different levels of reasoning and to confirm the boundedly rational hypothesis. Although many participants tend to play their Nash equilibrium strategy, a large group also exhibit zero-order and first-order reasoning. Similarly, in a version of the guessing game, Nagel (1995) finds evidence supporting a boundedly rational hypothesis of behavior. Specifically, Nagel's participants exhibit low levels of reasoning in the initial plays of the game, though, with feedback between rounds, tend toward the equilibrium "guess" over time.

Camerer et al. (2004) examine strategic choices in a several classes of games finding that participants' behavior is, on average, consistent with 1.5 steps of strategic reasoning. More specifically, for mixed strategies games, participants' behavior is consistent with an even lower average of 1.2 levels of reasoning. These results help explain the "own-payoff" effect documented in the economics studies (e.g., Ochs 1995; Goeree and Holt 2001; Goeree et al. 2003) and the auditing studies (e.g., Fischbacher and Stefani 2007; Bowlin et al. 2008) summarized in Section 2.3.

2.5 BELIEF ELICITATION AS A STRATEGIC REASONING PROMPT

Although prior research has demonstrated that people exhibit a rather low level of strategic reasoning (e.g., Stahl and Wilson 1995; Zimbelman and Waller 1999; Camerer et al. 2004), few studies have tested interventions that could enhance strategic reasoning. A small number of studies in economics do test whether eliciting players' beliefs about opponents' strategies can enhance strategic reasoning, but the results of those studies have been mixed. While many economics studies elicit participants' beliefs about opponents' behavior in order to determine whether participants' behavior corresponds optimally to their beliefs, Croson (2000) argues that simply asking participants to form those beliefs could prompt them to think more strategically and ultimately alter their behavior. To test this premise, Croson (2000) conducts an experiment that manipulates whether players in a public goods game are asked to estimate the amount of other players' contributions. Her results indicate that eliciting those beliefs results in contributions that are more consistent with game theoretic predictions. Consistent with Croson's (2000) findings, Hales (2008) demonstrates, in a market setting, that prompting traders to consider others' perspectives reduces their tendency to myopically focus on private information, resulting in less speculative trading. However, Ortmann et al. (2000) finds that questionnaires that prompt players to predict their opponents' behavior in a trust game do not change average levels of investment suggesting that that prompt does not affect strategic reasoning.

In a setting more strategically similar to the audit setting, Costa-Gomes and Weizsäcker (2006) report that players of one-shot 3×3 mixed strategies games are less likely to take their opponents' decision problem into account when they choose their own actions as compared to when they are prompted to state beliefs about their opponents' strategy choices. However, Costa-Gomes and Weizsäcker (2006) also find that even though subjects accurately anticipate their opponents' strategies, they fail to appropriately respond to those beliefs.

The current study examines the effects of strategic prompts in a multi-account audit setting. Though an audit can be characterized as a mixed strategy game (King 2002), a strategic prompt is more likely to be effective in my setting as compared to that of Costa-Gomez and Weizsacker (2006) because the different levels of non-strategic risk across the audited accounts suggest an intuitive allocation rule that could result in out-of-equilibrium resource allocations when auditors do not receive a strategic prompt. However, this same difference in non-strategic risk may be helpful to auditors in predicting the managers' beliefs and reporting behavior when auditors are prompted to consider those issues.

Chapter 3: A Multi-Account Audit Game

3.1 SETTING

Models of auditing as a economic game (e.g., Shibano 1990; Bloomfield 1995; Newman et al. 2005) illustrate that incentives can lead managers to commit fraud if they believe misstatements are unlikely to be detected but can lead them to report honestly if detection is probable. In other words, the risk of fraud is endogenous and dependent on the auditor's strategy. The setting for this study is a multi-account audit and is constructed following this game-theoretic reasoning described in the prior analytic research and employed in prior experimental research as described in Chapter 2.

In this setting, the auditor is responsible for detecting misstatements within two financial statement accounts, $i \in (1,2)$, either of which could be misstated due to a non-strategic accounting system error or due to an accounting manager's intentional (and strategic) override of the accounting system. To accomplish this task, the auditor allocates a fixed pool of audit resources among the two audited accounts and his or her personal consumption.

Following Bloomfield (1997), for each account, the accounting system materially misstates each accounting balance with probability r_i, which differs between accounts, and generates an accurate report with probability $1- r_i$. Though, the value of r_i is common knowledge by assumption, neither the manager nor the auditor knows whether the accounting system will actually generate a misstatement prior to making their respective choices. Thus, simultaneous with the accounting system's outcome, the manager chooses whether to accept that outcome or to override the accounting system by purposely misstating the reported account balance. If the manager chooses to override the accounting system with respect to an account, that account will be misstated with certainty but will not also be unintentionally misstated. Though, in practice, multiple misstatements could occur within a single account, this assumption does not alter the strategic tension between the auditor and the manager but does allow for a more straight-forward analysis of the game and implementation in the laboratory.

Without prior knowledge of the manager's decisions, the auditor chooses the number of costly audit resources units, e_i, to devote to the audit of each account. The probability that the auditor will detect any existing misstatement in account i, p_i (the detection probability), is the product of e_i and an audit effectiveness multiplier, T, which represents the marginal increase in the auditor's probability of detecting a misstatement for each additional unit of resources devoted to a given account. Although, in practice, this factor likely varies across accounts, for the purposes of this dissertation, T is set to 1% for all accounts. In other words, for each additional unit of resources devoted to an account, the probability of detecting an existing misstatement increases by one percentage point. Accordingly, if the auditor allocates 100 resource units to account i (i.e., $e_i = 100$), the probability of detecting any existing misstatement, p_i, is 100%. Alternatively, if no resources are devoted to account i (i.e., $e_i = 0$), there is zero probability of detecting a misstatement associated with that account.

After the manager has chosen whether to override the two accounts and the auditor has allocated his or her resources, audit outcomes are determined randomly based on those choices and the non-strategic risk of misstatement, r_i. Each player's payoff depends on these outcomes, as described below.

3.2 PAYOFFS AND THE NASH EQUILIBRIUM

The auditor's total cost of resources is $\sum_i e_i K$, where K is the auditor's cost per unit of resource. Consistent with King (2002), the total amount of resources devoted to auditing the two accounts is exogenously limited by an audit fee, FK. In other words, $FK \geq \sum_i e_i K$. Any resources that are not allocated to the audit provide additional income to the auditor.

In addition to the utility garnered from unused resources, the auditor receives utility of Y for each account for completing the audit. Although the value of Y does not affect the equilibrium solution to the audit game (as derived in Appendix A), a sufficiently high value of Y serves the practical purpose of ensuring non-negative payoffs to experimental participants. Therefore, for consistency, I include it in the auditor's utility function here. When undetected misstatements occur, the auditor also incurs a penalty, Z, which does not depend on whether the undetected misstatement was intentional or unintentional. Since the misstatement is detected with probability p_i and an unintentional misstatement occurs with probability r_i, the auditor's expected payoff simplifies to:

$$EU_{auditor} = FK + 2Y - \sum_i \left[Z(1 - e_i T)(q_i + r_i(1 - q_i)) + e_i K \right],$$

where q_i is the auditor's belief about the probability that the manager will override the accounting system (the auditor's fraud risk assessment) with respect to account i.

For each account, if the manager accepts the balance generated by the accounting system, his or her payoff is M_A when a misstatement does not occur or when a misstatement does occur but is not detected. When a misstatement is detected, the manager's payoff is $M_A - V_E$. On the other hand, when the manager overrides the accounting system, he or she receives M_O when the auditor does not detect the resulting (intentional) misstatement and $M_O - V_O$ when that misstatement is detected. Consistent with prior research, I assume that the financial reporting manager prefers to override the accounting system when misstatements will not be detected, but prefers to accept the system's output when misstatements will be detected. That is, $M_O > M_A$, but $(M_O - V_O) < (M_A - V_E)$. The manager's expected payoff simplifies to the following:

$$EU_{Manager} = 2M_A + \sum_i \left[q_i (M_O - M_A) - e_i T (q_i V_O + (1 - q_i) r_i V_E) \right]$$

Solving for the equilibrium gives $q_i{}^* = \dfrac{K - Zr_i T}{(Z - Zr_i)T}$ and $e_i{}^* = \dfrac{M_O - M_A}{T(V_O - r_i V_E)}$ as derived in Appendix A. Consistent with the logic of a mixed strategy equilibrium (Fudenberg and Tirole 1991), the auditor's (manager's) optimal strategy is a function of the manager's (auditor's) payoff function and the account-specific non-strategic risk, r_i, but does not depend on his or her own payoffs. Additionally, the equilibrium is not affected by the level of the auditor's fee, F, given that the fee is sufficient to fund the auditor's equilibrium strategy, e_i. I assume that the amount of resources available to the auditor is sufficient to provide equilibrium level of resources to both accounts. If resources were constrained to lower levels, the auditor would always allocate below equilibrium resources to, at least, one account. This would result in corner solutions, where the manager always overrides at least one of the accounts. Assuming a sufficient level of available resources allows me to focus on the more interesting circumstances with interior solutions.

Table 2 summarizes my parameterization of the game. These parameters are intended to capture the real-world outcome preferences of both the auditor and manager. In addition, the parameters avoid less interesting corner solutions. For example, if the auditor's marginal utility for unused resources are very high, auditors will never audit and managers will always override both accounts. The two accounts in this game differ only in non-strategic risk, r_i, which is 20% and 80% for account 1 (the low-risk account) and account 2 (the high-risk account), respectively. The equilibrium is approximately (e_1*, e_2*, q_1*, q_2*) = (48, 52, .75, 0) for both resource conditions.

Under this parameterization of the game, the combination of the exogenous risk of error and the endogenous risk of fraud results in an equilibrium misstatement risk of 80% for each account regardless of the non-strategic risk. Therefore, the auditor will allocate similar amounts of resources to the two accounts even though an unintentional misstatement is substantially more likely to occur in account i = 2 versus account i = 1.

Although, in equilibrium, the probability of misstatement is the same for both accounts, the auditor allocates slightly more resources to the high-risk account in equilibrium. This occurs because the manager is penalized when an unintentional misstatement is detected. Since the manager cannot control the quality of the accounting system in the short-run, this penalty reduces the marginal disincentive of the penalty for override. This marginal disincentive increases as the quality of the accounting system decreases (or the non-strategic risk of error increases). To offset this incentive effect, the auditor allocates more resources to the high-risk account. Although, in practice, equilibrium allocations of auditor effort could be more sharply skewed towards the high-risk account, the equilibrium in this setting strengthens the ability of an experiment to test the theoretical premise that endogenous management reporting incentives can offset differences in exogenous risk.

3.3 Model Limitations

This model is limited by a number of simplifying assumptions that facilitate implementation in the laboratory. First, although this game is meant to represent a fraud setting, the manager does not issue a (potentially fraudulent) accounting report on which the auditor opines, but instead chooses a hidden action (whether to override the accounting system), which, in the analytic literature, has been more closely associated with auditee misappropriation of firm assets rather than misreporting (Newman et al. 1996). Second, consistent with Anderson and Young (1988) but contrary to Newman et al. (1996), I assume that there are no interdependencies between the two audited accounts. That is, detecting a misstatement in one account does not make a misstatement in the other account more likely to be detected. Third, I analyze the audit as a one-shot game, though, in reality, the same auditor and manager may repeatedly interact many times over the course of their relationship, which would allow each party to learn about the other's behavior. A multi-period Bayesian analysis of the game could provide further insights and predictions about auditor and manager behavior. However, it should be pointed out that, although each of these assumptions has important implications for predicted behavior, the purpose of this model of the auditor-manager interaction is not to form precise predictions about auditor and manager behavior, per se. Rather, the intent is to capture, in a multi-account setting, the strategic nature of the auditor-manager relationship as demonstrated in prior analytic and experimental research.

TABLE 1

Audit Outcome Payoffs for Each Account Under Audit

	Auditor	Manager
No Misstatement Occurs	$-p_iK+Y$	M_A
Override Occurs / Detected	$-p_iK+Y$	$M_O - V_O$
Override Occurs / Not Detected	$-p_iK+Y-Z$	M_O
Error Occurs / No Override / Detected	$-p_iK+Y$	M_A-V_E
Error Occurs / No Override / Not Detected	$-p_iK+Y-Z$	M_A

TABLE 2

Variable Parameterization

		Adequate Resources	Excess Resources
Parameters	F	101	181
	K	.12	.12
	Y	15	15
	Z	15	15
	T	.01	.01
	r_1	20%	20%
	r_2	80%	80%
	M_O	15	15
	M_A	8	8
	V_O	15	15
	V_E	2	2
Equilibrium	$e_1{}^*$	47.95	47.95
	$e_2{}^*$	52.24	52.24
	$q_1{}^*$	75.00%	75.00%
	$q_2{}^*$	0.00%	0.00%

Chapter 4: Hypotheses

4.1 EFFECT OF NON-STRATEGIC RISK

The theoretic equilibrium solution to the multi-account audit game described in Chapter 3 assumes that both the auditor and the manager are able to anticipate the other's choices. As discussed in Chapter 2, however, people generally exhibit low levels of the strategic reasoning necessary to do so (e.g., Ochs 1995; Bloomfield 1997; Zimbelman and Waller 1999; Wilks and Zimbelman 2004; Fischbacher and Stefani 2007; Bowlin et al. 2008).[7] Instead, people often adopt intuitive decision rules when faced with cognitively challenging problems (Tversky and Kahneman 1986). Such intuitive approaches are likely in the case of the multi-account audit game due to the cognitive complexity of the strategic reasoning implied by the game's mixed strategy equilibrium. Since the only *observable* difference between the two accounts in this setting is the non-strategic risk of misstatement, that risk will likely provide a salient focal point (Sugden 1995) upon which the auditor will construct an intuitive allocation strategy, directing substantially more resources to the high-risk account than the low-risk account.

H1: Auditors will allocate a smaller percentage of available resources to the "low-risk" account relative to the "high-risk" account.

[7] Wilks and Zimbelman (2004) define strategic reasoning as the auditor's ability to anticipate the manager's response to the auditor's strategy.

Because the auditor only learns (in the short-term) of misstatements that he or she actually detects, the auditor's feedback is likely to reinforce this intuitive allocation strategy. That is, an auditor allocating large amounts of resources to the high-risk account and few resources to the low-risk account will likely detect a relatively large number of misstatements in the high-risk account and relatively few misstatements in the low-risk account even if the manager responds to the auditor's strategy and overrides the low risk account. Therefore, learning is not likely to result in convergence of auditor behavior toward the equilibrium in this setting.

4.2 EFFECT OF STRATEGIC PROMPTS

As explained above, the auditor is likely to initially employ an exogenously risk-based allocation strategy (H1), and, as further explained in Section 4.4, the manager is likely to anticipate and respond to that allocation (H4). However, the auditor is less likely to anticipate the manager's response, because to do so, the auditor must first recognize that the manager will anticipate the auditor's intuitive strategy, and then the auditor must determine how the manager's strategy will be affected. Therefore, in order for the auditor to choose an efficient allocation strategy, his or her characterization of the audit must include the possibility that the manager will anticipate H1. However, a prompt that simply asks the auditor to predict the manager's strategy (the auditor's first-order beliefs) may not sufficiently enhance the auditor's understanding of managerial incentives. To the extent that auditors naturally engage in the Level-1 reasoning described in Chapter 2, a prompt that merely elicits the auditor's beliefs about the manager's likely choice could only elicit Level-1 priors (that the manager will behave randomly).

Conversely, a strategic prompt that begins by asking auditors to predict the manager's beliefs about the auditor's allocation strategy (i.e., the auditor's first-order beliefs) and then asks the auditor to predict the manager's response to those beliefs (i.e., the auditor's second-order beliefs) likely provides auditors with a stronger prompt and a more sophisticated understanding of managerial incentives. For this reason, auditors in the *prompt* condition of this study are asked to provide both first-order and second-order beliefs. When auditors receive such strategic prompts, they are likely better able to form a mental representation of the reporting manager as a *strategic* opponent, who is actively anticipating and responding to auditor behavior. In terms of the hierarchy of beliefs described above, I predict that auditors receiving the strategic prompt will be more likely to develop Level-2 beliefs than will auditors who do not receive the prompt. In turn, Level-2 beliefs will likely lead auditors to infer that managers are more likely to override the low-risk account, thereby increasing that account's overall risk of misstatement. That understanding is likely to result in more resources being allocated to the low-risk account, as predicted in H2 below:

H2: Auditors receiving the strategic prompt will allocate more resources to the "low-risk" account relative to auditors who do not receive such a prompt.

4.3 Effect of Resource Availability

Prior research suggests that the way in which auditors perceive and respond to risk could depend on the degree to which audit resources are constrained (Houston 1999). A low level of audit resources could affect auditors' perceptions of risk due to constraint stress, which occurs when one feels that he or she is externally prevented from doing what is desired or necessary (Schuler 1980). Prior auditing research indicates that when auditors face this type of stress, they often respond by mentally filtering away information that seems less relevant to the judgment at hand (e.g., Glover 1997; Asare et al. 2000).

When auditors in strategic settings face resource constraints, they may similarly respond by filtering away information that seems less important to the required judgments. However, in the setting described in Chapter 3, the information that seems less important would likely be the information about the managers' incentives and potential strategic behavior, which is more ambiguous and less salient than the information about non-strategic risk. Contrary to auditors in the *no prompt* condition, who are less likely to comprehend the strategic implications of the game, auditors in the *prompt* condition are more likely to recognize the strategic nature of the game. However, when resources are constrained, they may filter that information when they make their allocation decisions. Auditors with *excess resources* are less likely to suffer from constraint stress and, therefore, are less likely to filter strategic information. Consequently, the strategic prompt could be more effective under the *excess resources* condition than in the *adequate resources* condition. Figure 2 graphically depicts this potential interactive effect of PROMPT and RESOURCES.

