The Effects of Audit Methodology and Audit Experience on the Development of Auditors' Knowledge of the Client's Business

by

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ABSTRACT

This dissertation examines how differences between the strategic-systems audit approach and the traditional, transaction-based audit approach affect the content and complexity of client business knowledge in long-term memory, how these mental representations develop with experience, and how the representations affect risk assessment. Knowledge of the client's business is essential to conducting an effective and efficient audit, but researchers have devoted little attention to how this knowledge is represented in memory and what effect it has on audit judgment. Moreover, proponents of the strategic-systems approach argue that this approach leads to the formation of a more-complex client business model and results in better audit judgments than the transaction-based approach. The study's results contradict these claims, with the strategic-systems auditors having less-complex models than their TBA counterparts. Also, no experience-related differences were found in the client models, and risk assessments were only weakly affected by content and complexity differences between client models. After a variety of supplemental analyses, it was concluded that there is no evidence from this dissertation to suggest that the SSA methodology does not result in an auditor possessing an enhanced knowledge of the client's business compared to that possessed by an auditor employing a traditional audit approach.

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INTRODUCTION

Recent audit-market pressures have led to "radical and pervasive" (Eilifsen, Knechel, and Wallage 2001) changes to the audit methodologies of some accounting firms. In an effort to reduce audit costs while increasing both an audit's effectiveness and its value to the client, these firms have developed a new audit methodology. The methodology incorporates the analysis of a client's business and strategic risks into client business models that allow the formation of knowledge-laden expectations about the client's financial position and results of operations (Lemon, Tatum, and Turley 2000). In addition to being documented in audit workpapers, some form of these client business models is likely stored in the auditor's long-term memory (Waller and Felix 1984).

The content and complexity of an auditor's mental representation of the client business model is an important topic to study regardless of the audit approach used. Bonner and Pennington (1991) suggest that the development of a client model is crucial to guiding subsequent audit judgments and that it takes about 3.5 years of experience to develop a well-structured model. Bédard and Chi (1993) propose that auditors seek a context of client data within which they can condition their complex audit judgments. Despite the importance of these models, researchers have yet to empirically examine how client models develop with experience. The investigation of client models is now even more important given the new methodology's increased emphasis on the application of an in-depth knowledge of the client's business. This dissertation contributes evidence concerning this important, but largely unexplored area of auditor expertise.

A firm's audit methodology can affect both an auditor's knowledge and judgment performance (Libby and Luft 1993). Therefore, we may expect any methodological

differences to influence auditors' client models and the audit judgments based on these models. The new strategic-systems audit (SSA) approaches differ from the traditional, transaction-based audit (TBA) approach in at least two ways.[1] First, only after the SSA auditor has gathered in-depth client business knowledge does she begin to focus on the account balances and the transactions that comprise them. Thus, the SSA is a top-down approach, and is considered an audit of the client's business which results in an opinion on the financial statements (Salterio and Weirich 2002). In contrast, the TBA takes a bottom-up approach, with the auditor first focusing on the client's transactions and accounts and then working up to the financial statements, ultimately resulting in an opinion on the financial statements. Second—and perhaps most important—the SSA's enhanced client knowledge base constitutes part of a chain of substantive audit evidence, whereas in a TBA, the client knowledge serves mainly as background to the planning, testing, and completion procedures of the audit. Overall, knowledge of the client's business is used more extensively in an SSA than in a TBA. Both approaches obviously result in an opinion on the client's financial statements, but the SSA focuses effort and evidence gathering on the client's high-level systems dynamics, whereas the TBA focuses on the client's low-level accounting systems and transactions (Bell, Marrs, Solomon, and Thomas 1997).

Studying the effects of these methodological differences on the development of auditors' client models is important for several reasons. Strong claims have been made regarding the superiority of the SSA over the TBA. For instance, Bell et al. (1997) assert

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[1] In this paper, the term strategic-systems audit, or SSA, will be used to refer to the new audit methodologies, such as KPMG's *Business Measurement Process* and Ernst & Young's *Audit Innovation*. The term transaction-based audit, or TBA, will be used to refer to the more traditional, audit risk-based methodologies, which are still in use by the vast majority of public accounting firms.

that the "use of the top-down, aggregative, strategic-systems lens *increases the likelihood* that the auditor will have obtained a sufficient understanding of the client's business and industry for the purpose of conducting a financial-statement audit" (p. 7, emphasis added). Erickson et al. (2000) make a similar claim in their case study of the Lincoln Savings and Loan audit failure. In his *Foreword* to the Bell et al. monograph, Kinney states that many of the authors' claims of SSA's superiority "are controversial, and should be subjected to systematic inquiry" (p. *vi*). By investigating how the content and complexity of client models differ between auditors applying SSA and TBA methodologies, and how these differences affect auditors' risk assessments, this dissertation contributes needed empirical evidence related to these claims.

Several recent studies have investigated the effects of methodology differences on auditors' knowledge (Kopp and O'Donnell 2005) and judgment (Kotchetova 2002; O'Donnell 2003; O'Donnell and Schultz 2003; Kopp and O'Donnell 2005), but all of them manipulated methodology in a laboratory setting. Simply manipulating audit methodology in a laboratory setting, however, is not sufficient for determining how years of experience using one methodology affects an auditor's knowledge and, ultimately, his judgment. This is because methodology affects judgment by interacting with experience, knowledge, and ability (Libby and Luft 1993). Therefore, the designs of these studies make it difficult to draw firm conclusions about their results, since important determinants of an auditor's judgment were not examined. This dissertation overcomes these limitations—and therefore makes an important contribution to this stream of research—by examining the knowledge and judgment of auditors with roughly three years of assurance experience employing one of three audit methodologies that vary in

the extent to which they incorporate SSA information and analysis.

These critical features of the research design permitted the investigation of three related research questions. First, what are the effects of audit methodology on the development of auditors' client models? Second, what are the effects of audit experience on the development of these client models? Finally, do methodology- and experience-related differences in these client models result in different risk assessments? In general, this dissertation examines the relations between audit experience, audit methodology, an auditor's client business knowledge, and resulting audit judgments. It is important to note that this dissertation cannot—and was not intended to—determine which type of audit methodology is most effective, but it was designed to provide evidence on how knowledge and judgment varies across methodologies.

To provide the data needed to answer these research questions, 88 experienced auditors from six firms that apply an SSA methodology, a TBA methodology, or a hybrid of the two (classified as the SSA-TBA methodology) studied 60 pieces of information about a fictional audit client, then recalled this information from memory, and also used it to make risk assessments and write a memo justifying their assessments. Thirty university students with limited audit experience completed the same set of tasks. The resulting data were used to make inferences about the content and complexity of the participants' client models and the effects of model differences on the risk assessments.

Contrary to expectations, the data revealed that TBA auditors had better developed client models than the SSA auditors. Specifically, the TBA auditors recalled significantly more client facts than the SSA auditors and also possessed significantly more-complex relational knowledge than their SSA counterparts. The SSA-TBA auditors

had client models that were statistically indistinguishable from the TBA auditors. In addition—and also unexpectedly—the experienced auditors did not recall significantly more facts than the auditing students, nor did they display significantly more-complex relational knowledge than their less-experienced counterparts. Even removing the SSA and SSA-TBA auditors from the experienced group because they had similar levels of task-specific experience to the students did not alter the experience-related findings: the students' recall performance and knowledge complexity were not significantly different from those of the significantly more-experienced TBA auditors.

Finally, weak support was found for the relation between auditors' client models and their risk judgments, although supplementary analyses revealed that the SSA-TBA auditors made significantly higher risk assessments than one or both of the other two groups of auditors on two of eight issues. This latter finding can be interpreted as being somewhat consistent with recently introduced changes to assurance standards, which require auditors to employ an approach similar to the hybrid approach used by the SSA-TBA auditors in this study, in the hope that such an approach will lead to better risk assessments than those that would be made using a pure TBA approach.