On the other hand, the opposite prediction is also plausible. Prior economics research has shown that introducing excess cash into a market can result in large price bubbles even when fundamental value is well-known (Caginalp et al. 2001). Similarly, when auditors have access to excess resources, they can choose to devote large amounts of resources to both accounts (relative to the equilibrium) and still retain some resources as profit. Under these circumstances, auditors may not attune as closely to the differences in risk between the two accounts. Since recognition of the difference in non-strategic risk between the high- and low-risk accounts is necessary in order for the strategic prompt to be meaningful to the auditor, resource allocations may be less affected by strategic prompts when resources are higher. This possible interaction is illustrated in Figure 3. Ultimately, whether and how the effectiveness of the strategic prompt is moderated by the level of audit resources is an empirical question. Therefore, I test the following hypothesis in the null form:

> **H3: The effect of the strategic prompt on the amount of resources allocated to the low-risk account will not differ between the adequate and excess resources conditions.**

4.4 MANAGER BEHAVIOR

Allocating significantly more resources to the high-risk account, as predicted by H1, would be reasonable if managers do not anticipate or respond to that strategy, but such an allocation is inefficient if the manager does, in fact, exploit such auditor behavior. The game-theoretic predictions of manager behavior in Chapter 3 suggest that managers will override the low-risk account with a much greater probability (75%) than the high-risk account (0%). Further, if the manager anticipates the audit strategy predicted in H1, game theory predicts that he or she would respond by always overriding the accounting system with respect to the low-risk account and never overriding the high-risk account.

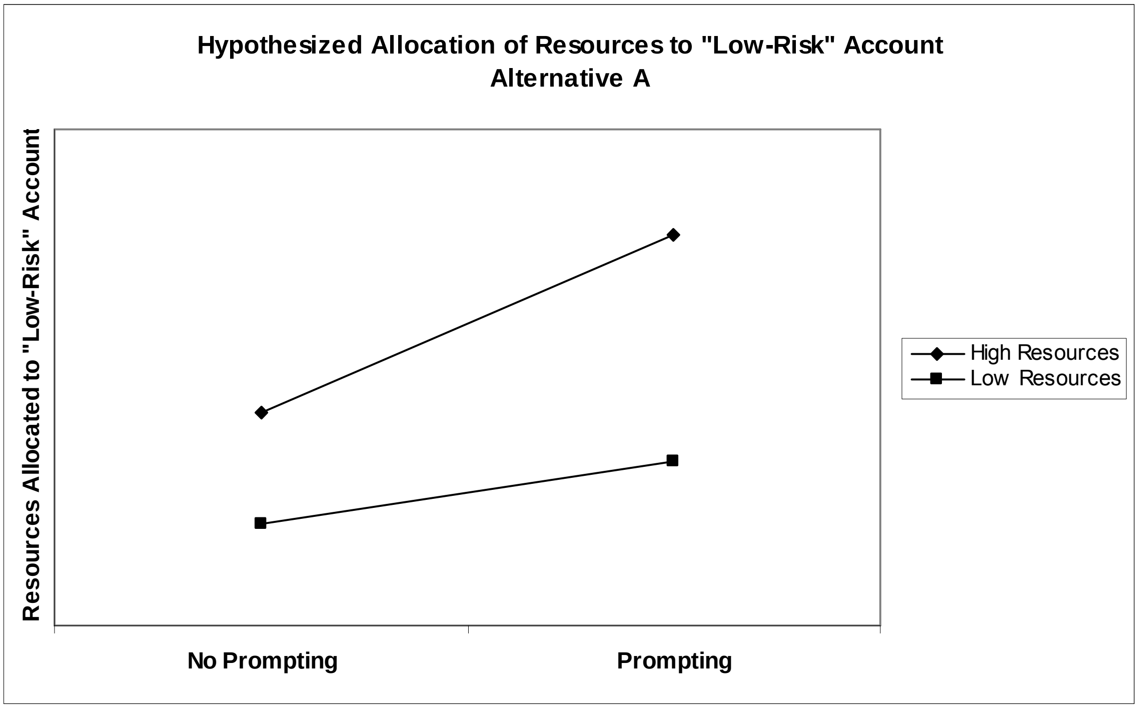
Following this game-theoretic reasoning, I predict that managers will override the low-risk account significantly more often than the high-risk account. To the extent the manager does not *initially* anticipate the auditor's intuitive allocation, the feedback he or she receives will indicate that overriding the high-risk account is detected by the auditor much more often than overriding the low-risk account. This prediction is consistent with Bowlin et al. (2008), which finds that participants in the manager role learn about auditor behavior by experimenting with aggressive financial reporting. Additionally, in this dissertation, since non-strategic risk is known to the managers, they can learn about auditor allocations by observing the frequency with which errors are detected when managers do not override. Therefore, feedback should reinforce the following hypothesis:

H4: Managers will override the accounting system with respect to the low-risk account more often than the high-risk account.

Under the *prompt* condition, managers' *initial* behavior is likely to mirror that of managers under the *no prompt* condition. However, feedback provided to managers will facilitate their learning about and responding to auditor behavior. If auditors behave as predicted in H2, the managers' initial penchant toward overriding the accounting system with respect to the low-risk account will likely be curbed by the auditors' more frequent detection of those misstatements under the *prompt* condition relative to the no prompt condition. Additionally, when auditors have access to high levels of resources, managers are likely to be dissuaded from choosing to override. Therefore, managers will likely override the accounting system less often under the *prompt-high resources* treatment relative to all other treatments. I formalize this reasoning as a fifth hypothesis:

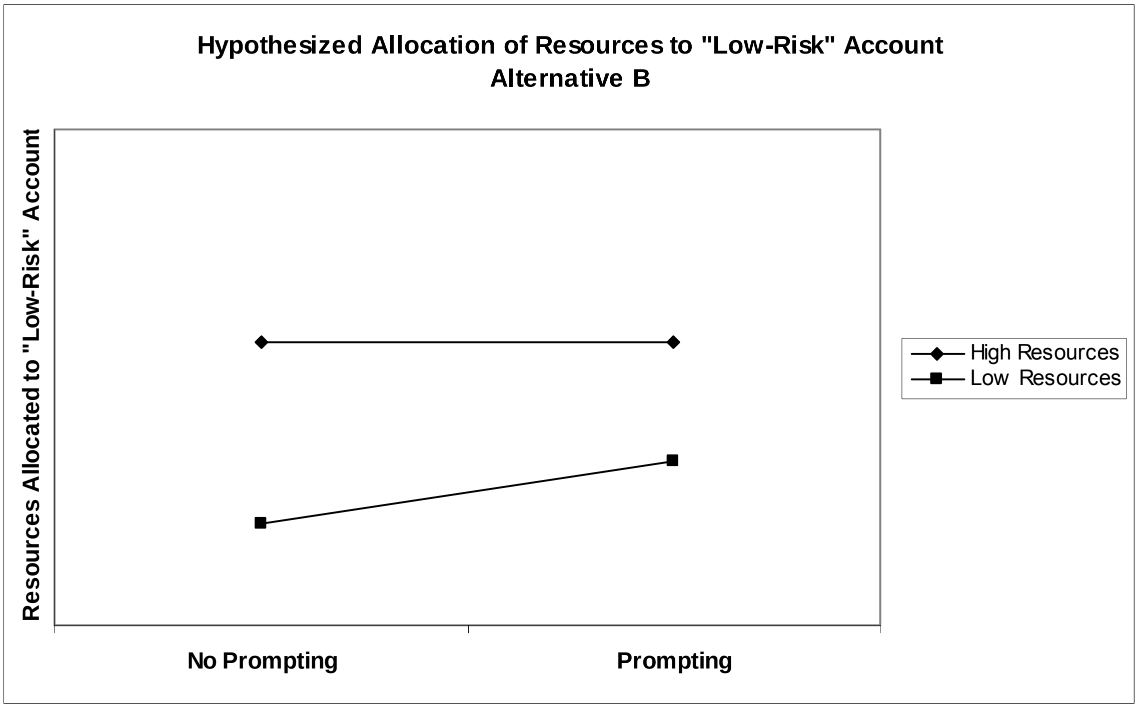
> **H5: Managers will override the accounting system with respect to the low-risk account less often under the *prompt-excess resources* treatment relative to managers under other treatments.**

FIGURE 2



Hypothesized Allocation of Resources to "Low-Risk" Account
Alternative A
Resources Allocated to "Low-Risk" Account
High Resources
Low Resources
No Prompting
Prompting

FIGURE 3



Hypothesized Allocation of Resources to "Low-Risk" Account
Alternative B
Resources Allocated to "Low-Risk" Account
High Resources
Low Resources
No Prompting
Prompting

Chapter 5: Method

5.1 Experimental Setting and Procedures

This study was conducted in a controlled laboratory environment with 132 volunteer upper-division accounting students as participants. Prior to beginning the experiment, participants were provided with written instructions (see Appendix B), which were read aloud by the experimenter. The instructions explained that each player would be anonymously assigned to one of two player types: a "Chooser" (analog to a financial reporting manager) or a "Guesser" (analog to an auditor) and that each Chooser would be paired with one Guesser to play 20 rounds of the audit game described in Section 3. The instructions' use of the Guesser and Chooser terminology was intended to reduce the potential for demand effects, where participants behave as they believe auditors and managers ought to behave rather than responding the game's incentive structure. Although, the "Guesser" label could potentially suggest that participants in that role should simply guess at the appropriate levels of resources to allocate to each account, results discussed further in Chapter 6 suggest that Guessers do not behave in this manner. Instead, Guessers' resource allocations systematically differ, as hypothesized, between accounts according to difference in non-strategic risk. Further, in responses to open-ended post-experimental questions, nearly all Guesser participants indicate that their allocation strategies that are more sophisticated than a simple guessing strategy.

The instructions further familiarized participants with the game setting, the choices to be made by each player type, and their respective payoffs for each of the possible game outcomes. To enhance comprehension of the game, the instructions characterized the game as a production process in which two machines (representing the accounting system) each deposit 100 marbles in its output bin. Of the 100 marbles placed in the bin, one may be an odd color (representing a misstatement) depending on whether the Chooser overrides the machine or the machine places an odd-colored marble in its bin by chance. The instructions explained that the Guesser may search for odd-colored marbles by specifying the number of marbles to be drawn from each bin up to a maximum of 101 and 181 marbles in the *adequate* and *excess resource* conditions, respectively.

The game was implemented using z-Tree software (Fischbacher 2007) on networked laboratory computers. See Appendix C for an illustration of the z-Tree participant interface. After the experimenter read the primary instructions, z-Tree provided participants with supplemental instructions, which summarized the paper-based instructions. For auditors in the *prompt* condition, the supplemental instructions also described the strategic prompt. After reading these supplemental instructions, participants took a true-or-false quiz to help ensure comprehension of the instructions.

When all participants had completed the quiz, the zTree software began the first round of the game described above and in Section 3. In all conditions, the managers indicated whether they wanted to override each of the two accounts. Simultaneously, auditors determined how much of their resources would be allocated to each account and how much would be unallocated. However, before making their allocation decisions, auditors in the prompt condition responded to the belief-elicitation questions that made up the strategic prompt as depicted in Exhibits 1 and 2 and described in more detail in Section 5.3 below. When all decisions had been entered, the computer randomly generated outcomes conditional on participant choices and the account specific risk of error. After receiving feedback reports, the game was repeated as described above for 19 additional rounds.

5.2 Feedback and Compensation

After the computer determined the outcomes at the end of each round, each participant received feedback for each account that reported the participant's own choice and whether the auditor detected a misstatement. This incomplete feedback captures an institutional reality that auditors cannot know with certainty that an account balance is correctly stated unless that account is fully audited (Rittenberg and Schwieger 2005). Similarly, the manager did not explicitly learn the amount of audit resources devoted to each account, consistent with Bowlin et al. (2008).

Note that the auditor only learned whether he or she detected a misstatement and not whether that misstatement occurred by chance or due to manager override. This is consistent with Statement on Auditing Standards No. 99 (SAS 99), which suggests that auditors may have difficulty determining whether a detected misstatement is intentional or due to error (AICPA 2002, footnote 4).

Consistent with the tenets of experimental economics, participants were anonymously compensated at the end of the session. Participants received a show-up fee of $5.00 plus $.06 per point earned. Average compensation was $25.80 and $30.36 per participant in the *adequate resources* and *excess resources* conditions, respectively.

5.3 MANIPULATIONS

I manipulated two factors between-subjects. All participants received identical instructions with the exception of between-condition differences in the maximum amount of resources available to the auditor. However, at the beginning of each round, auditors in the *prompt* condition were required to state their first-order and second-order beliefs about the managers prior to specifying the amount of resources they wished to allocate to each account. Specifically, using the marble and bin terminology as depicted in Exhibit 1 and described in Section 5.1, each auditor in the *prompt* condition entered his or her beliefs about the number of marbles the manager expected the auditor to draw from each bin (the auditor's second-order beliefs). Then, using an 11-point Likert scale as depicted in Appendix D, the auditor entered his or her beliefs about the likelihood that the manager would override each machine (the auditor's first-order beliefs). To maintain *ceteris paribus* conditions, the managers were not be made aware of this prompt.

The level of resources was also manipulated between subjects. Continuing with the marble and bin terminology, auditors in the *adequate resources* condition could draw up to a total of 101 of the 200 marbles collectively in the two bins. However, auditors in the excess resources condition could draw as many as 181 marbles from the two bins. The level of resources available to the auditor was common information to both auditors and managers.

Chapter 6: Results

One hundred thirty-two upper-division accounting students at the University of Texas at Austin participated in twelve experimental sessions. Each session consisted of 20 rounds of the audit game described in Section 2. To construct independent observations, each participant's choices are averaged across all twenty rounds so that each participant provides a single observation of auditor or manager behavior. For each account, each auditor observation represents the average number of resource units, e_i, allocated to that account. Each manager observation for each of the two accounts represents the percentage frequency with which the manager chooses to override that account.

Panels A, B, and C of Table 3 summarize the mean number of resource units that auditors utilize in total and specifically devote to the low-risk and high-risk accounts, respectively. Figures 4 and 5 illustrate the amounts of resources allocated to the low-risk account and high-risk accounts and summarize the primary results with respect to auditor behavior. Tables 7, 8, and 9 summarize manager behavior under each experimental condition and Tables 10, 11, and 12 report the effects of the strategic prompt and resource availability on audit risk.

Levene tests for equality of variance (Levene 1957) suggest that there is significant heterogeneity among the cell variances reported in Panels A and B of Table 3 and Panel B of Table 5. This variance heterogeneity can be reduced by converting the data to ranks (Kachelmeier and Messier Jr 1990). However, in general, inferences based on the analysis of rank-transformed data do not qualitatively differ from inferences based on the analysis of raw data. Therefore, for consistency across analyses, the results discussed in the following sections are based on the raw data.

6.1 PRELIMINARY ANALYSIS OF AUDITOR BEHAVIOR

Panel A of Table 3 indicates that more resources are utilized when auditors receive the strategic prompt and when higher levels of resources are available. Pooling across resource conditions, auditors utilize a mean of 110.0 resource units when they receive the prompt but only use an average of 98.6 units when they are not prompted. In addition, auditors utilize 122.5 resource units in the *excess resources* condition, but only utilize an average of 84.7 units in the *adequate resources* condition.

Table 4 presents a three-factor, repeated-measures ANOVA on audit resource allocations with two between-subjects factors (PROMPT and RESOURCES) and one within-subjects factor (ACCOUNT). This ANOVA provides an omnibus test of the overall effects of RESOURCES and PROMPT across both the high-risk and low-risk accounts. The significant main effects of PROMPT ($F = 3.49, p = .033$) and RESOURCES ($F = 26.59, p < .01$) suggest that both prompting auditors to consider the strategic nature of the audit and making more resources available to the auditor result in the utilization of more of audit resources overall.

6.2 EFFECT OF NON-STRATEGIC RISK (H1)

Recall that Hypothesis 1 predicts that auditors will allocate more resources to the high-risk account relative to the low-risk account. Consistent with H1, results tabulated in Panels B and C of Table 3 and illustrated in Figure 6 show that more resources are allocated to the high-risk account than the low-risk account under all treatments. Pooling across prompt conditions in the *excess resources* condition, auditors allocate, on average, 68.8 and 53.7 resource units to the high- and low-risk accounts, respectively. Similarly, in the *adequate resources* condition auditors allocate 55.4 units to the high-risk account and 29.2 to the low-risk account. Paired t-tests indicate that these differences are statistically significant at $p < .01$ in both resource conditions. A significant main effect of ACCOUNT ($t = 5.69$, $p < .01$ *one-tailed*) in the omnibus ANOVA reported in Table 4 further confirms that the overall difference in the amount of resources devoted to the high-risk account relative to the low-risk account is also significant.

6.3 Effect of Strategic Prompt (H2)

Because auditors are less likely to allocate sufficient resources to the low-risk account, an effective strategic prompt would result in an increase in resources being devoted to the low-risk account. Accordingly, H2 focuses on the specific effect of the strategic prompt on the amount of resources devoted to the low-risk account and, consistent with the supporting theory, predicts that auditors receiving the prompt will devote more resources to the low-risk account relative to auditors who do not receive the prompt.

Although, the repeated-measures ANOVA in Table 4 suggests that the overall utilization of audit resources is affected by the strategic prompt, this omnibus analysis is not capable of testing the prompt’s specific effect on the amount of resources allocated to the low-risk account. Therefore, I separately analyze resource allocations to the low-risk account in a 2×2 ANOVA in Table 5, Panel A that crosses PROMPT with RESOURCES. Pooling across resource conditions, auditors receiving the strategic prompt allocate 47.3 units to the low-risk account, while auditors under the *no prompt* condition devote 36.8 resource units to that account. The main effect reported in Table 5, Panel A indicates that this difference is statistically significant ($t = 2.18, p < .02$ *one-tailed*). The ANOVA presented in Panel B of Table 5 indicates that there is no main effect of PROMPT ($F = 0.20, p = .66$) on $e_{High\ Risk}$, the amount of resources allocated to the high-risk account.

Theory suggests that when auditors receive the strategic prompt, they will be more likely to recognize that managers could anticipate an allocation of fewer resources to the low-risk account relative to the high-risk account and that the low-risk account may, therefore, be particularly attractive to managers as an opportunity for fraud. This implies that allocations of resources to the low-risk account will be more strongly affected by the strategic prompt relative to allocations to the high-risk account. Such results would support the underlying theory that eliciting first- and second-order beliefs enhances auditors' strategic understanding of the audit and of misstatement risk rather than simply prompting a general increase in resource utilization.

While it is true that the main effect of prompt is significant with respect to the low-risk account and is not significant with respect to the high-risk account, these results alone do not support the premise that the affect of PROMPT is more pronounced for the low-risk account relative to the high-risk account. Rather, the omnibus ANOVA in Table 4 provides a more direct test of this prediction. The ACCOUNT×PROMPT interaction tests whether the relative effect of the strategic prompt differs between the high- and low-risk accounts. This interaction is marginally significant (*t = 1.32, p = .097 one-tailed*), providing limited support for the premise that the form of strategic prompt tested in this study can enhance auditors' strategic reasoning.