Because of the puzzling results of this dissertation, its findings should be interpreted with caution. A large body of empirical evidence in accounting supports the theory (Libby and Luft 1993) that experienced auditors possess a larger body of better organized knowledge than their junior counterparts (e.g., Weber 1980; Bonner and Lewis 1990; Frederick 1991; Tubbs 1992; Libby and Tan 1994). So, the failure to replicate those findings here likely has much more to do with the limitations of this dissertation's research design than it does to the possibility that less-experienced students actually

possess client business models similar to those of more-experienced auditors.

Similarly, because even the students displayed significantly better developed client models than the SSA auditors, firmly concluding that TBA and SSA-TBA methodologies produce auditors with better client business knowledge than a pure SSA methodology is not possible. It seems that there may have been something peculiar about the sample of SSA auditors in this study that caused such unexpected findings. Unfortunately, the opportunities for future research to follow-up on these unexpected results are severely limited by the fact that international and Canadian assurance standards now *require* auditors to apply a methodology very similar to those used by the SSA-TBA auditors in this study. Therefore, all firms must now incorporate SSA-type evidence and analyses into their audit approaches, making it impossible to investigate the types of SSA vs. TBA research questions that were examined in this dissertation. These changes also make such questions somewhat moot, because standard setters have clearly decided that an SSA-based methodology is better than a pure TBA approach.

This dissertation proceeds with a chapter that reviews the relevant literature from accounting and psychology. Chapter 2 then synthesizes this literature for the purpose of developing the dissertation's hypotheses. The research design is then described in Chapter 3 and the results of the hypothesis tests are presented in Chapter 4. Chapter 5 further explores the results of the hypothesis tests by presenting a variety of supplemental statistical analyses. Chapter 6 concludes the dissertation with discussion of its findings and a delineation of its limitations.

CHAPTER 1 - LITERATURE REVIEW

Introduction

The purpose of this chapter is to review the various streams of audit and psychology literature that have a direct relation to this dissertation's research questions. The first section describes the SSA approach in depth and identifies key differences between this approach and the TBA, differences that may affect auditors' knowledge development and judgment. The second section details the determinants of auditor judgment performance which are relevant to this study, namely the audit environment, audit experience, and auditor knowledge. The final section reviews the cognitive psychology literature on schema theory, which presents one view of how knowledge is encoded in, stored in, and retrieved from memory. This section also reviews a variety of theoretical and empirical audit judgment studies which build on the foundations of schema theory and provide insight into the structure of knowledge in an auditor's memory and how these knowledge structures affect audit judgment. A recent series of studies comparing the effects of differences between the SSA and TBA methodologies on auditors' knowledge and judgment are also discussed and summarized. The key findings from these streams of literature will then be assimilated in Chapter 2, where the dissertation's hypotheses are developed.

Strategic-Systems Auditing

Introduction

Strategic-systems auditing (SSA) is a relatively recent advance in financial statement auditing. As such, there is relatively little extant literature describing either the nature of the approach or the practical application of the approach. The primary source of

information is a monograph by Bell et al. (1997), which describes the nature of and concepts underlying an SSA while also providing detailed insights into how KPMG is applying this approach in practice. Complementing this monograph is an SSA primer by Salterio and Weirich (2002), which compares an SSA with the traditional TBA, details the phases of an SSA, and introduces some of the tools used in this approach. Lemon et al. (2000) published a monograph that describes recent developments in the methodologies of several international accounting firms, including those adopting the SSA approach. Eilifsen et al. (2001) present a descriptive field study comparing the SSA and TBA. Erickson et al. (2000) describe a case study in which they argue an SSA could have been very helpful in detecting management fraud and averting an audit failure. Finally, Ballou et al. (Ballou, Earley, and Rich 2004), Kotchetova (2002), and O'Donnell and various colleagues (O'Donnell 2003; O'Donnell and Schultz 2003; Kopp and O'Donnell 2005) present early empirical evidence on the effectiveness of the SSA approach.[2]

Overview of the SSA approach

The SSA approach has four major components: strategic analysis, business process analysis, risk assessment, and business measurement. Each of these components is described in detail below. This dissertation focuses primarily on the strategic analysis phase of the approach and, to a lesser extent, business process analysis and how these phases affect SSA auditors' knowledge development and judgment performance. Details on the latter two components of the approach are presented mainly to provide a thorough

[2] Several teaching-oriented cases have also been written to demonstrate how the SSA approach can be used in practice (Bell and Solomon 2002). The focus of this portion of the literature review is on the theoretical basis and general nature of the approach, thus these cases are not reviewed here because they detail case-specific applications of the SSA approach.

overview of the new audit methodology.

Salterio and Weirich (2002) note that the SSA is an evolution in audit practice akin to past advances, such as the decision to begin auditing the income statement in addition to the balance sheet, or the conception of the audit risk model. Bell et al. (1997) argue that this latest evolution is necessary because it allows auditors to "embrace and master, rather than simplify, the complexity inherent in the [globalized] economic web of interrelationships of which the client organization is a part" (p. 1). The "strategic" in strategic-systems auditing refers to the client's business strategy, which has been defined as "how a company creates value by differentiating its products or services from its competitors" (Simmons 1992). Bell et al. (1997) define an SSA's second component—a system—as a "collection of parts that interact to function as a whole", with the relevant parts being the client's strategic management process, its business processes and related controls, its information systems, and its risk management process. To comprehend a system one needs to understand not only its parts, but the interrelationships among the parts and how the system interacts with the larger environment in which it operates (Salterio and Weirich 2002). It is this attention to a system's interrelationships and interactions—instead of simply the components of a system—that distinguishes the SSA from the TBA.

Knowledge of the client's business

In accordance with generally accepted auditing standards, all auditors must use knowledge of the client's business in the planning, testing, and completion phases of the

audit (Canadian Institute of Chartered Accountants (CICA) 2001, Section 5140).[3] The amount and type of knowledge gathered is left to the auditor to judge based on each client's circumstances, but in a TBA this knowledge typically includes: past financial statements; a brief history of the client; a summary of its operations; an organizational chart; and a list of major competitors, suppliers, and customers. Salterio and Weirich (2002) note, however, that if the auditor acquired all of the knowledge of the client's business as outlined in professional auditing standards, "s/he would have most of the information necessary for a SSA audit" (p. 13). Thus, in principle, auditing standards do not discourage the TBA auditor from acquiring the same amount and types of client-environmental facts as the SSA auditor. Firms' audit manuals and leading auditing textbooks, however, suggest that in practice the SSA auditor may routinely gather a larger quantity and wider array of facts than the TBA auditor. Therefore, the primary distinction between the client business knowledge gathered by a TBA auditor and that gathered by an SSA auditor is not that the latter *necessarily* collects more client knowledge than the former. Rather, the advantage of the SSA is that it organizes this knowledge into a logical model that constitutes part of a chain of substantive audit evidence (Salterio and Weirich 2002). In contrast, the TBA auditor generally just gathers and lists the client knowledge without assembling it into a readily interpretable framework. Moreover, this knowledge is generally not considered audit evidence, but merely information that will be used to plan the nature, extent, and timing of evidence to be gathered.

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[3] Section 5140 of the CICA Handbook was replaced by Section 5141 in May 2005. The participants who supplied the data for this dissertation did so when the standards and guidance of Section 5140 were still in effect.