6.4 EFFECT OF RESOURCE AVAILABILITY (H3)

As discussed in Section 3, prior research suggests that the level of resources available to an auditor could potentially moderate the strategic prompt's effect on resource allocations, though it is unclear whether increasing available resources would increase or decrease the effectiveness of the strategic prompt. However, an insignificant ANOVA interaction term ($F = 0.28$, $p = .60$), as reported in Panel A of Table 5, indicates that the effect of PROMPT is robust to the level of resources available to the auditor, consistent with the null hypothesis (H3).[8]

Though resource availability does not interact with the strategic prompt to affect the amount of resources allocated to the low-risk account, the main effect of RESOURCES ($F = 26.59$, $p < .01$) reported in the omnibus ANOVA in Table 4 indicates that the availability of resources does affect the overall amount of resources utilized. Pooling across prompt conditions, auditors allocate 29.2 resource units to the low-risk account in the *adequate resources* condition, but in the *excess resources* condition, auditors devote 53.7 units to that account. Similarly, for the high-risk account, the resource allocation increases from 55.4 units under low resources to 68.8 under high

[8] Likewise, Panel B of Table 5 indicates that the amount of resources allocated to the high-risk account is not affected by the interaction of the strategic prompt and resource availability.

resources. The main effects of RESOURCES in the two-factor ANOVAs in Panels A and B of Table 5 indicate that the increases in resources devoted to each account in the excess resources condition are individually significant.

6.5 Auditors' Reported Beliefs and Resource Allocation Decisions

Although the experimental design does not distinguish the possible separate effects of first- and second-order beliefs, some insights can potentially be gained by examining the relationships among those beliefs and auditors' ultimate resource allocation decisions. For this analysis, I use only first round data. A summary of this data by resource condition is presented in Table 6, Panel A.

It may be reasonable to expect that, for a given account, auditors' second-order beliefs would be negatively correlated with auditors' first-order beliefs and that those first-order beliefs would, in turn, be positively correlated with the amount of resources allocated to that account. That is, if an auditor believes that the manager expects him to allocate a small amount of resources to the low-risk account, that auditor would also reasonably assume that the manager is likely to override that account. In that case, the auditor would be more likely to devote relatively larger amounts of resources to the low-risk account in order to detect the fraud that he views as probable. However, auditors' reported first- and second-order beliefs are uncorrelated, which is inconsistent with this reasoning.

Panel B of Table 6 reports the results of a regression of the resources allocation to each account on auditors' corresponding first- and second-order beliefs and a dummy variable for low resources. Consistent with the above reasoning, the coefficient on auditors' first-order beliefs is positive and significant, suggesting that auditors allocate more resources to the low-risk account when they believe the manager is more likely to override it. The positive and significant coefficient on auditors' second-order beliefs suggests that when auditors believe that managers expect them to allocate relatively high levels of resources to the low-risk account, auditors do just that. This result is inconsistent with the reasoning described in the preceding paragraph and could potentially be explained as an "anchoring" effect (Tversky and Kahneman 1974; Epley and Gilovich 2005), as the scale used in eliciting second-order beliefs (0 – 100) is also used to allocate resources. Negative and moderately significant coefficients on the interactions of first- and second-order beliefs with a dummy variable for low resources, $D_{Low\ Resources}$, provide limited evidence that auditors are less responsive to their beliefs about the manager when fewer resources are available.

6.6 MANAGER BEHAVIOR (H4 AND H5)

Consistent with H4 and as illustrated in Figure 9 and tabulated in Table 7, managers choose to override the low-risk account significantly more often than the high-risk account under both prompt conditions. Managers under the *adequate resources* condition choose to override the low-risk account 67.4% of the time, while overriding the high-risk account 47.6% of the time. Similarly, under the *excess resources* condition, managers choose to override the low-risk and high-risk accounts 49.7% and 35.1% of the time, respectively. The main effect of ACCOUNT in the three-factor, repeated-measures ANOVA reported in Table 8 (*$t=4.62$, $p<.01$ one-tailed)* indicates that, overall, managers override the low-risk account more often than the high-risk account, suggesting that managers are responding to the auditors' strategies of allocating larger amounts of resources to the high-risk account relative to the low-risk account.

The two-factor ANOVA results reported in Table 9, Panel A and illustrated in Figure 7 indicate that there is no main effect ($F = .88, p = .35$) of PROMPT on the frequency with which managers choose to override the accounting system for the low-risk account. In addition, the interaction of PROMPT and RESOURCES is insignificant ($F= .03, p = .85$) in its affect on manager behavior, meaning that although auditors conducted more extensive tests of the low-risk account under the prompt condition, managers did not recognize or respond to this increased auditor diligence. However, a contrast-coded model (Buckless and Ravenscroft 1990) supports H5 in that managers override the low-risk account less often under the *prompt-high resources* treatment than an equally weighted composite of the other three groups ($F = 5.95$; $p = 0.02$), though this is primarily due to a significant main effect of RESOURCES on the frequency of override of the low-risk account ($F = 11.37$, $p < .01$).

6.7 AUDIT RISK

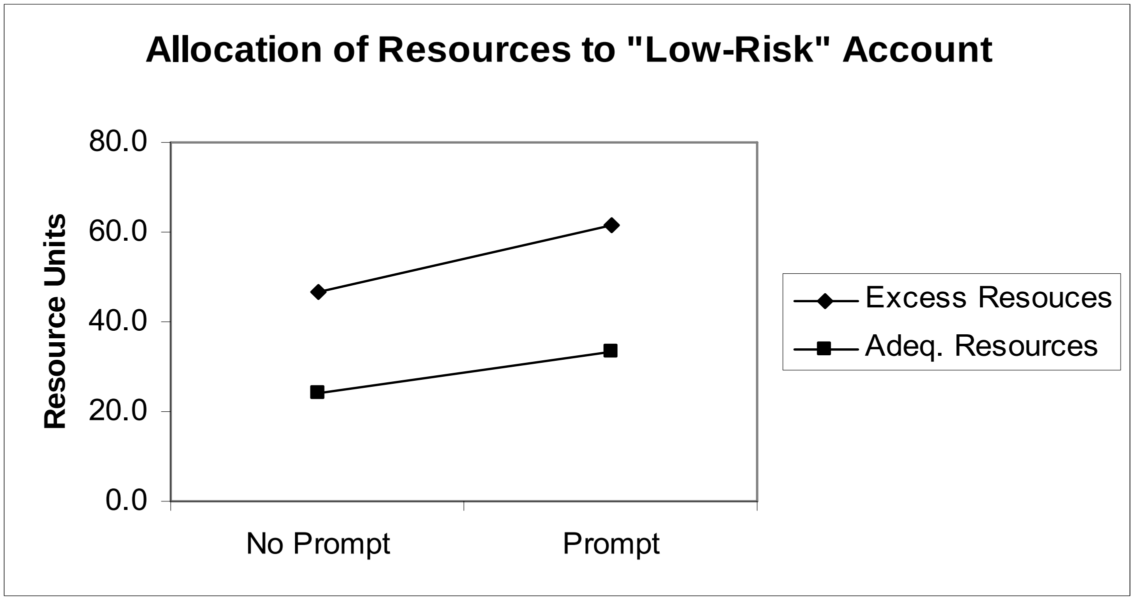
The results presented in Section 6.6 suggest that managers anticipate that auditors devote larger amounts of resources to the high-risk account than the low-risk account and that the managers respond by overriding the low-risk account more often than the high-risk account. However, the game-theoretic predictions in Chapter 3 suggest that managers should override the low-risk account with greater frequency than they actually do in this study. Since managers do not fully best-respond to auditor behavior, it is important to determine whether the high-risk account truly is the riskier of the two accounts, in which case auditors would be justified in allocating greater amounts of resources to that account.

Audit risk is the probability that a misstatement will occur within an account and will not be detected by the audit or the product of the misstatement risk and detection risk (AICPA 1984). In this study, misstatement risk can be calculated as $q_i + r_i (1 – q_i)$, where q_i is the probability that the manager will override account i and r_i is the probability that account i will be misstated due to error (conditional on no override). Multiplying misstatement risk by detection risk, which is simply the complement to the detection probability determined by the auditor's allocation of resources, provides a measure of account-specific audit risk.

Table 10 summarizes, and Figure 10 illustrates, this account-specific audit risk by treatment. For each treatment, other than the *prompt-excess resources* condition, the mean audit risk for the low-risk account exceeds that of the high-risk account. A main effect of ACCOUNT in the three-factor, repeated measures ANOVA in Table 11 indicates that the overall difference in audit risk between the two accounts is significant. Further, the two-factor ANOVA presented in Table 11, Panel A indicates a marginally significant effect of PROMPT on audit risk specific to the low-risk account ($F = 3.78$, $p < .06$), while the ANOVA reported in Panel B indicates that there is no significant effect of the strategic prompt on the level of audit risk specific to the high-risk account. However, the interaction of ACCOUNT and PROMPT in the ANOVA in Table 11 is not significant. Therefore, I am unable to conclude that the relative effect of PROMPT differs between the high- and low-risk accounts.

These results suggest that although managers themselves do not fully anticipate or best respond to the auditors' resource allocations, the auditors' allocation of more resource units to the high-risk account relative to the low risk account combined with the managers' anticipation and partial exploitation of those allocations results in circumstances where undetected misstatements are more likely to occur among the ostensibly low-risk account. However, the presence of strategic reasoning prompts or high levels of audit resources can reduce the level of audit risk specific to the low-risk account.

FIGURE 4



Allocation of Resources to "Low-Risk" Account
Resource Units
80.0
60.0
40.0
20.0
0.0
No Prompt
Prompt
Excess Resouces
Adeq. Resources

FIGURE 5

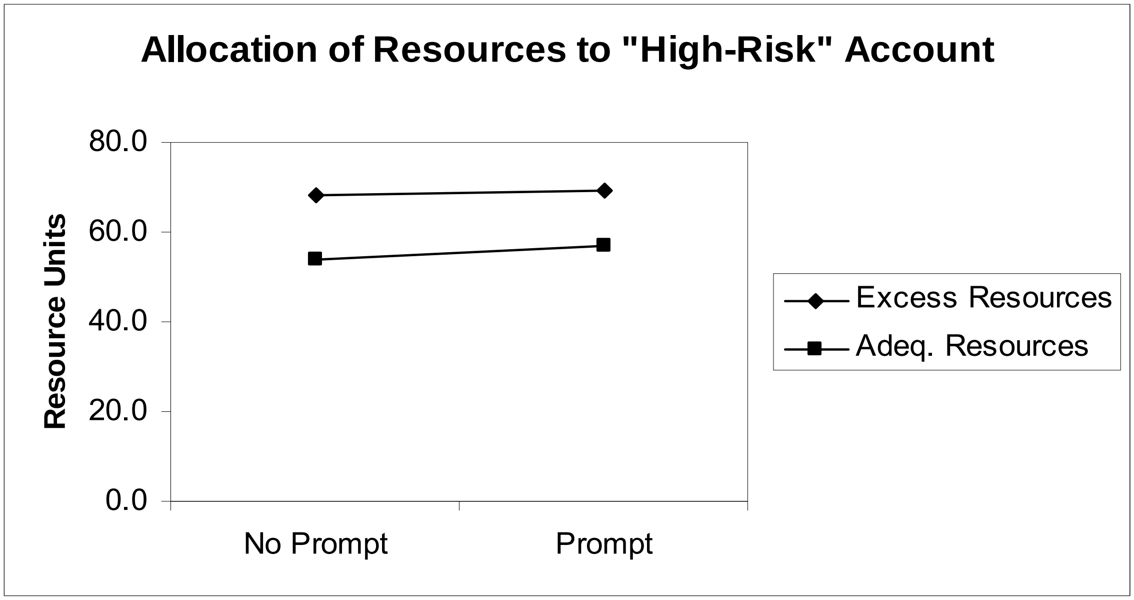

Allocation of Resources to "High-Risk" Account
80.0
60.0
40.0
20.0
0.0
Resource Units
No Prompt
Prompt
Excess Resources
Adeq. Resources

FIGURE 6

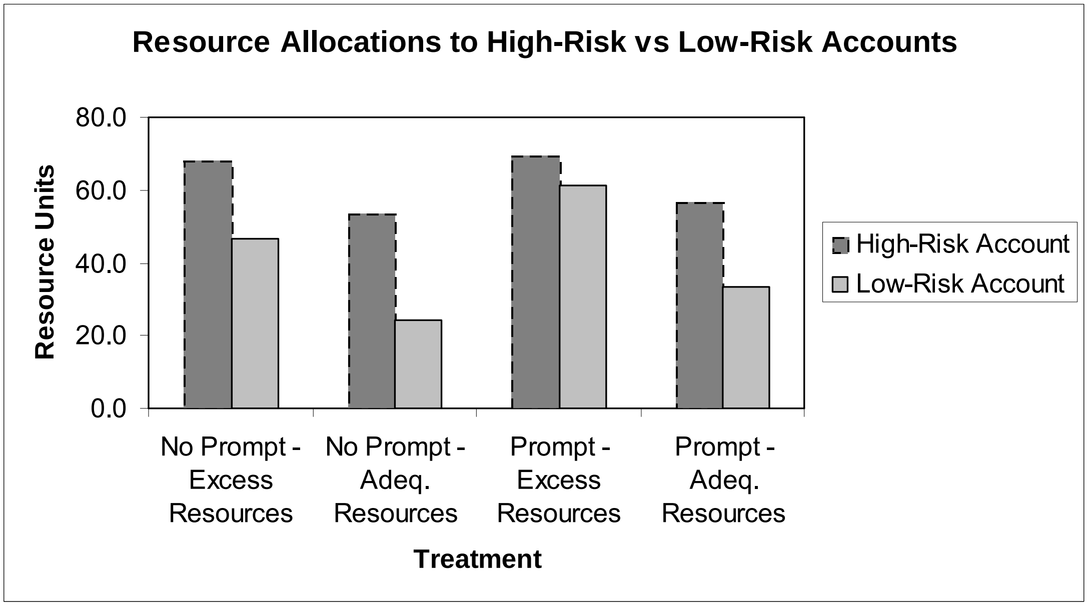
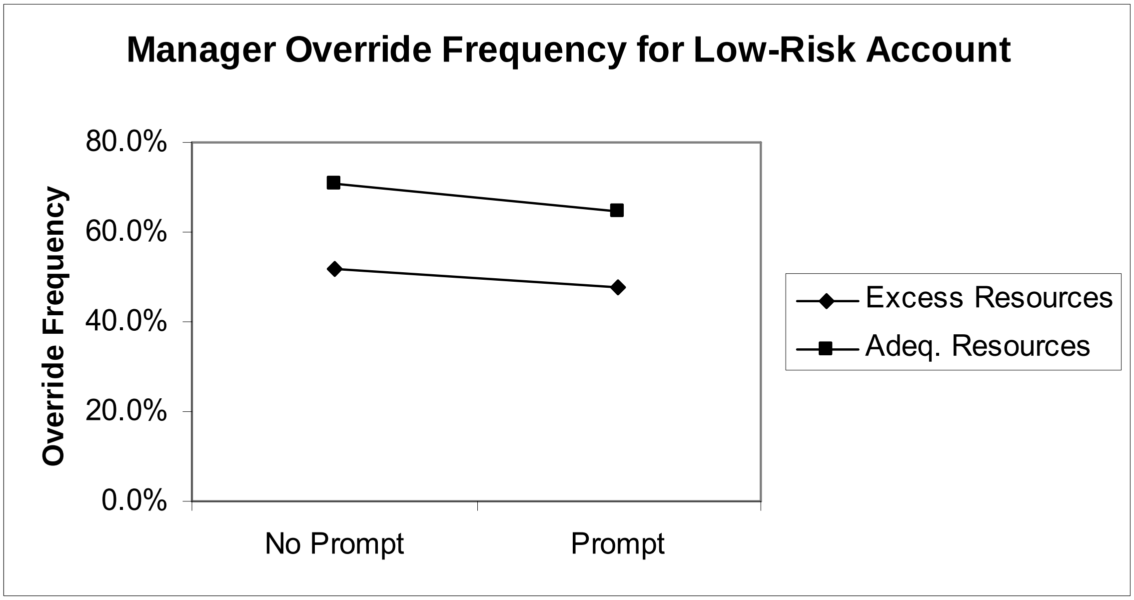

Resource Allocations to High-Risk vs Low-Risk Accounts
Resource Units
80.0
60.0
40.0
20.0
0.0
No Prompt - Excess Resources
No Prompt - Adeq. Resources
Prompt - Excess Resources
Prompt - Adeq. Resources
Treatment
High-Risk Account
Low-Risk Account

FIGURE 7



Manager Override Frequency for Low-Risk Account
80.0%
60.0%
40.0%
20.0%
0.0%
Override Frequency
No Prompt
Prompt
Excess Resources
Adeq. Resources

FIGURE 8

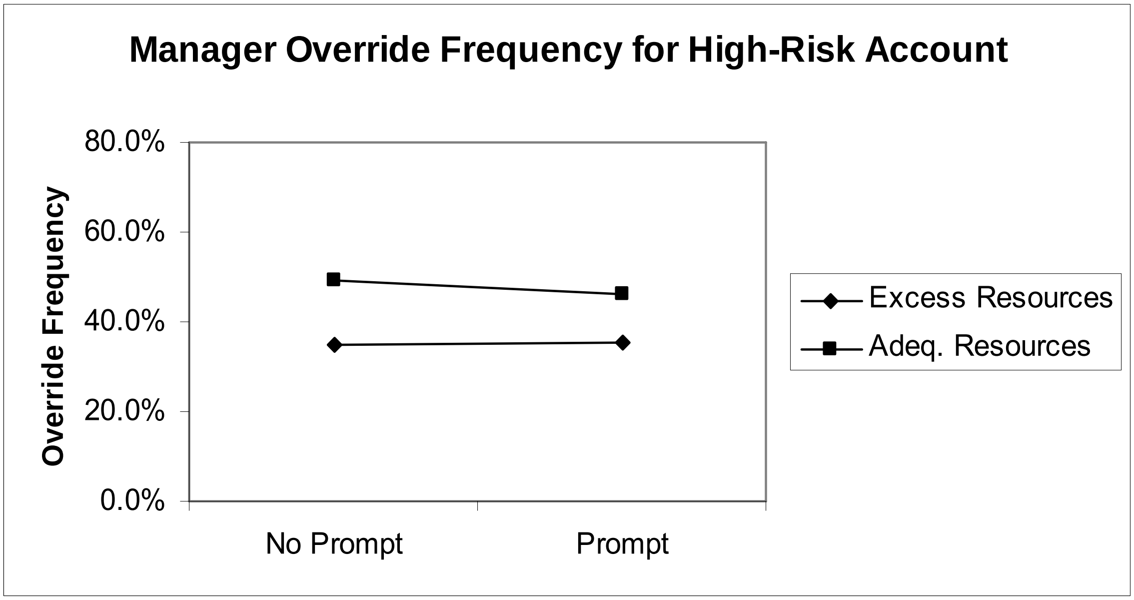
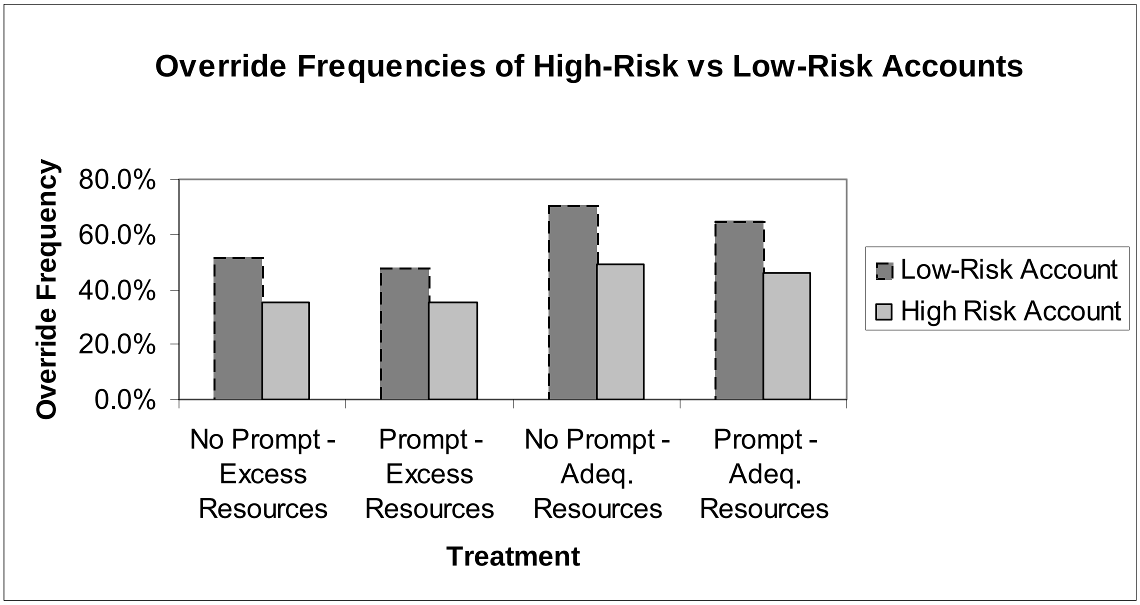

Manager Override Frequency for High-Risk Account
Override Frequency
80.0%
60.0%
40.0%
20.0%
0.0%
No Prompt
Prompt
Excess Resources
Adeq. Resources

FIGURE 9



Override Frequencies of High-Risk vs Low-Risk Accounts
Override Frequency
80.0%
60.0%
40.0%
20.0%
0.0%
No Prompt - Excess Resources
Prompt - Excess Resources
No Prompt - Adeq. Resources
Prompt - Adeq. Resources
Treatment
Low-Risk Account
High Risk Account

FIGURE 10

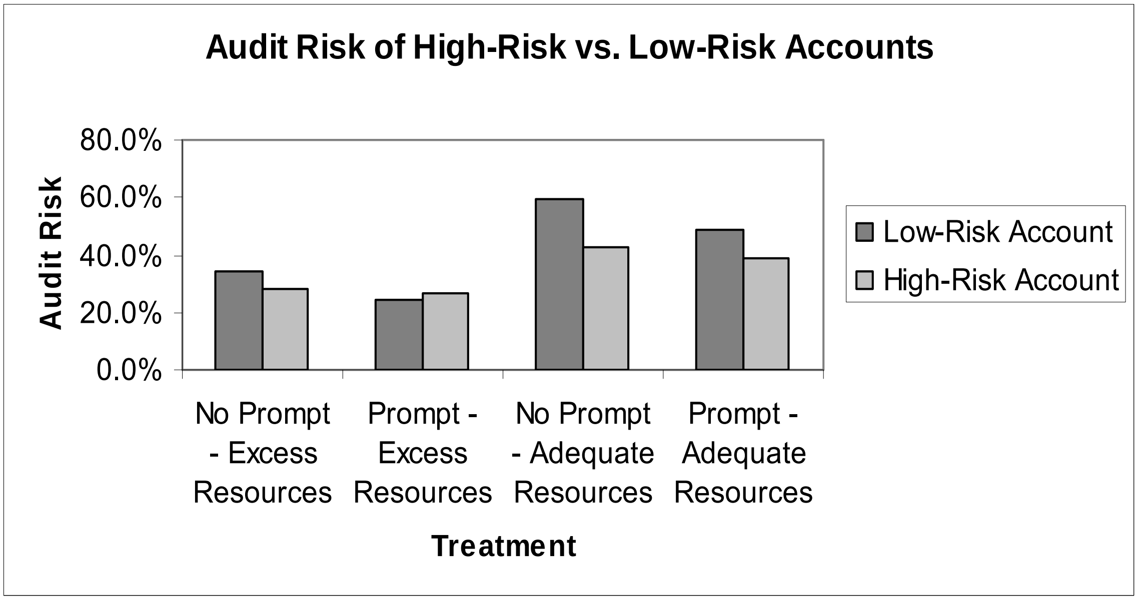

Audit Risk of High-Risk vs. Low-Risk Accounts
80.0%
60.0%
40.0%
20.0%
0.0%
Audit Risk
No Prompt - Excess Resources
Prompt - Excess Resources
No Prompt - Adequate Resources
Prompt - Adequate Resources
Treatment
Low-Risk Account
High-Risk Account

TABLE 3

Audit Resource Allocations

Panel A: Overall utilized resources
(means with standard deviation in parentheses)

	No Prompt	*Prompt*	
Excess Resources	115.0	130.8	122.5
	(42.6)	(32.6)	(38.4)
	n=18	*n=17*	*n=35*
Adequate Resources	78.0	90.1	84.7
	(24.9)	(8.9)	(18.7)
	n=14	*n=17*	*n=35*
	98.6	110.0	
	(39.9)	(31.3)	
	n=32	*n=34*	

Panel B: Resources allocated to the low-risk account
(means with standard deviation in parentheses)

	No Prompt	*Prompt*	
Excess Resources	46.5	61.3	53.7
	(26.2)	(24.6)	(26.2)
	n=18	*n=17*	*n=35*
Adequate Resources	24.3	33.3	29.2
	(20.0)	(14.1)	(17.1)
	n=14	*n=17*	*n=31*
	36.8	47.3	
	(25.8)	(24.4)	
	n=32	*n=34*	

Panel C: Resources allocated to the high-risk account (means with standard deviation in parentheses)

	No Prompt	*Prompt*	
Excess Resources	68.1	69.5	68.8
	(25.2)	(16.6)	(21.1)
	n=18	*n=17*	*n=35*
Adequate Resources	53.7	56.9	55.4
	(23.8)	(14.0)	(18.8)
	n=14	*n=17*	*n=31*
	61.8	63.2	
	(25.3)	(16.4)	
	n=32	*n=34*	

TABLE 4

Three-factor Repeated Measures ANOVA on Audit Resource Allocations[9]

Source	***DF***	***F***	***p***
Within-subjects factor:			
Account	1	32.32	<.001
Between-subjects factors:			
Prompt	1	3.49	.066
Resources	1	26.59	<.001
Interactions:			
Account × Prompt	1	1.73	.194
Account × Resources	1	2.59	.112
Prompt × Resources	1	.07	.795
Account × Prompt × Resources	1	.27	.603

[9] Insofar as theory predicts directional effects, the text of this dissertation refers to *t*-statistics and one-tailed *p*-values that are analogous to the *F*-statistics reported here.

TABLE 5

Two-factor ANOVAs on Audit Resource Allocations[10]

Panel A: Two-factor ANOVA on resources allocated to low-risk account

Source	***DF***	***SS***	***F***	***p***
Prompt	1	2275	4.77	0.04
Resources	1	10,391	21.77	<0.01
Prompt × Resources	1	136	0.28	0.60

Panel B: Two-factor ANOVA on resources allocate to high-risk account

Source	***DF***	***SS***	***F***	***p***
Prompt	1	82	0.20	0.66
Resources	1	2988	7.21	<0.01
Prompt × Resources	1	14	0.03	0.86

[10] Insofar as theory predicts directional effects, the text of this dissertation refers to *t*-statistics and one-tailed *p*-values that are analogous to the *F*-statistics reported here.

TABLE 6

Auditors' Reported Beliefs and Corresponding Resource Allocations

Panel A: Mean first-round responses to strategic prompt and corresponding resource allocations

	Low-Risk Account		High-Risk Account	
	Adequate Resources	Excess Resources	Adequate Resources	Excess Resources
***Beliefs**$_{2nd\ Order}$*	24.3	63.2	54.1	73.7
***Beliefs**$_{1st\ Order}$*	6.12	4.88	5.76	5.00
e_i	24.5	57.4	53.9	59.5

Panel B: Regression of resources allocations on 1st and 2nd Order Beliefs

Model: $p_i = \alpha + \beta_1(Beliefs_{1st\ Order}) + \beta 2(Beliefs_{2nd\ Order}) + \beta_3(D_{Low\ Resources}) + \beta_4(Beliefs_{1st\ Order} * Beliefs_{2nd\ Order}) + \beta_5(Beliefs_{1st\ Order} * D_{Low\ Resources}) + \beta_6(Beliefs_{2nd\ Order} * D_{Low\ Resources}) + \beta_7(Beliefs_{1st\ Order} * Beliefs_{2nd\ Order} * D_{Low\ Resources})$

	Low-Risk Account		High-Risk Account	
	Estimate	*p*	Estimate	*p*
Intercept	-16.15	0.48	12.67	0.72
***Beliefs**$_{1st\ Order}$*	2.81	0.03	1.34	0.31
***Beliefs**$_{2nd\ Order}$*	2.15	0.02	-0.03	0.99
$D_{Low\ Resources}$	38.79	0.18	5.02	0.89
$Beliefs_{1st\ Order} * Beliefs_{2nd\ Order}$	-0.09	0.07	-0.01	0.84
$Beliefs_{1st\ Order} * D_{Low\ Resources}$	-2.72	0.08	-0.28	0.86
$Beliefs_{2nd\ Order} * D_{Low\ Resources}$	-2.47	0.10	0.29	0.87
$Beliefs_{1st\ Order} * Beliefs_{2nd\ Order} * D_{Low\ Resources}$	0.11	0.20	0.00	0.99

TABLE 7

Manager Override Frequency

Panel A: Low-Risk Account: Mean (Standard Deviation)

Override of:	*No Prompt*	*Prompt*	
Excess Resources	51.7% (22.3%) *n=18*	47.6% (22.6%) *n=17*	49.70% (22.2%) n=35
Adequate Resources	70.7% *(22.4%)* *n=14*	64.7% (19.2%) *n=17*	67.40% (20.6%) *n=31*
	60.0% (24.0%) *n=32*	56.2% (22.4%) *n=34*	

Panel B: High-Risk Account: Mean (Standard Deviation)

Override of:	*No Prompt*	*Prompt*	
Excess Resources	35.0% (21.2%) *n=18*	35.3% (16.4%) *n=17*	35.1% (18.8%) *n=35*
Adequate Resources	49.3% (29.3%) *n=14*	46.2% (24.3%) *n=17*	47.6% (26.2%) *n=31*
	41.3% (25.7%) *n=32*	40.7% (21.1%) *n=34*	

TABLE 8

Three-factor Repeated Measures ANOVA on Manager Override Frequency[11]

Source	*DF*	*F*	*p*
Within-subjects factor:			
Account	1	21.30	<.01
Between-subjects factors:			
Prompt	1	0.67	0.42
Resources	1	14.40	<.01
Interactions:			
Account × Prompt	1	0.25	0.62
Account × Resources	1	0.50	0.48
Prompt × Resources	1	0.10	0.75
Account × Prompt × Resources	1	0.01	0.91

[11] Insofar as theory predicts directional effects, the text of this dissertation refers to *t*-statistics and one-tailed *p*-values that are analogous to the *F*-statistics reported here.

TABLE 9

Two-factor ANOVAs on Manager Override Frequency

Panel A: Two-factor ANOVA on frequency of override of low-risk account

Source	***DF***	***SS***	***F***	***p***
Prompt	1	0.04	0.88	0.35
Resources	1	0.53	11.37	<.01
Prompt × Resources	1	0.00	0.03	0.85

Panel B: Two-factor ANOVA on frequency of override of high-risk account

Source	***DF***	***SS***	***F***	**p**
Prompt	1	0.74	0.00	0.96
Resources	1	1171.39	4.93	0.08
Prompt × Resources	1	9.40	0.03	0.87

TABLE 10

Audit Risk

Mean audit risk for high-risk / low-risk accounts

	No Prompt	*Prompt*	
Excess Resources	28.2% / 34.1% *n=18*	26.6% / 24.4% *n=17*	27.4% / 29.4% *n=35*
Adequate Resources	42.3% / 59.3% *n=14*	38.7% / 48.8% *n=17*	40.3% / 53.5% *n=31*
	34.4% / 45.1% *n=32*	32.7% / 36.6% *n=34*	

TABLE 11

Three-factor Repeated Measures ANOVA on Audit Risk

Source	***DF***	***F***	***p***
Within-subjects factor:			
Account	1	5.17	.03
Between-subjects factors:			
Prompt	1	3.04	*0.04*
Resources	1	26.93	<.01
Interactions:			
Account × Prompt	1	1.22	0.27
Account × Resources	1	2.97	0.09
Prompt × Resources	1	0.04	0.85
Account × Prompt × Resources	1	0.01	0.92

Italics indicate one-tailed p-values

TABLE 12

Two-factor ANOVAs on Audit Risk

Panel A: Two-factor ANOVA on audit risk specific to the low-risk account

Source	*DF*	*SS*	*F*	p
Prompt	1	0.17	3.78	0.06
Resources	1	1.01	22.86	<.01
Prompt × Resources	1	0.00	0.01	0.94

Panel B: Two-factor ANOVA on audit risk specific to the high-risk account

Source	*DF*	*SS*	*F*	p
Prompt	1	0.01	0.30	0.58
Resources	1	0.28	7.54	<.01
Prompt × Resources	1	0.00	0.05	0.83

Chapter 7: Summary and Conclusions

7.2 Summary and Implications

Risk-based auditing is an intuitive approach under which auditors focus more audit resources on accounts deemed to be riskier and fewer resources on accounts viewed to be less risky. However, to the extent that auditors focus on non-strategic risks and overlook the strategic risks that arise when managers anticipate risk-based allocations of audit resources, opportunities for fraud may be created among ostensibly low-risk accounts. The purpose of this study is to investigate whether prompting auditors to form first- and second-order beliefs about financial reporting managers can enhance auditors' sensitivity to the endogenous risk of fraud.

I conduct a laboratory experiment in which research participants assume the role of auditors and managers and interact in a multi-account audit setting, which captures the essential strategic tension that exists between real-world auditors and managers. Results indicate that auditor-participants fail to grasp the strategic nature of the multi-account audit game and allocate fewer of their available resources to an account with relatively low non-strategic risk. Manager-participants exploit this behavior by overriding this low-risk account with greater frequency than they override the high-risk account. I find that the strategic prompt results in greater utilization of available resources, with most of the additionally utilized resources being devoted to the ostensibly low-risk account. This change in resource allocation also results in a significant reduction in the audit risk related to the low-risk account. Additionally, results indicate that although increasing the amount of resources available to the auditor results in more resources being devoted to both high- and low-risk accounts, the relative effect of the strategic prompt is robust across levels of available resources.

These results suggest implications for both audit firms and audit standard-setters including the AICPA's Auditing Standards Board and the PCAOB. Whereas current auditing standards generally promote risk assessment procedures that are intended to focus auditor attention toward observable factors that indicate that certain financial statement accounts are more, and others are less, likely to be misstated (e.g., AICPA 2002; AICPA 2006), the results reported in this dissertation suggest audit procedures that prompt auditors to consider the possibility that financial reporting managers will anticipate and exploit auditor's risk assessments could result in fewer undetected misstatements. As an example of such a strategic prompt, audit standards could require audit teams to specifically discuss or document their expectations about whether the manager is likely to anticipate which accounts will receive less audit attention and whether or how managers could exploit those strategies.

7.2 Limitations and Directions for Future Research

One limitation of this study is that the experimental design does not disentangle the potentially separate effects of eliciting auditors' first- and second-order beliefs. Though the broader purpose of this dissertation is to determine whether strategic prompts, in general, can enhance auditors' strategic reasoning and sensitivity to fraud risk, disentangling these effects could be important to audit firms and standard-setters as they structure audit standards and guidance.

Consistent with the traditions of experimental economics (Kachelmeier and King 2002), this study attempts to capture the strategic essence of auditing using a relatively stark but tractable setting. As such, I abstract away from several institutional aspects of real-world auditing. For example, the amount of resources available to a real-world auditor is likely to be endogenously determined through negotiation between the auditor and his or her client. I assume that the auditor's fee is sufficient for allocating equilibrium resources to all audited accounts. However, if auditors do not naturally understand strategic risk and how it affects the amount of resources necessary to conduct an "equilibrium" audit, it is unclear whether auditors would be likely to negotiate a sufficient fee. The question of whether auditors negotiate sufficient fees and how insufficient fees could affect the auditor's ability to detect and deter fraud is left for future research.

Additionally, characterizing the audit as described in Chapter 3 assumes that a manager is equally capable of intentionally misstating each financial statement account regardless of its level of non-strategic risk. However, it is possible that, in practice, certain low-risk accounts are not as easily manipulated. If this were the case, the implications of this study's findings could be more limited. However, the broader point would still apply. That is, as auditors focus their attention on the ostensibly high-risk accounts and away from ostensibly low-risk accounts, the manager's expected benefit for intentionally misstating a low-risk account is increased. Without a strategic prompt similar to that tested in this dissertation, many auditors may fail to appreciate this strategic risk and the consequent risk of fraud, resulting in a misallocation of audit effort and an increase in undetected misstatements.