Strategic analysis

Integral to the formation of this SSA model is an understanding of the client's business strategy. In a strategic analysis, the auditor evaluates the client's industry, the client's strategy to attain a sustainable competitive advantage in that industry, the risks that threaten the strategy's success, and the client's responses to these risks. Tools from the strategy literature, such as PEST (Political-legal, Economic, Social, and Technological) analysis and Porter's Five Forces Model (Porter 1980), are commonly used by an SSA auditor to aid the evaluation.[4] Upon completion of the strategic analysis, the SSA auditor will have a framework for understanding the client's strategic business risks (see Figure 1).[5] A business risk is a threat that an event or action will adversely affect an organization's ability to achieve its business objectives and execute its strategies (Lemon et al. 2000). Improperly managed business risks can ultimately have a serious impact on a client's operations and financial position, so a thoroughly conducted strategic analysis is the first major step in forming expectations about the client's financial statements. Indeed, strategic analysis can be so useful to the auditor that the CICA's Auditing and Assurance Standards Board (AASB), in conjunction with the International Federation of Accountants (IFAC), has recently (May 2005) issued new assurance standards that require analysis similar to this on all audit engagements.

Business process analysis

The business process analysis provides the auditor with an in-depth understanding of the client's key business processes. A business process is a structured set of activities,

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[4] The five forces are competitive pressures coming from: the threat of new market entrants; the threat of substitute products or services from industry outsiders; the rivalry among existing industry competitors; supplier-client collaboration and bargaining; and client-buyer collaboration and bargaining (Porter 1980).
[5] Note that Figure 1 is not a generic framework, but rather one that is specific to a large retail organization.

which produces a specific output and creates value for the organization. For example, a retail client's key business processes might include brand and image delivery, product and service delivery, customer service delivery, and customer sales. In turn, each process will have several sub-processes, such as customer service policies, store staffing, operational standards, customer loyalty, and after-sales service within the customer service delivery process. It is important for the auditor to gain a basic understanding of each of the client's processes and sub-processes, but special attention is devoted to the analysis of key processes.

The auditor chooses key processes by subjectively weighing at least three factors: (1) the strategic relevance of the process, that is, how vital the process is to achieving a client's strategic objectives, (2) the process's inherent business risk, that is, how likely it is that a business risk will occur in the process, ignoring the effects of related controls, and (3) the strength of the client's control environment, that is, management's attitude, awareness, and commitment toward the importance of controls. Once chosen, the auditor studies each key process to gain an understanding of significant process objectives and related business risks, the controls in place to mitigate these risks, and the financial-statement implications of these risks and controls. To assist with the generation of financial-statement expectations, the auditor identifies classes of transactions within each process that pose differential misstatement risks (e.g., routine versus non-routine transactions and accounting estimates) and relates these risks to specific account balances. Upon completion of the business process analysis, the auditor has an updated understanding of (1) how the client creates value, (2) whether the client has effectively aligned the process activities with the business strategy, (3) the significant process risks

that threaten the achievement of the business objectives, (4) how effective the processes are at controlling the significant strategic and process risks, and (5) the financial-statement implications of process activities and their related risks and controls (Bell et al. 1997). This detailed knowledge of the client's business allows the auditor to develop expectations about its operating results and financial condition.

Ballou et al. (2004) present experimental evidence of how the strategic-positioning aspect of the auditor's business process analysis can hinder audit effectiveness. They examine the effects of changes in the strategic positioning of one critical client business process on the auditor's evaluation of another (unrelated) critical business process. Based on prior findings in the cognitive psychology and auditing literatures, the authors predicted that auditors would unduly weight (ignore) problems in one critical business process when the strategic positioning of an unrelated process trailed (matched) industry norms. Consistent with these predictions, the strategic positioning of a grocery retailer's brand-and-image-delivery process negatively affected auditors' evaluations of evidence regarding the logistics-and-distribution process.