APPENDIX A: EQUILIBRIUM

Following is the auditor’s expected utility and the solution for the manager’s equilibrium strategy, q_i*:

$$EU_{auditor} = \overbrace{FK}^{\text{Available resources}} - \sum_i \overbrace{e_i K}^{\text{Resources used}}$$

$$+\sum_i \Big[\overbrace{Yq_i e_i T}^{\text{Detected fraud}} + \overbrace{(Y-Z)q_i(1-e_iT)}^{\text{Undetected fraud}} + \overbrace{Yr_i e_i T(1-q_i)}^{\text{Detected error}} + \overbrace{(Y-Z)r_i(1-q_i)(1-e_iT)}^{\text{Undetected error}} + \overbrace{Y(1-r_i)(1-q_i)}^{\text{No misstatement}} \Big]$$

$$\Rightarrow \frac{\partial EU_{auditor}}{\partial e_i} = -K + (Zq_i + Zr_i - Zr_i q_i)T = 0$$

$$\Rightarrow q_i{*} = \frac{K - Zr_i T}{(Z - Zr_i)T}$$

Following is the manager’s expected utility and the solution for the auditor’s equilibrium strategy, p_i*:

$$EU_{manager} = \sum_i \Big[\overbrace{M_O q_1(1-e_1T)}^{\text{Undetected override}} + \overbrace{(M_O - V_O)q_1 e_1 T}^{\text{Detected override}} + \overbrace{M_A(1-r_1)(1-q_1)}^{\text{No misstatement}} + \overbrace{M_A r_1(1-q_1)(1-e_1T)}^{\text{Undetected Error}} + \overbrace{(M_A - V_E)r_1 e_1 T(1-q_1)}^{\text{Detected Error}} \Big]$$

$$\Rightarrow \frac{\partial EU_{manager}}{\partial q_i} = M_O - V_O e_i T - M_A + V_E r_i e_i T = 0$$

$$\Rightarrow e_i{*} = \frac{M_O - M_A}{T\left(V_O - V_E r_i\right)}$$

where:

- — ***F*** : the total number of resource units available to the auditor
- — ***K*** : the auditor's marginal utility per unit of unused resources
- — ***Y*** : the auditor's payoff for a completed audit of account *i*
- — ***Z***: the auditor's penalty for a failed audit of account *i*
- — ***T***: the marginal effect per unit of resources on probability of detecting a misstatement in account *i*
- — $\boldsymbol{M_O}$: the manager's payoff for undetected override in account *i*
- — $\boldsymbol{M_A}$: the manager's payoff for no fraud or undetected error in account *i*
- — $\boldsymbol{V_O}$: the manager's penalty for a detected override in account *i*
- — $\boldsymbol{V_E}$: the manager's penalty for a detected error in account *i*
- — $\boldsymbol{e_i}$: the number of resource units allocated to the audit of account *i*
- — $\boldsymbol{q_i}$: the probability that the manager will override the account *i*
- — $\boldsymbol{r_i}$: the (exogenous) probability of error in account *i* conditional on no override

Appendix B: Experimental Materials

LOW RESOURCES CONDITION

Welcome!

Thank you for volunteering for this business decision-making study. This study is part of an important line of research. Therefore, I ask that you take your role as a participant seriously. Although this is serious business research, I expect that you will also find it to be a fun experience.

Ground rules:

- **No Deception**
  I promise you that this study will be carried out just as described in these instructions.

- **No Talking**
  I ask you to refrain from talking from this point onward. Comments, even those made in jest, could contaminate the research. If you have a question, please raise your hand.

- **After the Study**
  When you leave the lab today, please leave all materials other than the consent form. Please do not discuss this study with others. I plan to complete a number of these sessions in the next several of days, and outside discussion could affect decisions made by future participants.

How will you be compensated?

In today's session, you will have the opportunity to earn points based on the choices you and others make. Each point you earn will increase your cash payment.

The formula I will use to convert points to cash is:

US $ Payment = Total Points Earned × 6 cents per point + $5.00.

The number of points and the amount of money you earn will depend on the decisions you make, the decisions made by others, and on random outcomes. Therefore, the exact amount of money you will be paid cannot be precisely estimated beforehand. However, I can tell you that you will be paid a minimum of $5 and that it is possible to earn in excess of $40.

The choices you will make are described in more detail below, but the important thing to keep in mind is that the ***more points you earn, the more money you will be paid.***

Procedures

Role Assignment and Pairings

Today's session will be made up of 20 rounds. Prior to beginning the first round, the computer will assign each of you to a player role. Half of you will be *Choosers*, and half of you will be *Guessers*.

Additionally, at the start of the session, each player will be matched with a player of the opposite role. These pairings will be anonymous, so you will not know with whom you are paired. ***You will be paired with the same person for all 20 rounds*.**

During each round of this session, points will be earned based on decisions made by the Choosers and Guessers and by outcomes determined randomly by the computer. You will make your choices using your computer's keyboard and mouse.

Choosers' Decisions

In this session, you can think of the computer as simulating two marble dispensing "machines" (Machine 1 and Machine 2). Each of these machines will dispense 100 marbles into its collection bin. Of the 100 marbles each machine puts in its bin, either all 100 will be white, or 99 will be white and 1 will be non-white (either blue or yellow).

The Chooser will decide whether or not to "over-ride" each machine. Choosers may over-ride neither of the machines, one of the machines or both of the machines. If the Chooser decides to over-ride a particular machine, one of the 100 marbles placed in the machine's bin will be yellow.

If the Chooser does not over-ride a particular machine, one of the 100 marbles placed in the machine's bin may be blue depending on the following probabilities:

- If the Chooser does not over-ride **Machine 1**, there is an **80%** probability that one of the 100 marbles in its bin will be blue.

- If the Chooser does not over-ride **Machine 2**, there is a **20%** probability that one of the 100 marbles in its bin will be blue.

Guessers' Decisions

If you are a Guesser, you may search each bin for a non-white marble by choosing a number of marbles to be drawn from each bin. You may select any number of marbles to be drawn from each bin (from zero to 100), but ***the total number of marbles drawn can not exceed 101 marbles.*** The computer will then simulate drawing the chosen number of marbles from each bin and will check whether each draw includes a non-white marble.

If a non-white marble has been placed in a particular bin, the chance (expressed as a percentage) that you will find it is equal to the number of marbles you draw from that bin. In other words, if you draw *x* number of marbles from one of the bins, there is an *x*% chance that you will find the non-white marble ***assuming that there is a non-white marble in that bin***. Therefore, the more marbles you draw from a particular bin, the more likely you are to find the non-white marble if there actually is a non-white marble in that bin. Of course, if there is no non-white marble in the bin, then you will not find one there regardless of the number of marbles you draw from that bin.

Notice that if you draw 100 marbles from a particular bin, you will be certain to find any non-white marble that is in that bin. Also note that if you draw zero marbles from a particular bin, there is no chance that you will find a non-white marble in that bin.

IMPORTANT: The Chooser will make his or her choices without knowing how many marbles the Guesser will draw from each bin. Similarly, the Guessers will not know whether the Chooser decided to override either of the machines.

Next, I describe the points for each possible outcome in a round.

Point Outcomes

The number of points you earn each round will depend on the choices you and the other player make as well as random computer generated outcomes as previously described. Following are the Points Summary Tables for Bin 1 and Bin 2, which summarize the number of points Choosers and Guessers will earn for each possible outcome in each bin. You have also received a laminated copy of this table to review during the session.

BIN 1

Point Summary Table

Chooser

Over-ride → Non-white (Yellow) Marble in Bin

No Over-ride → 80% Non-white (Blue) Marble in Bin; 20% No Non-white Marble in Bin

Guesser	Non-white (Yellow) Marble in Bin	Non-white (Blue) Marble in Bin	No Non-white Marble in Bin
Finds Non-white Marble	0 15	6 15	N/A N/A
Does Not Find Non-white Marble	15 0	8 0	8 15

BIN 2

Points Summary Table

Chooser

Over-ride → Non-white (Yellow) Marble in Bin

No Over-ride → 20% Non-white (Blue) Marble in Bin; 80% No Non-white Marble in Bin

Guesser	Non-white (Yellow) Marble in Bin	Non-white (Blue) Marble in Bin	No Non-white Marble in Bin
Finds Non-white Marble	0 15	6 15	N/A N/A
Does Not Find Non-white Marble	15 0	8 0	8 15

Note that in every round, you will earn points for each of the two bins as described in the tables above and in the summaries on the next page.
The following explains the Points Summary Tables in words:

Chooser Point Outcomes

For each bin:

If the Chooser overrides the machine and the Guesser does not find the non-white (yellow) marble in that machine's bin, the Chooser will receive 15 points.

If the Chooser overrides the machine and the Guesser finds the non-white (yellow) marble in that machine's bin, the Chooser will receive 0 points.

If the Chooser does not override the machine and the Guesser does not find a non-white (blue) marble in that machine's bin, the Chooser will receive 8 points.

If the Chooser does not override the machine and the Guesser finds a non-white (blue) marble in that machine's bin, the Chooser will receive 6 points.

The total number of points the Chooser will earn each round include points from Bin 1 plus points from Bin 2.

Guesser Point Outcomes

For each bin:

If there is a non-white (blue or yellow) marble in the bin and the Guesser does not find it, the Guesser will receive 0 points.

If there is a non-white (blue or yellow) marble in the bin and the Guesser finds it, the Guesser will receive 15 points.

If there is not a non-white (blue or yellow) marble in the bin, the Guesser will receive 15 points.

Recall that the Guesser may draw any number of marbles up to a total of 101. The difference between 101 and the number of marbles actually drawn are “extra marbles”, which will be converted into additional Guesser points according to the following formula:

Extra Points = (101 – number of marbles drawn) × .12

For example:

- If the Guesser draws a total of 91 marbles from the two bins, there will be 10 extra marbles (101– 91 = 10). These 10 extra marbles will result in 1.2 extra points (10 × .12 = 1.2) to the Guesser.
- If the Guesser draws a total of 51 marbles from the two bins, there will be 50 extra marbles (101 – 51 = 50). These 50 extra marbles will result in 6 extra points (50 × .12 = 6) to the Guesser.
- If the Guesser draws a total of 11 marbles from the two bins, there will be 90 extra marbles (101 – 11 = 90). These 90 extra marbles will result in 10.8 extra points (90 × .12 = 10.8) to the Guesser.

The total points the Guesser will earn each round include points from Bin 1 plus points from Bin 2 plus extra points.

Feedback

After each round, each player will see a computerized feedback report that summarizes the outcome for each machine. For each machine, each player will be reminded of his or her own choice and will learn whether the Guesser found a non-white marble.

The feedback report will not inform Choosers of the number of marbles drawn by the Guesser. Similarly, the feedback report will not inform the Guesser about whether the Chooser chose to over-ride the machine. Again, players will only be informed about whether the Guesser found a non-white marble.

Additionally, the feedback report will also inform Choosers and Guessers about the number of points they actually earned during the period, except for the Guesser when he or she does not find a non-white marble.

Post-Session Questionnaire and Payment

At the end of the session, I will ask you to complete a short questionnaire about your experience. When all participants have completed this questionnaire, I will privately distribute cash payments and payoff summary reports.

HIGH RESOURCES CONDITION

Welcome!

Thank you for volunteering for this business decision-making study. This study is part of an important line of research. Therefore, I ask that you take your role as a participant seriously. Although this is serious business research, I expect that you will also find it to be a fun experience.

Ground rules:

- **No Deception**
  I promise you that this study will be carried out just as described in these instructions.

- **No Talking**
  I ask you to refrain from talking from this point onward. Comments, even those made in jest, could contaminate the research. If you have a question, please raise your hand.

- **After the Study**
  When you leave the lab today, please leave all materials other than the consent form. Please do not discuss this study with others. I plan to complete a number of these sessions in the next several of days, and outside discussion could affect decisions made by future participants.

How will you be compensated?

In today's session, you will have the opportunity to earn points based on the choices you and others make. Each point you earn will increase your cash payment.

The formula I will use to convert points to cash is:

US $ Payment = Total Points Earned × 6 cents per point + $5.00.

The number of points and the amount of money you earn will depend on the decisions you make, the decisions made by others, and on random outcomes. Therefore, the exact amount of money you will be paid cannot be precisely estimated beforehand. However, I can tell you that you will be paid a minimum of $5 and that it is possible to earn in excess of $40.

The choices you will make are described in more detail below, but the important thing to keep in mind is that the ***more points you earn, the more money you will be paid.***

Procedures

Role Assignment and Pairings

Today's session will be made up of 20 rounds. Prior to beginning the first round, the computer will assign each of you to a player role. Half of you will be *Choosers*, and half of you will be *Guessers*.

Additionally, at the start of the session, each player will be matched with a player of the opposite role. These pairings will be anonymous, so you will not know with whom you are paired. ***You will be paired with the same person for all 20 rounds*.**

During each round of this session, points will be earned based on decisions made by the Choosers and Guessers and by outcomes determined randomly by the computer. You will make your choices using your computer's keyboard and mouse.

Choosers' Decisions

In this session, you can think of the computer as simulating two marble dispensing "machines" (Machine 1 and Machine 2). Each of these machines will dispense 100 marbles into its collection bin. Of the 100 marbles each machine puts in its bin, either all 100 will be white, or 99 will be white and 1 will be non-white (either blue or yellow).

The Chooser will decide whether or not to "over-ride" each machine. Choosers may over-ride neither of the machines, one of the machines or both of the machines. If the Chooser decides to over-ride a particular machine, one of the 100 marbles placed in the machine's bin will be yellow.

If the Chooser does not over-ride a particular machine, one of the 100 marbles placed in the machine's bin may be blue depending on the following probabilities:

- If the Chooser does not over-ride **Machine 1**, there is an **80%** probability that one of the 100 marbles in its bin will be blue.
- If the Chooser does not over-ride **Machine 2**, there is a **20%** probability that one of the 100 marbles in its bin will be blue.

Guessers' Decisions

If you are a Guesser, you may search each bin for a non-white marble by choosing a number of marbles to be drawn from each bin. You may select any number of marbles to be drawn from each bin (from zero to 100), but ***the total number of marbles drawn can not exceed <u>181</u> marbles.*** The computer will then simulate drawing the chosen number of marbles from each bin and will check whether each draw includes a non-white marble.

If a non-white marble has been placed in a particular bin, the chance (expressed as a percentage) that you will find it is equal to the number of marbles you draw from that bin. In other words, if you draw *x* number of marbles from one of the bins, there is an *x*% chance that you will find the non-white marble ***assuming that there is a non-white marble in that bin***. Therefore, the more marbles you draw from a particular bin, the more likely you are to find the non-white marble if there actually is a non-white marble in that bin. Of course, if there is no non-white marble in the bin, then you will not find one there regardless of the number of marbles you draw from that bin.

Notice that if you draw 100 marbles from a particular bin, you will be certain to find any non-white marble that is in that bin. Also note that if you draw zero marbles from a particular bin, there is no chance that you will find a non-white marble in that bin.

IMPORTANT: The Chooser will make his or her choices without knowing how many marbles the Guesser will draw from each bin. Similarly, the Guessers will not know whether the Chooser decided to override either of the machines.

Next, I describe the points for each possible outcome in a round.

Point Outcomes

The number of points you earn each round will depend on the choices you and the other player make as well as random computer generated outcomes as previously described. Following are the Points Summary Tables for Bin 1 and Bin 2, which summarize the number of points Choosers and Guessers will earn for each possible outcome in each bin. You have also received a laminated copy of this table to review during the session.

BIN 1

Point Summary Table

Chooser

	Over-ride	No Over-ride (80%)	No Over-ride (20%)
Guesser	Non-white (Yellow) Marble in Bin	Non-white (Blue) Marble in Bin	No Non-white Marble in Bin
Finds Non-white Marble	15 / 0	15 / 6	N/A / N/A
Does Not Find Non-white Marble	0 / 15	0 / 8	15 / 8

BIN 2

Points Summary Table

Chooser

	Over-ride	No Over-ride (20%)	No Over-ride (80%)
Guesser	Non-white (Yellow) Marble in Bin	Non-white (Blue) Marble in Bin	No Non-white Marble in Bin
Finds Non-white Marble	15 / 0	15 / 6	N/A / N/A
Does Not Find Non-white Marble	0 / 15	0 / 8	15 / 8

Note that in every round, you will earn points for each of the two bins as described in the tables above and in the summaries on the next page.
The following explains the Points Summary Tables in words:

Chooser Point Outcomes

For each bin:

If the Chooser overrides the machine and the Guesser does not find the non-white (yellow) marble in that machine's bin, the Chooser will receive 15 points.

If the Chooser overrides the machine and the Guesser finds the non-white (yellow) marble in that machine's bin, the Chooser will receive 0 points.

If the Chooser does not override the machine and the Guesser does not find a non-white (blue) marble in that machine's bin, the Chooser will receive 8 points.

If the Chooser does not override the machine and the Guesser finds a non-white (blue) marble in that machine's bin, the Chooser will receive 6 points.

The total number of points the Chooser will earn each round include points from Bin 1 plus points from Bin 2.

Guesser Point Outcomes

For each bin:

If there is a non-white (blue or yellow) marble in the bin and the Guesser does not find it, the Guesser will receive 0 points.

If there is a non-white (blue or yellow) marble in the bin and the Guesser finds it, the Guesser will receive 15 points.

If there is not a non-white (blue or yellow) marble in the bin, the Guesser will receive 15 points.

Recall that the Guesser may draw any number of marbles up to a total of 181. The difference between 181 and the number of marbles actually drawn are "extra marbles", which will be converted into additional Guesser points according to the following formula:

Extra Points = (181 – number of marbles drawn) × .12

For example:

- If the Guesser draws a total of 171 marbles from the two bins, there will be 10 extra marbles (181– 171 = 10). These 10 extra marbles will result in 1.2 extra points (10 × .12 = 1.2) to the Guesser.

- If the Guesser draws a total of 131 marbles from the two bins, there will be 50 extra marbles (181– 131 = 50). These 50 extra marbles will result in 6 extra points (50 × .12 = 6) to the Guesser.

- If the Guesser draws a total of 91 marbles from the two bins, there will be 90 extra marbles (181– 91 = 90). These 90 extra marbles will result in 10.8 extra points (90 × .12 = 10.8) to the Guesser.

- If the Guesser draws a total of 51 marbles from the two bins, there will be 130 extra marbles (181 – 51 = 130). These 130 extra marbles will result in 15.6 extra points (130 × .12 = 15.6) to the Guesser.

- If the Guesser draws a total of 11 marbles from the two bins, there will be 170 extra marbles (181 – 11 = 170). These 170 extra marbles will result in 20.4 extra points (170 × .12 = 20.4) to the Guesser.

The total points the Guesser will earn each round include points from Bin 1 plus points from Bin 2 plus extra points.

Feedback

After each round, each player will see a computerized feedback report that summarizes the outcome for each machine. For each machine, each player will be reminded of his or her own choice and will learn whether the Guesser found a non-white marble.

The feedback report will not inform Choosers of the number of marbles drawn by the Guesser. Similarly, the feedback report will not inform the Guesser about whether the Chooser chose to over-ride the machine. Again, players will only be informed about whether the Guesser found a non-white marble.

Additionally, the feedback report will also inform Choosers and Guessers about the number of points they actually earned during the period, except for the Guesser when he or she does not find a non-white marble.

Post-Session Questionnaire and Payment

At the end of the session, I will ask you to complete a short questionnaire about your experience. When all participants have completed this questionnaire, I will privately distribute cash payments and payoff summary reports.

Appendix C: Post-Experimental Questionnaire

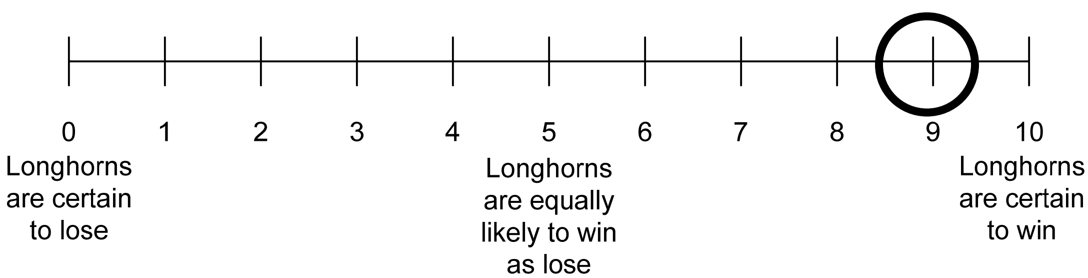
<u>FOLLOW-UP QUESTIONNAIRE</u> (CHOOSER)

Please enter your **Participant ID Number:** ___________________________

Answer the questions in the order they appear. After you have answered a question, please do **<u>not</u>** go back and change your response. Also, please do not refer to the instructions handout while answering these questions.

When scales are provided, please *circle* one number on the scale corresponding to your judgment as illustrated in the example below.

What is the likely outcome of the Longhorns' next football game?



(1) If the Chooser does not over-ride ***Machine 1***, what is the probability that a blue marble will be placed in ***Bin 1***?

____

(2) If the Chooser does not over-ride ***Machine 2***, what is the probability that a blue marble will be placed in ***Bin 2***?

____

(3) Please briefly describe the overall strategy you adopted during this session.

(4) Did your strategy change during the session? If so, please explain how your strategy changed over time.

(5) On average (over the 20 rounds), how many marbles do you believe the Guesser chose to draw from ***Bin 1***?

____

(6) On average (over the 20 rounds), how many marbles do you believe the Guesser chose to draw from ***Bin 2***?

____

(7) Imagine that you are a <u>Guesser</u> and that you are going to play one round with a new Chooser. How many marbles would that new Chooser expect you (the Guesser) to draw from ***Bin 1***?

____

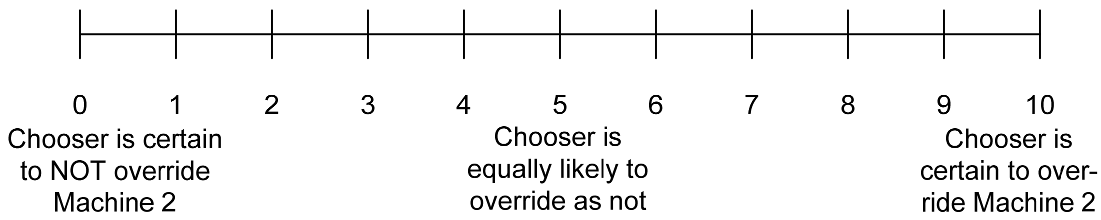
(8) Imagine that you are a <u>Guesser</u> and that you are going to play one round with a new Chooser. How many marbles would that new Chooser expect you (the Guesser) to draw from ***Bin 2***?

____

(9) Considering your answer to (7) above, what is the likelihood that the new Chooser will over-ride ***Machine 1***?

0	1	2	3	4	5	6	7	8	9	10
Chooser is certain to NOT override Machine 1					Chooser is equally likely to override as not					Chooser is certain to over-ride Machine 1

(10) Considering your answer to (8) above, what is the likelihood that the new Chooser will over-ride ***Machine 2***?



(11) Imagine that you are advising a new Chooser on whether to over-ride the machines.

a. Out of 100 rounds, how many times would you advise the Chooser to over-ride ***Machine 1***?

____

b. Out of 100 rounds, how many times would you advise the Chooser to over-ride ***Machine 2***?

____

c. Please use the space below to explain your answers to (1)a and (1)b.

(12) Imagine that you are advising a new Guesser on how many marbles to draw from each bin. (Remember that the Guesser can only draw a total 101 marbles from the two bins.)

a. How many marbles would you advise the Guesser to draw from ***Bin 1*** out of 100 marbles placed in that bin?

____

b. How many marbles would you advise the Guesser to draw from ***Bin 2*** out of 100 marbles placed in that bin?

____

c. How many marbles would you advise the Guesser to leave as extra marbles?

____

d. Please use the space below to explain your answers to (2)a and (2)b.

(13) If the Guesser draws 20 marbles from ***Bin 1*** and finds a non-white marble, is that marble more likely to be a blue marble or a yellow marble?

0	1	2	3	4	5	6	7	8	9	10
Marble is certain to be blue					Marble is equally likely to be blue or yellow					Marble is certain to be yellow

(14) If the Guesser draws 20 marbles from ***Bin 2*** and finds a non-white marble, is that marble more likely to be blue or to be yellow?

0	1	2	3	4	5	6	7	8	9	10
Marble is certain to be blue					Marble is equally likely to be blue or yellow					Marble is certain to be yellow

(15) Please describe any other factors that impacted your decision making during the experiment.

(16) Were there any aspects of the instructions that you did not understand?

General Questions:

(1) What is your current classification in school?: ______________________________

(2) What is your major? ____

(3) What is your gender?:

a. _______ Male

b. _______ Female

(4) What is your age?: _________________

(5) Which of the following best describes your work experience (including current & past work experience)?

a. _______ no work experience

b. _______ part-time work only

c. _______ part-time/ full-time

d. _______ full-time only

THANK YOU for your participation!

Please leave this questionnaire at your computer. You may collect your things & take your participant ID code to the experimenter at the door. He will give you your payment for participating in today's research study.

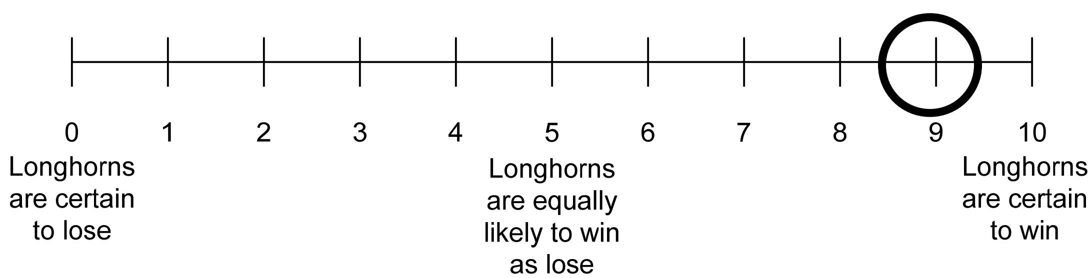
<u>FOLLOW-UP QUESTIONNAIRE</u> (Guesser)

Please enter your **Participant ID Number:** ___________________________

Answer the questions in the order they appear. After you have answered a question, please do **<u>not</u>** go back and change your response. Also, please do not refer to the instructions handout while answering these questions.

When scales are provided, please *circle* one number on the scale corresponding to your judgment as illustrated in the example below.

What is the likely outcome of the Longhorns' next football game?



(17) If the Chooser does not over-ride ***Machine 1***, what is the probability that a blue marble will be placed in ***Bin 1***?

____

(18) If the Chooser does not over-ride ***Machine 2***, what is the probability that a blue marble will be placed in ***Bin 2***?

____

(19) Please briefly describe the overall strategy you adopted during this session.

(20) Did your strategy change during the session? If so, please explain how your strategy changed over time.

(21) Over the 20 rounds, how many times do you believe the Chooser chose to override ***Machine 1***?

____

(22) Over the 20 rounds, how many times do you believe the Chooser chose to override ***Machine 2***?

____

(23) Imagine that you are a Guesser and that you are going to play one round with a new Chooser. How many marbles would that new Chooser expect you (the Guesser) to draw from ***Bin 1***?

____

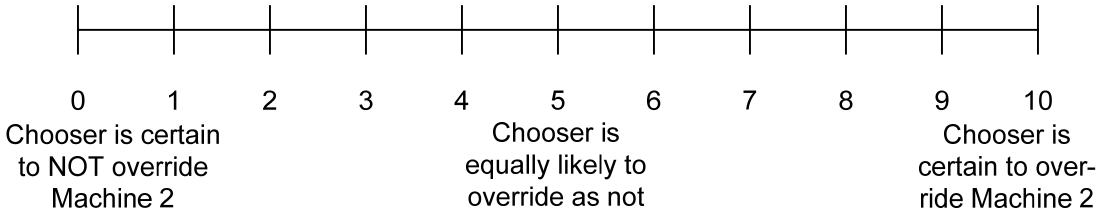
(24) Imagine that you are a Guesser and that you are going to play one round with a new Chooser. How many marbles would that new Chooser expect you (the Guesser) to draw from ***Bin 2***?

____

(25) Considering your answer to (7) above, what is the likelihood that the new Chooser will over-ride ***Machine 1***?

0	1	2	3	4	5	6	7	8	9	10
Chooser is certain to NOT override Machine 1					Chooser is equally likely to override as not					Chooser is certain to over-ride Machine 1

(26) Considering your answer to (8) above, what is the likelihood that the new Chooser will over-ride ***Machine 2***?



(27) Imagine that you are advising a new Chooser on whether to over-ride the machines.

a. Out of 100 rounds, how many times would you advise the Chooser to over-ride ***Machine 1***?

____

b. Out of 100 rounds, how many times would you advise the Chooser to over-ride ***Machine 2***?

____

c. Please use the space below to explain your answers to (1)a and (1)b.

(28) Imagine that you are advising a new Guesser on how many marbles to draw from each bin. (Remember that the Guesser can only draw a total 101 marbles from the two bins.)

a. How many marbles would you advise the Guesser to draw from ***Bin 1*** out of 100 marbles placed in that bin?

____

b. How many marbles would you advise the Guesser to draw from ***Bin 2*** out of 100 marbles placed in that bin?

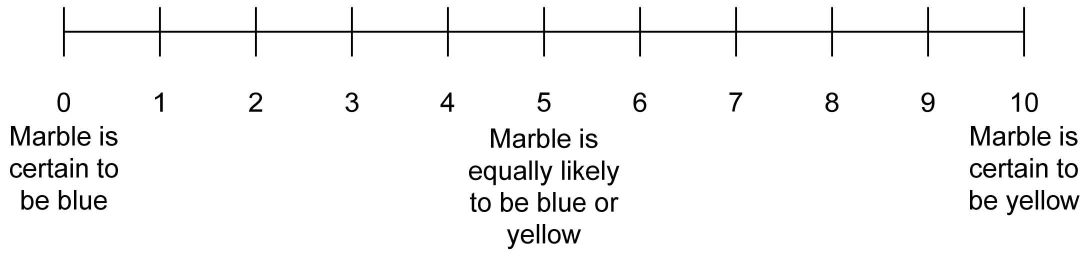
____

c. How many marbles would you advise the Guesser to leave as extra marbles?

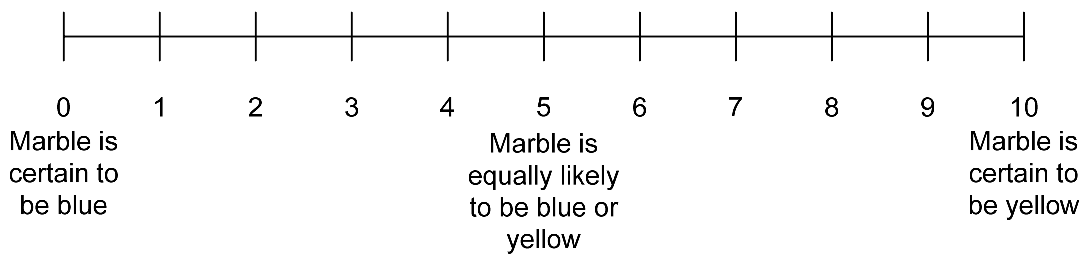
____

d. Please use the space below to explain your answers to (2)a and (2)b.

(29) If the Guesser draws 20 marbles from ***Bin 1*** and finds a non-white marble, is that marble more likely to be a blue marble or a yellow marble?



(30) If the Guesser draws 20 marbles from ***Bin 2*** and finds a non-white marble, is that marble more likely to be blue or to be yellow?



(31) Please describe any other factors that impacted your decision making during the experiment.

(32) Were there any aspects of the instructions that you did not understand?

General Questions:

(6) What is your current classification in school?: ______________________________

(7) What is your major? ____

(8) What is your gender?:

a. _______ Male

b. _______ Female

(9) What is your age?: _________________

(10) Which of the following best describes your work experience (including current & past work experience)?

a. _______ no work experience

b. _______ part-time work only

c. _______ part-time/ full-time

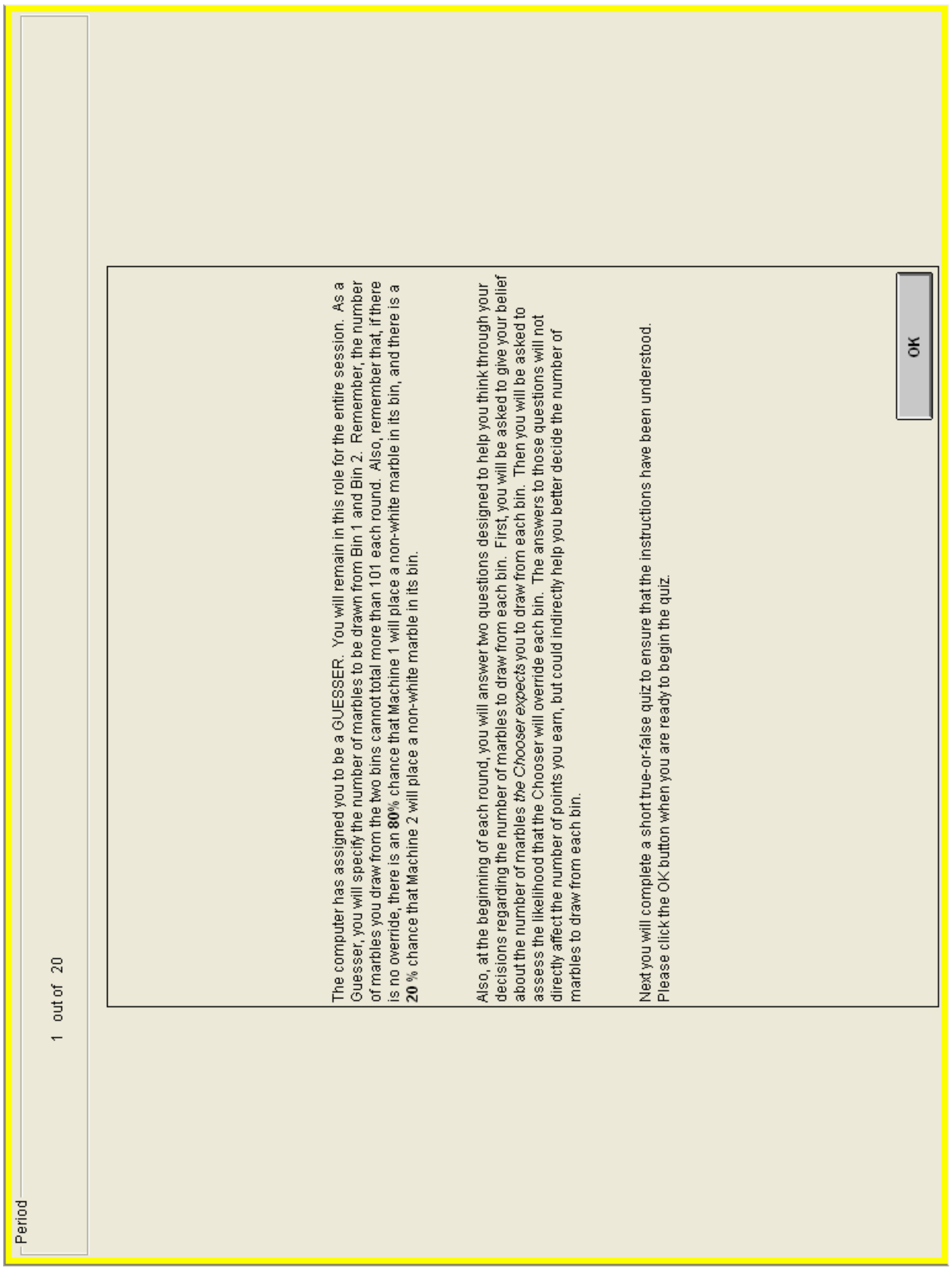
d. _______ full-time only

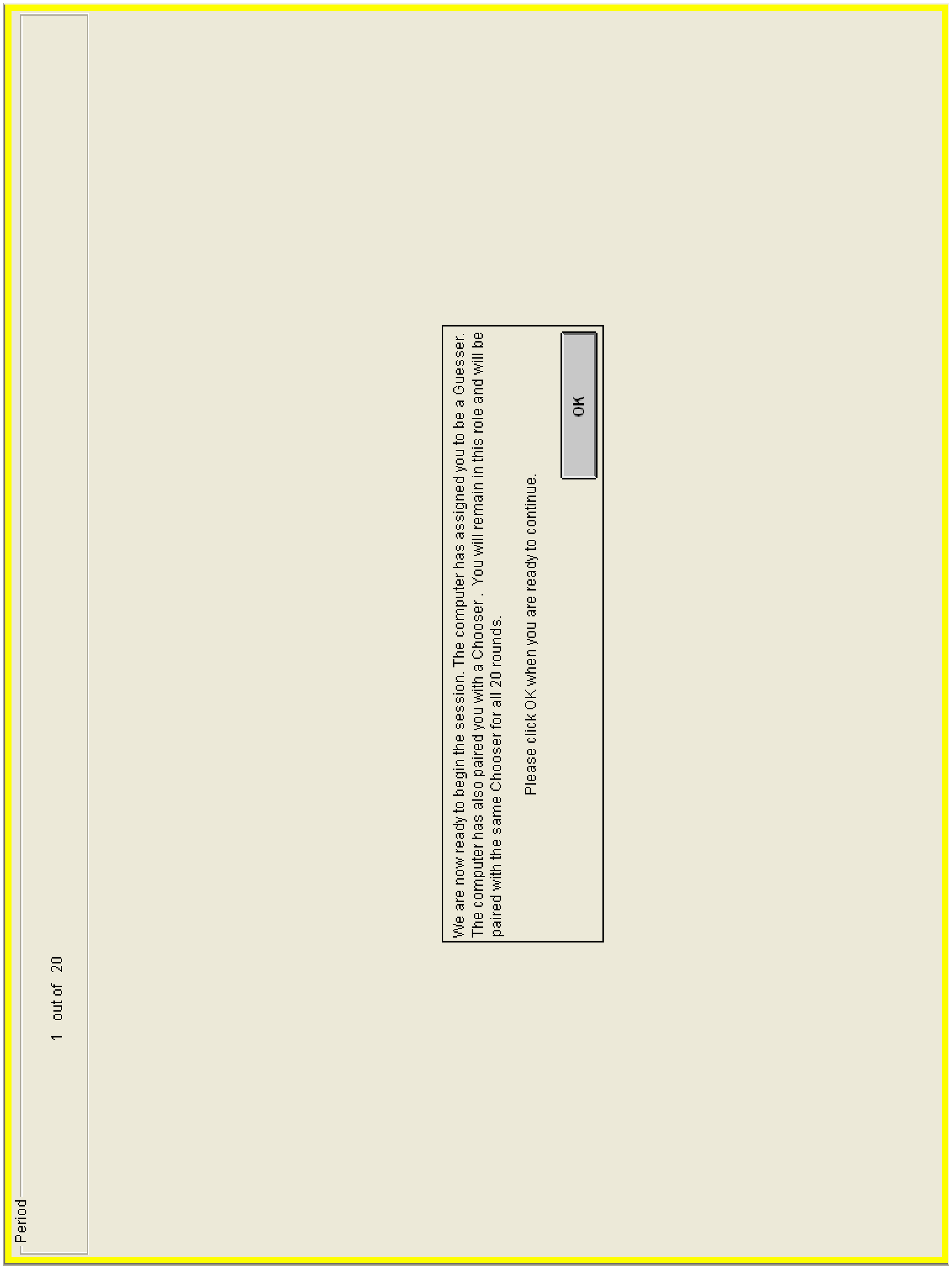
THANK YOU for your participation!