Risk assessment

The next SSA phase is risk assessment, which is actually more of a continuous process than a static one, in contrast to risk assessment in a TBA where inherent risk, control risk, and detection risk are assessed in the planning phase and then left unchanged for the remainder of the audit (unless information arises that causes the auditor to revise them). SSA risk assessment is an iterative process of considering and reconsidering strategic risks, business risks, and process risks and relating these risks to overall audit risk. The SSA auditor uses the knowledge gained from the strategic analysis and the

business process analysis, combined with an appraisal of the reasonableness of management's perception of and assumptions underlying its assessments of the potential impacts of the risks, to judge whether management has considered all significant business risks and how it has dealt with them. This latter analysis includes gaining an understanding of the management controls in place to reduce these risks and also testing the effectiveness of the controls. The auditor then groups any residual strategic and process risks (i.e., risks that management controls have not reduced to a sufficiently low level) based on the financial-statement assertions to which they relate and generates expectations of how the risks might be manifested in the financial statements. This integrated knowledge of residual risks and financial-statement expectations provides a basis for assessing the validity of the client's financial-statement assertions. Just as in a TBA, the results of this assessment determine the need for additional audit evidence to support an opinion on the validity of the assertions.

Kotchetova (2002) supplies evidence concerning the potential effectiveness of strategic analysis in assisting with risk assessment and audit planning. She proposes that—compared to the traditional understanding of the client's business— strategic analysis will improve an auditor's ability to identify various types of client risks, thus ultimately leading to better audit planning decisions. She provided participants with varying levels of strategic information (from none to a combination of strategy content and strategy processes) regarding a client and then asked them to make risk judgments and substantive planning decisions. In some cases strategic analysis led to better risk judgments, but in others a basic understanding of the client's business led to judgments that were just as accurate as those made using extensive strategic information. Moreover,

participants with just the basic client understanding made better substantive planning decisions than those with extensive strategic information. This dissertation addresses similar research questions using a different research design, so it may be able to provide insights into these somewhat surprising results.

In a related series of studies, O'Donnell and some colleagues (O'Donnell 2003; O'Donnell and Schultz 2003; Kopp and O'Donnell 2005) investigated how differences between the SSA and TBA approaches affected risk assessments in various contexts. O'Donnell (2003) provided undergraduate accounting students with computer-system control information organized with either a process focus, as in an SSA audit, or with a control-objective focus, as would be typical in a TBA audit. The participants in the process-focus condition found the task less complex than those in the objective-focus condition, and also displayed higher primacy bias and poorer recall performance. O'Donnell attributed these results to the fact that the process-focus condition provided the participants with the control information in a way that increased the clarity of the information compared to the way it was presented in the objective-focus condition, thus resulting in decreased task complexity. The enhanced clarity in the process-focus condition also required less effortful encoding of the information, thus explaining the higher primacy bias and lower recall performance among the process-focus participants. O'Donnell concluded that differences between these SSA and TBA approaches to organizing information have differing effects on auditors' cognition during the acquisition of client knowledge, and suggested that future research should examine these differences among experienced auditors. This dissertation provides evidence directly related to these issues.

O'Donnell and Schultz (2003) examined how SSA vs. TBA differences in the way client information is presented to auditors affected their ability to identify and assess risks in an analytical-procedures planning context. They presented experienced auditors, all of whom were seniors from a TBA firm, with client information organized with either a process focus, as in an SSA audit, or a transaction-cycle focus, as in a TBA audit. The auditors were then asked to use analytical procedures to identify risks and rate the level of misstatement risk for the engagement. Results showed that the auditors in the SSA condition identified more risks and rated misstatement risk at a higher level than auditors in the TBA condition, indicating that SSA vs. TBA differences can affect an auditor's decision performance. The authors concluded by suggesting that future research examine other dimensions of the association between knowledge acquisition and decision performance. This dissertation does so by investigating the effects of methodology differences on auditors' knowledge acquisition, content, and organization, as well as the effects of any resulting knowledge differences on audit judgment.