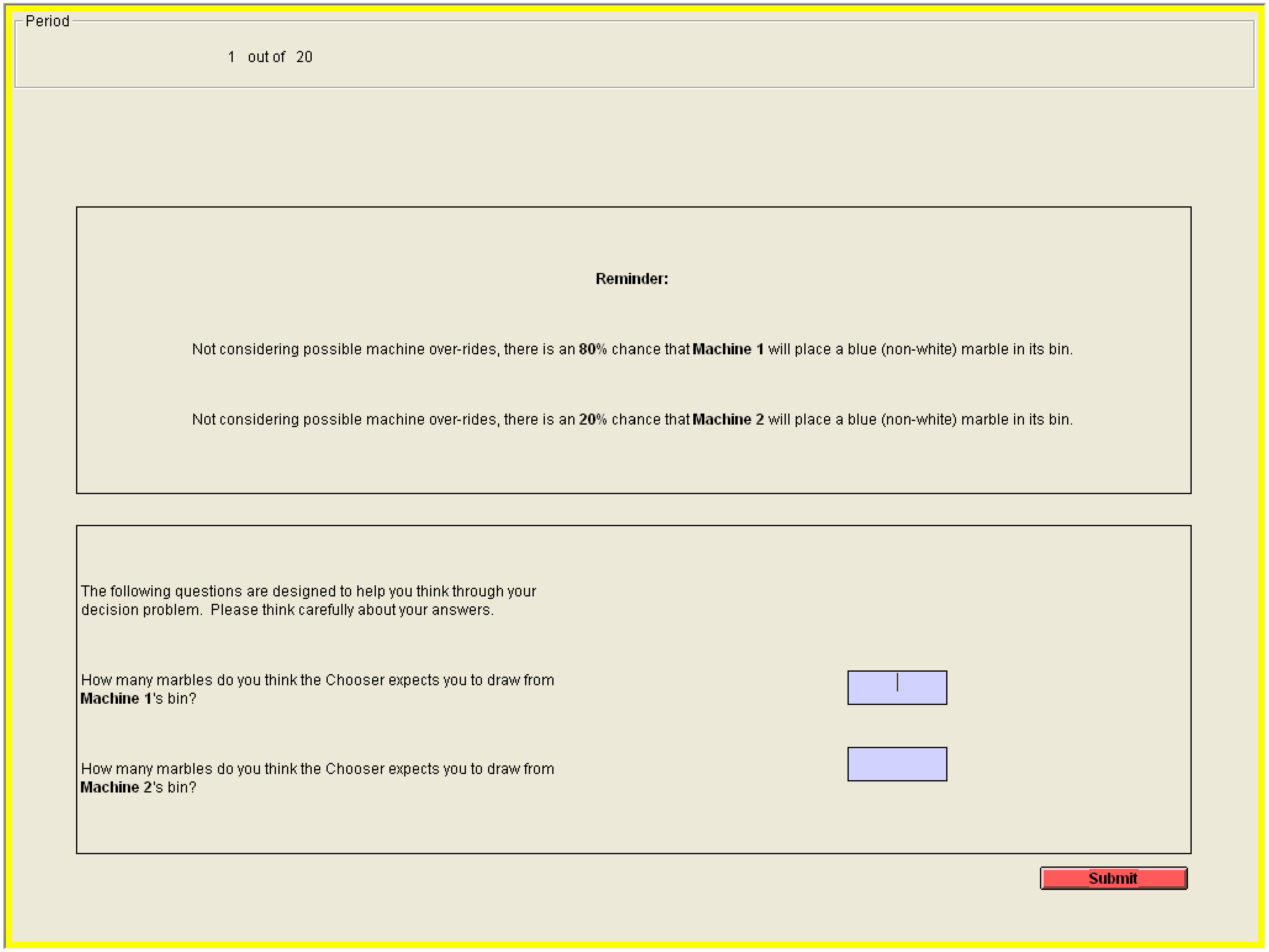
Please leave this questionnaire at your computer. You may collect your things & take your participant ID code to the experimenter at the door. He will give you your payment for participating in today's research study.

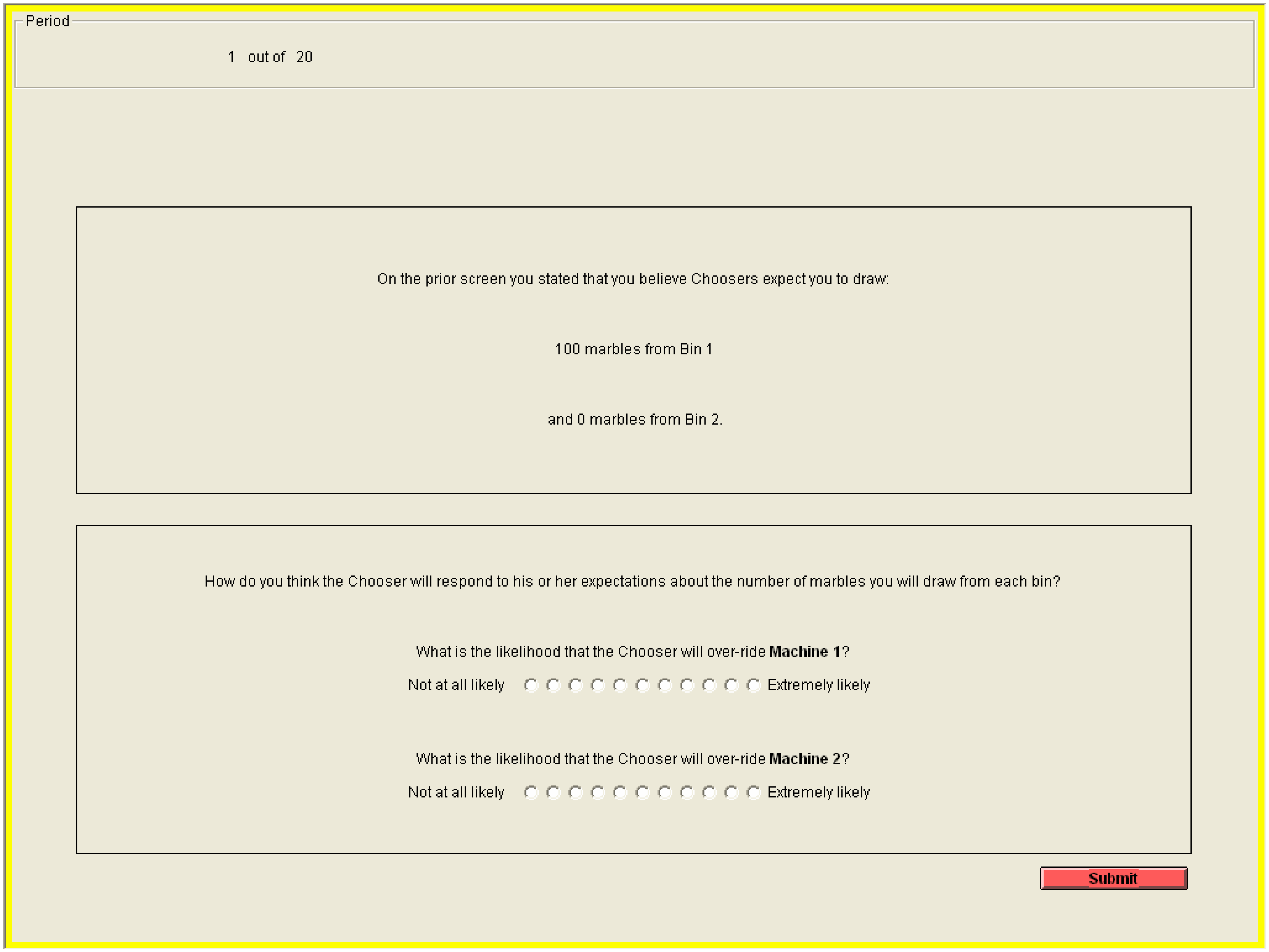
Appendix D: z-Tree Interface Screenshots

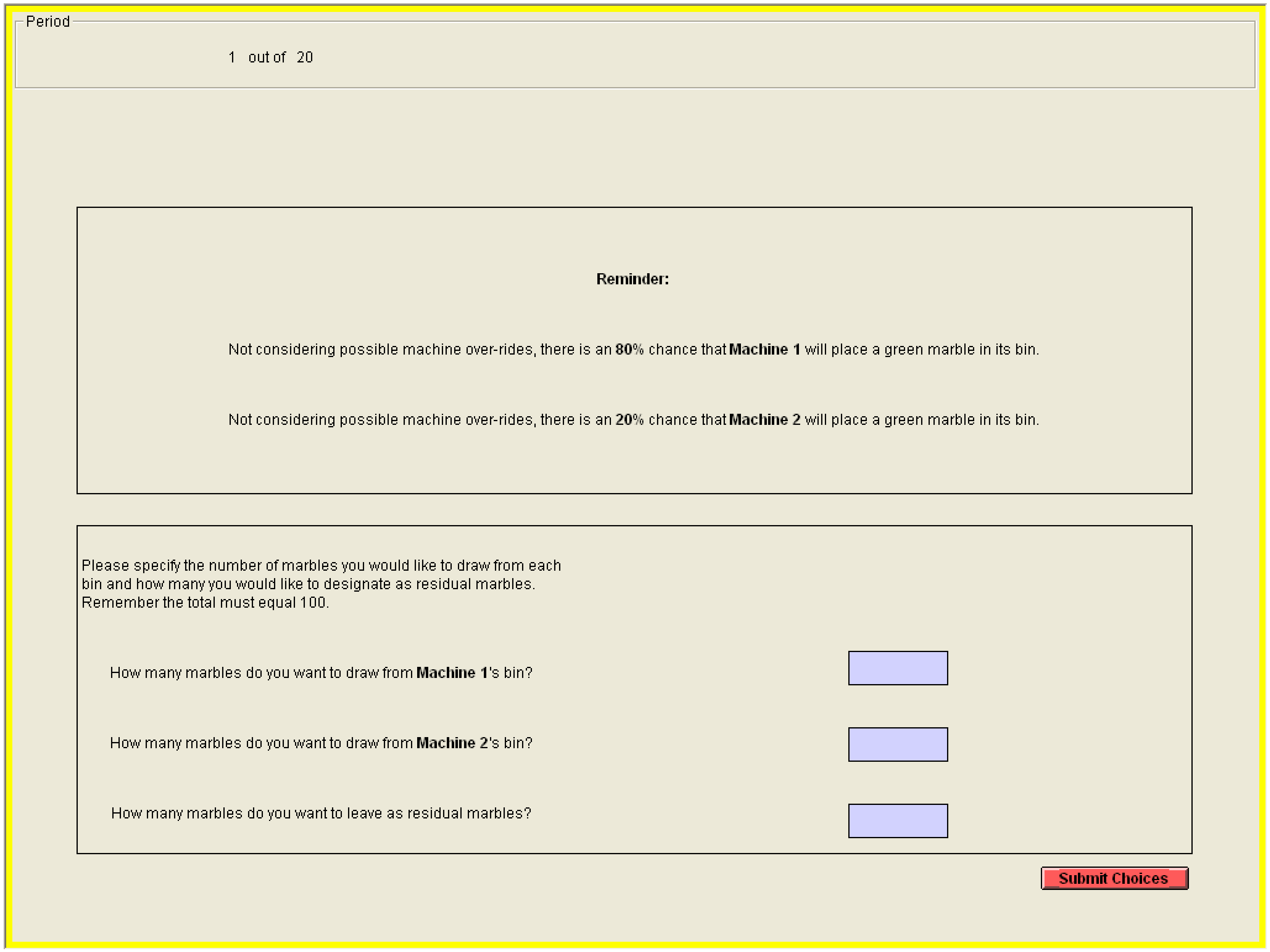
(GUESSER)

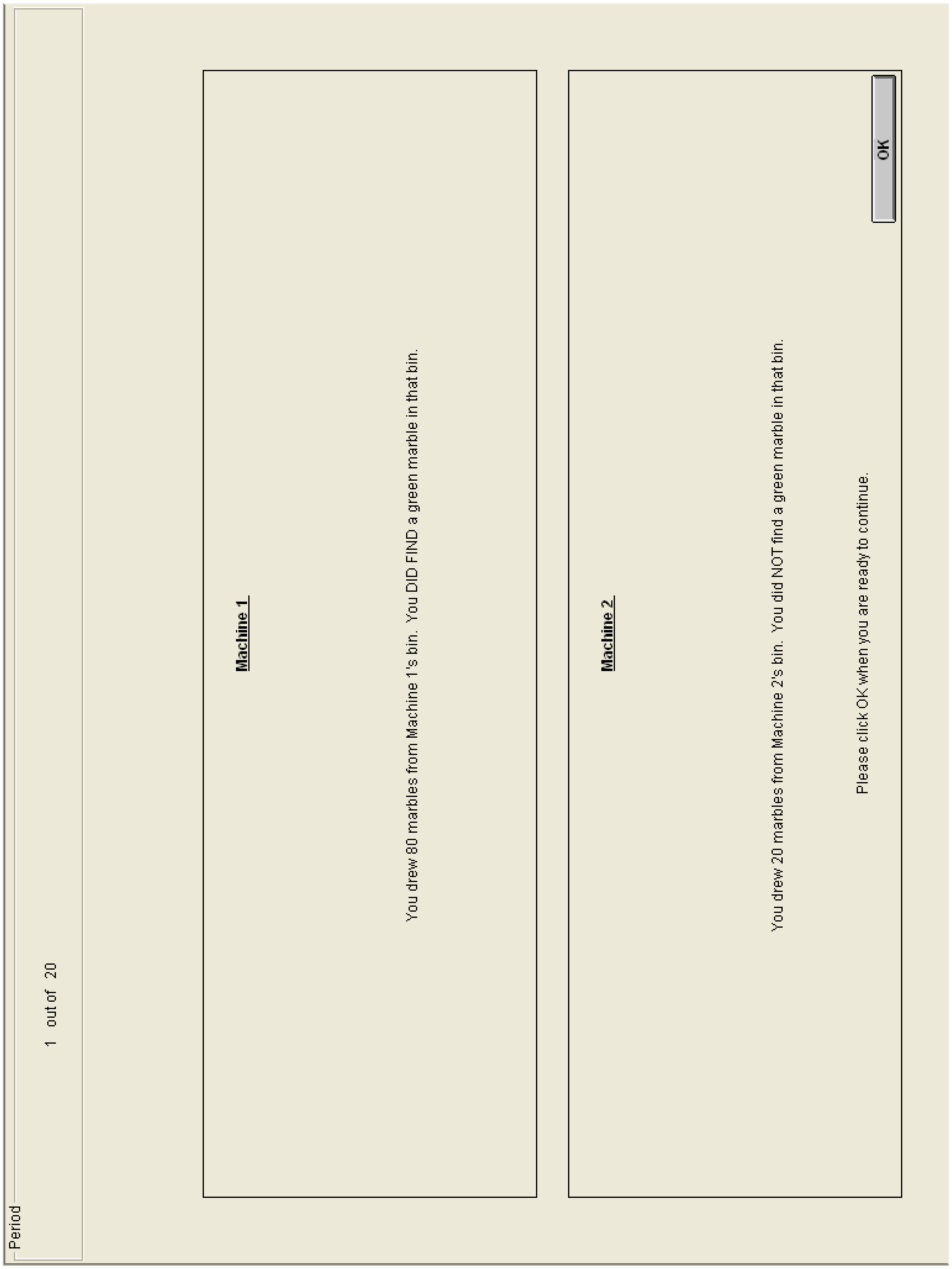


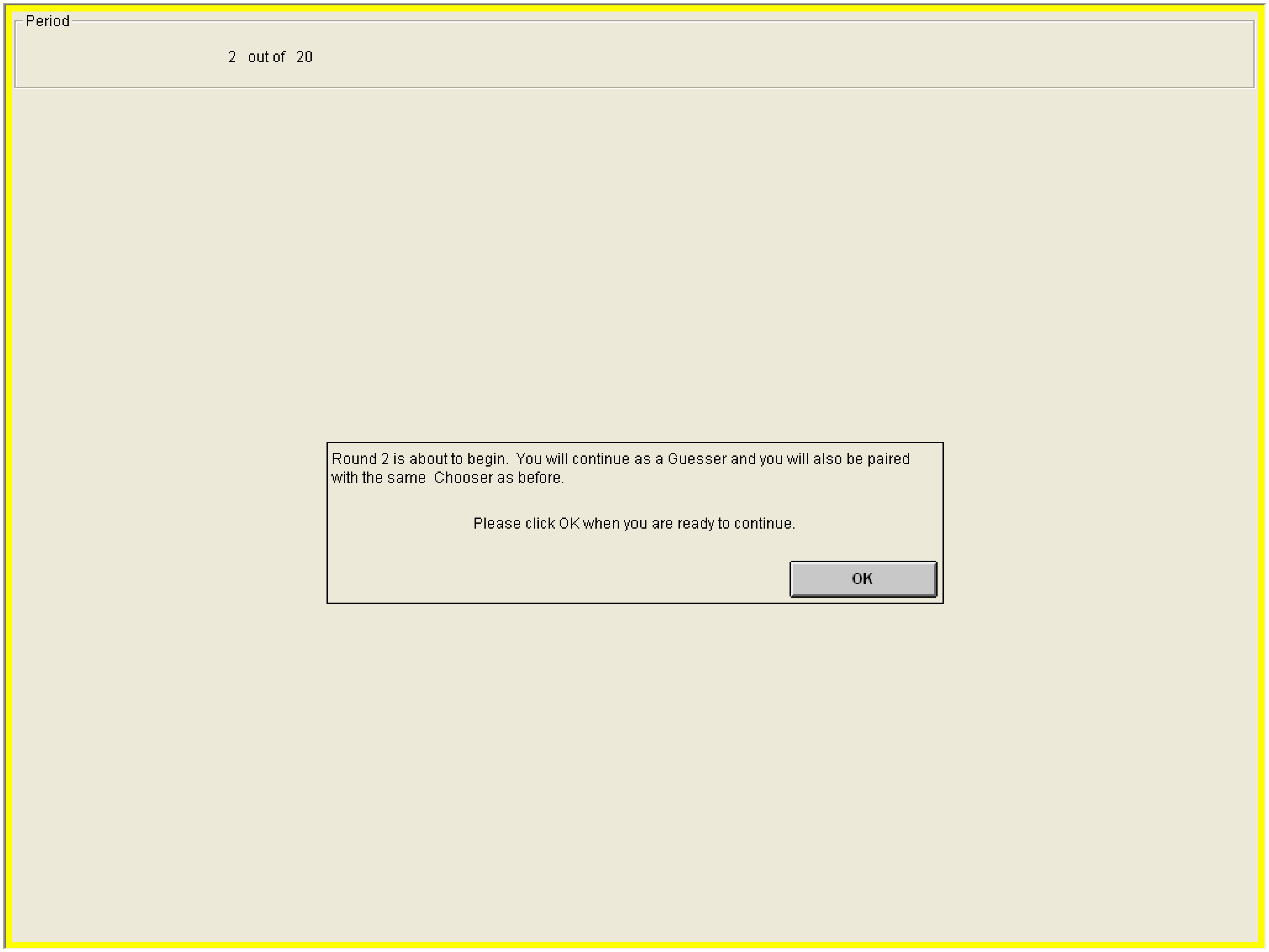

Period
1 out of 20
We are now ready to begin the session. The computer has assigned you to be a Guesser. The computer has also paired you with a Chooser. You will remain in this role and will be paired with the same Chooser for all 20 rounds.
Please click OK when you are ready to continue.
OK


Period
1 out of 20
Reminder:
Not considering possible machine over-rides, there is an 80% chance that Machine 1 will place a blue (non-white) marble in its bin.
Not considering possible machine over-rides, there is an 20% chance that Machine 2 will place a blue (non-white) marble in its bin.
The following questions are designed to help you think through your decision problem. Please think carefully about your answers.
How many marbles do you think the Chooser expects you to draw from Machine 1's bin?
How many marbles do you think the Chooser expects you to draw from Machine 2's bin?
Submit

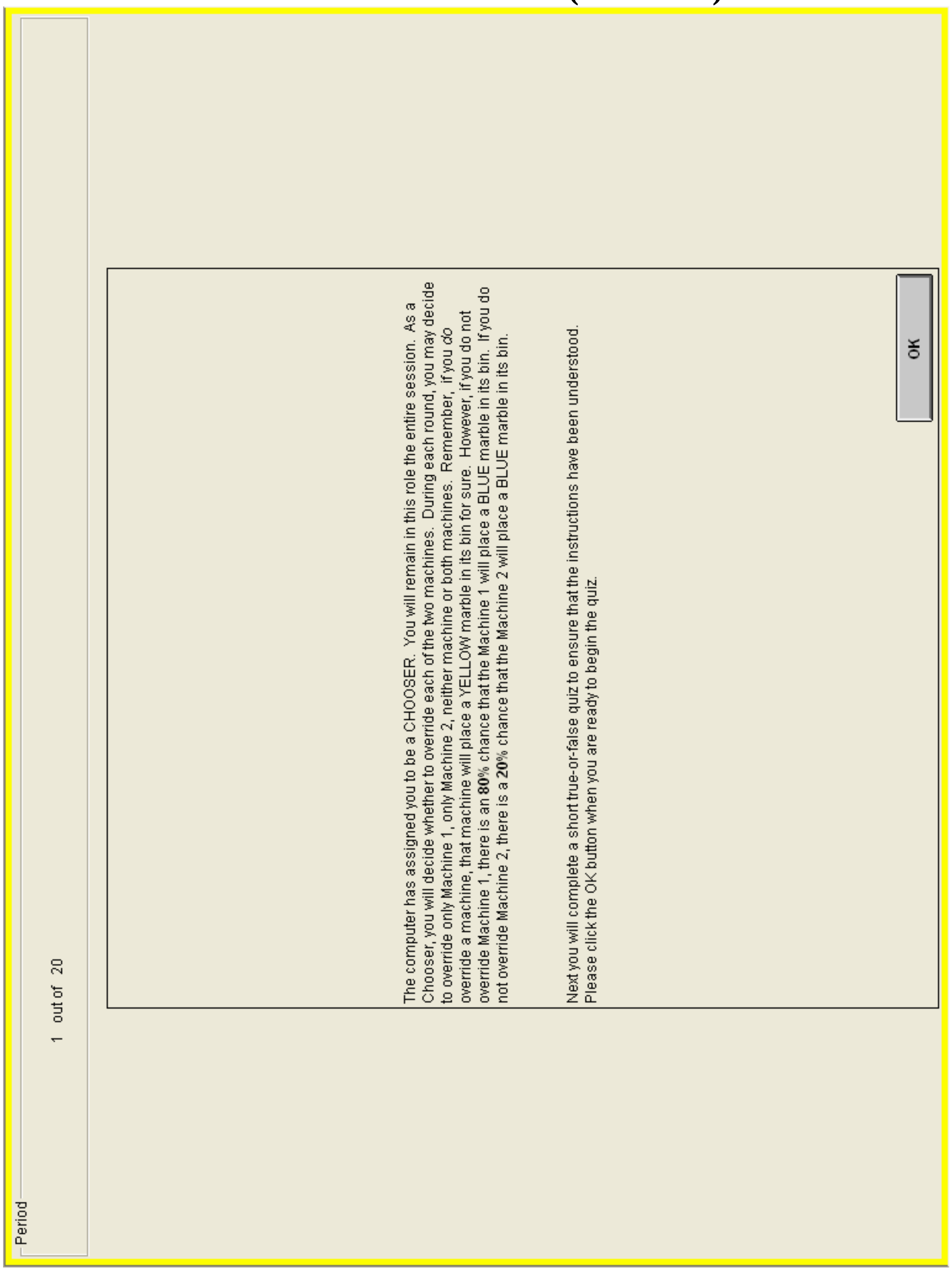

Period
1 out of 20
On the prior screen you stated that you believe Choosers expect you to draw:
100 marbles from Bin 1
and 0 marbles from Bin 2.
How do you think the Chooser will respond to his or her expectations about the number of marbles you will draw from each bin?
What is the likelihood that the Chooser will over-ride Machine 1?
Not at all likely
Extremely likely
What is the likelihood that the Chooser will over-ride Machine 2?
Not at all likely
Extremely likely
Submit

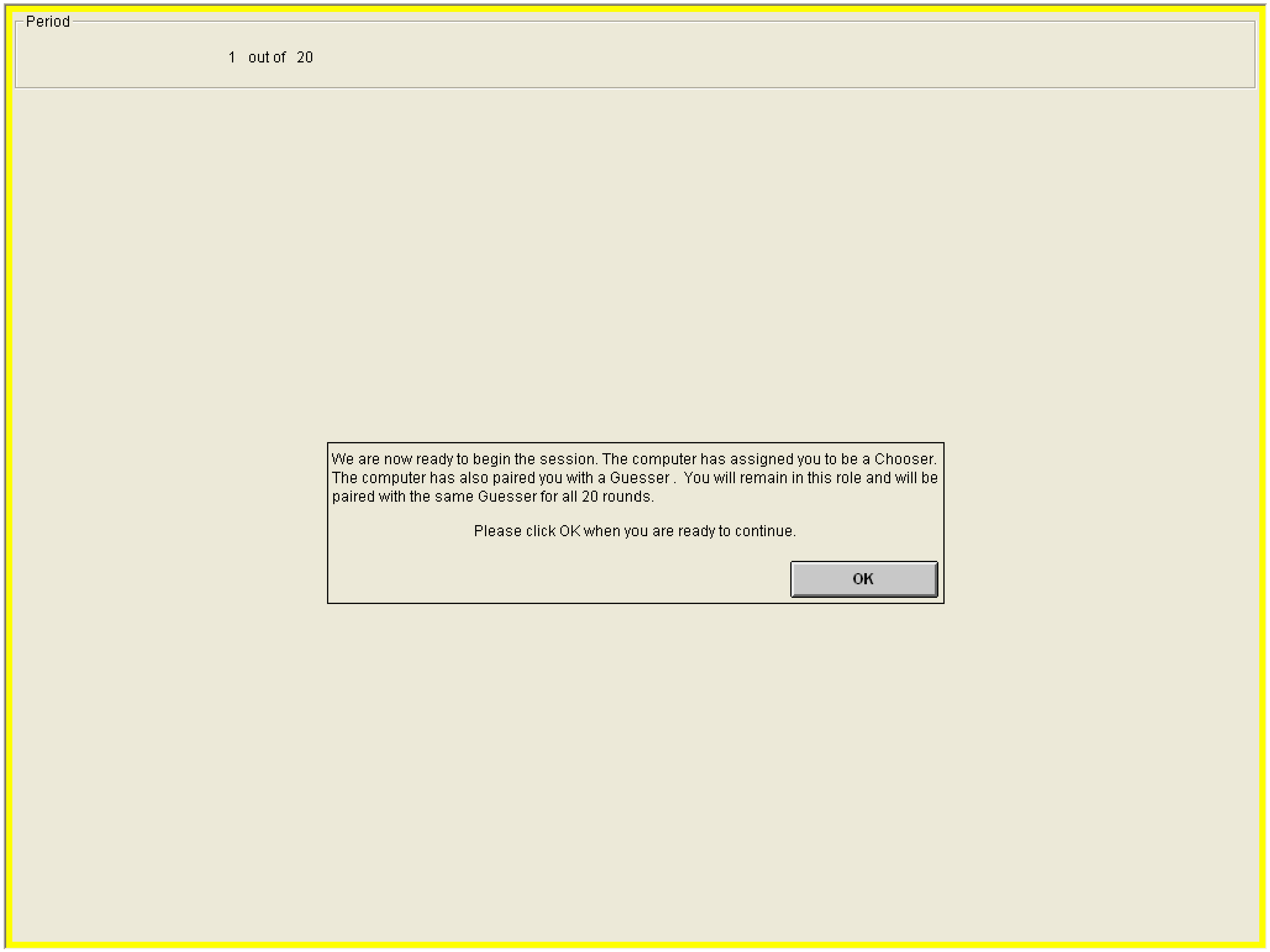

Period
1 out of 20
Reminder:
Not considering possible machine over-rides, there is an 80% chance that Machine 1 will place a green marble in its bin.
Not considering possible machine over-rides, there is an 20% chance that Machine 2 will place a green marble in its bin.
Please specify the number of marbles you would like to draw from each bin and how many you would like to designate as residual marbles. Remember the total must equal 100.
How many marbles do you want to draw from Machine 1's bin?
How many marbles do you want to draw from Machine 2's bin?
How many marbles do you want to leave as residual marbles?
Submit Choices


Period
1 out of 20
Machine 1
You drew 80 marbles from Machine 1's bin. You DID FIND a green marble in that bin.
Machine 2
You drew 20 marbles from Machine 2's bin. You did NOT find a green marble in that bin.
Please click OK when you are ready to continue.
OK


Period
2 out of 20
Round 2 is about to begin. You will continue as a Guesser and you will also be paired with the same Chooser as before.
Please click OK when you are ready to continue.
OK

Z-TREE INTERFACE (CHOOSER)




Period
1 out of 20
We are now ready to begin the session. The computer has assigned you to be a Chooser. The computer has also paired you with a Guesser . You will remain in this role and will be paired with the same Guesser for all 20 rounds.
Please click OK when you are ready to continue.
OK


Period
1 out of 20
Shell 1
Do you want to over-ride Machine 1? If you select yes, you will ensure that a green marble will be placed in the bin. If you select no, there is an 80% chance that the machine will place a green marble in the bin.
Yes, over-ride Machine 1.
No, do not over-ride Machine 1.
Shell 2
Do you want to over-ride Machine 2? If you select yes, you will ensure that a green marble will be placed in the bin. If you select no, there is an 20% chance that the machine will place a green marble in the bin.
Yes, over-ride Machine 2.
No, do not over-ride Machine 2.
Submit Choices

Period

1 out of 20

Machine 1

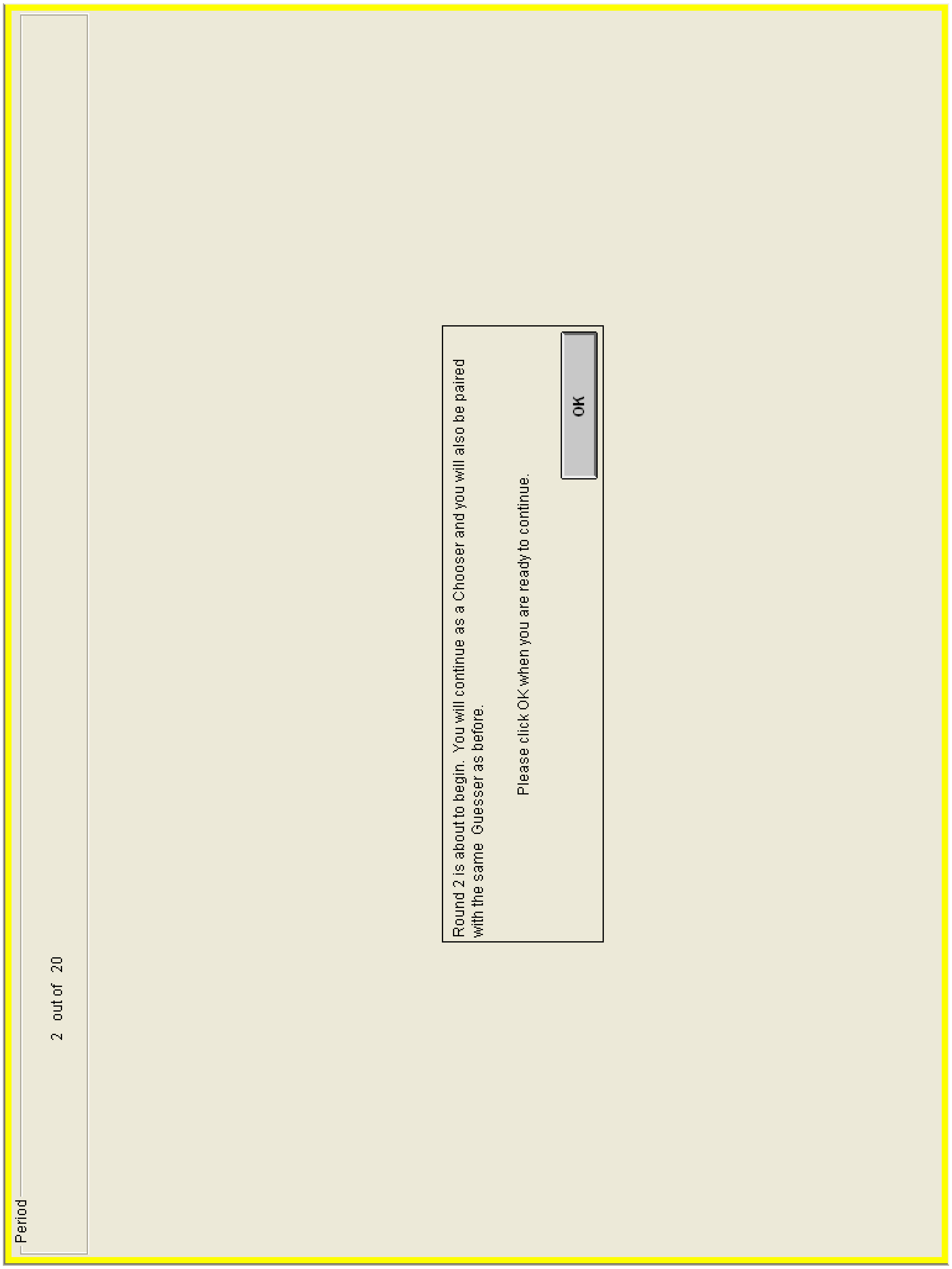
You chose to not over-ride Machine 1. Machine 1 put an green marble in its bin. The Guesser found that green marble.

Machine 2

You chose to over-ride Machine 2 and the Guesser did not find that green marble.

Please click OK when you are ready to continue.

OK


Period
2 out of 20
Round 2 is about to begin. You will continue as a Chooser and you will also be paired with the same Guesser as before.
Please click OK when you are ready to continue.
OK

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Vita

Kendall Bowlin was born in Jackson, Mississippi to George E. and Anne Bowlin. He is married to Mary Elisabeth Bowlin and has one child, Mary Kennedy Bowlin. After receiving a Bachelors of Business Administration in 1998 and a Masters of Accountancy in 1999 from the University of Mississippi, Kendall joined Ernst & Young in Memphis, Tennessee, where he practiced public accounting as a staff and then senior accountant. He has one academic publication: "Experimental evidence of how prior experience as an auditor influences managers' strategic reporting decisions" (with Jeffrey Hales and Steve Kachelmeier), *Review of Accounting Studies*, forthcoming.

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