Finally, Kopp and O'Donnell (2005) examined whether organizing internal-control information using a business-process focus instead of a control-objective focus resulted in better category knowledge and improved internal-control evaluation. Eighty-two undergraduate accounting students with no previous internal-control knowledge were trained to evaluate internal controls using either a process focus or a control-objective focus. They were then given a case and were asked to identify as many control strengths and weaknesses as they could. Finally, they were asked to sort 20 controls into four unlabelled categories. Results showed that category knowledge was significantly greater for participants in the process-focus condition and that these participants identified

significantly more control issues than those in the objective-focus condition. Additional analysis showed that the process-focused task structure improved issue identification beyond the benefits provided by stronger category knowledge. This dissertation examines related research questions, but uses auditors with actual practice experience employing SSA or TBA audit approaches. Thus, it will provide information that will be useful for comparing whether the knowledge and judgment effects found in the lab using novice participants also extend to experienced field auditors.

In summary, this series of SSA vs. TBA studies shows that organizing client information using a process focus, as in an SSA approach, instead of an objective focus, as in a TBA approach, results in less-complex tasks (O'Donnell 2003), better knowledge (Kopp and O'Donnell 2005), and improved risk judgments (O'Donnell and Schultz 2003; Kopp and O'Donnell 2005). The Kotchetova (2002) results, however, are somewhat inconsistent with this pattern, as she found that in some cases TBA information led to better judgment performance than SSA information. This dissertation investigates related research questions using auditors with actual experience applying SSA or TBA approaches in the field. Thus, it should provide empirical evidence to complement the results of these studies that manipulated methodology in the lab.

Business measurement

The fourth SSA phase is business measurement, which integrates the preceding strategic, process, and residual risk analyses to develop expectations about the contents of the financial statements. The overriding goal of this phase is to carefully consider whether these expectations are consistent with the operations and financial position portrayed in the client's financial statements. To achieve this goal, the auditor performs

several procedures, including (1) a review and evaluation of significant accounting policies, particularly revenue recognition policies, (2) a comparison of the client's performance with its industry peers, primarily using ratio analysis, (3) an analysis of the client's earnings quality, (4) an integrated analysis of linkages among financial and nonfinancial performance measures, and (5) an assessment of the fairness of the financial statement presentation and disclosure. The very rich client knowledge base gained from the SSA approach increases the effectiveness of these procedures, in particular the auditor should be in a very strong position to evaluate non-routine accounting transactions, accounting estimates, measurement uncertainty disclosures, and going-concern issues (Salterio and Weirich 2002). At the conclusion of the audit, the SSA auditor will have constructed a fully integrated client business model, containing all of the information collected and assimilated through the application of the four principles described above and through his mental or more formal business simulation processes (Bell et al. 1997). This completed model is the basis for the final review of the adjusted financial statements and the final assessment of the client's ability to continue as a going concern.

Summary of the SSA approach

There are four interlocking and iterative phases in a strategic-systems audit (Salterio and Weirich 2002):

Phase 1: Strategic Analysis – The auditor analyzes the client's business strategy, including the environment in which it operates, whether it has a sustainable competitive advantage, what its business risks are, and how the risks are being managed.

Phase 2: Business Process Analysis – The auditor identifies business processes that are key to the client achieving success. She analyzes these processes in detail to gain a deep understanding of significant business risks and mitigation strategies, including performance metrics and management controls.

Phase 3: Risk Assessment – This is a continuous process that considers the reasonableness of the client's assessments of its business risks, the adequacy of management's controls to minimize the risks, and the residual risks remaining after controls have been applied.

Phase 4: Business Measurement – Building on the evidence gathered in the previous phases, the auditor evaluates the client's revenue recognition policies, assesses its quality of earnings, analyzes the consistency of the client's financial and nonfinancial performance measures, and reviews any going-concern issues.

This dissertation focuses primarily on the first phase's effects on auditors' knowledge development and judgment, with a lesser focus on the second phase. The third and fourth phases here receive only expository attention.

Contrasts between the TBA and SSA approaches

There are at least two significant differences between an SSA and the traditional TBA (see Table 1 for a summary of major differences between the two approaches). First, the SSA auditor gathers knowledge of the client's business and logically arranges it into a client business model that highlights the interlinked activities carried out within the client, the external forces that bear upon the entity, and the business relationships with

external organizations (Bell et al. 1997). Moreover, this enhanced knowledge base constitutes part of a chain of substantive audit evidence that can be relied upon in forming an audit opinion, unlike the client knowledge gathered in a TBA, which serves mainly to inform the planning, testing, and completion procedures of the audit.

Second, and most important, the SSA approach has a top-down, holistic, business-risk orientation. It guides the focus, breadth, and depth of the auditor's knowledge acquisition, and the integration of business knowledge into expectations about financial-statement assertions. It focuses the auditor's assessment of risk through a *broad* strategic-systems lens, which directs the auditor's attention to the client's systems dynamics (Bell et al. 1997). In contrast, the TBA is a bottom-up, disaggregative, audit risk-based approach that focuses the auditor's assessment of risk through a *finer* accounting lens, which directs her attention, and her related assessment and testing activities, to the nature of account balances, classes of transactions, and properties of the client's accounting system for the purpose of assessing the risk that financial-statement assertions are materially misstated (Bell et al. 1997). The SSA auditor, however, does not initially focus on transactions and balances, which he views as the end product of the client's business strategy and the processes used to effect this strategy. Instead, only after gathering and organizing knowledge of the client's strategy and core processes does he focus on accounting transactions and related balances (Salterio and Weirich 2002). Throughout their monograph, Bell et al. argue that the use of a top-down, aggregative, strategic-systems lens increases the likelihood that the auditor will have obtained a sufficient understanding of the client's business and industry, thereby reducing the risk that audit procedures applied to specific high-risk transactions will be prematurely truncated. They

conclude their monograph with this claim (Bell et al. 1997, p. 71):

> The [transaction-based] approach assumes that accounting and auditing knowledge plays the primary role in forming audit judgments, and implicitly de-emphasizes the role of knowledge about the business. The risk-based strategic-systems approach reflects the systems-thinking view that to audit assertions effectively, the auditor must comprehend the client's whole business environment and interpret the role of significant transactions from this business knowledge frame—the broader context infuses meaning into the parts.

Application of the SSA approach

Eilifsen et al. (2001) present the first (externally peer-reviewed) descriptive evidence of the application of the SSA approach in practice. They conducted a field study of the 1997 KPMG audit of a state-owned bank in the Czech Republic, which was the first year that KPMG applied their *Business Measurement Process* (their version of the SSA methodology) to this client. The researchers compared and contrasted the conduct of and evidence from this audit with that from previous years' audits, which they note were textbook applications of a TBA's substantive testing with some reliance on internal controls and performance data.

KPMG's risk assessment of the bank changed significantly in 1997. In prior years, audit planning focused on risks related to loan management, investment management, and regulatory compliance. As a result of applying the SSA approach in 1997, the audit team de-emphasized certain of these risks, concluding that there were no significant residual risks requiring substantive testing. The new approach also led them to conclude that other risks were of greater significance than they had been assessed in the past. The

audit team emphasized that these changes in risk assessment were due to their better *understanding* of the bank's conditions and environment rather than to any specific changes in its *actual* operations or environment. Also, by broadening their view of risks to include those related to the bank's strategy, they identified several process, political, social, and technological risks that had not been noted in the past.

The audit workpapers reflected a distinct shift from substantive evidence to evidence concerning risks, their related controls, and key performance indicators. KPMG relied much less on evidence from the documentation of routine transactions than in the past, instead relying on corroborative interview evidence, available performance measures, and assessments of management's handling of exceptions. Also, relying on key business processes and linking business risks to specific audit risks allowed them to significantly decrease substantive testing, while focusing the testing that was done on the banks more-complex transactions and particularly risky loans. The audit team noted that the SSA's enhanced client business knowledge and risk assessment provided far more evidence about risks and potential financial statement errors than did the much larger quantity of relatively shotgun-like substantive test evidence gathered in past years.

Total engagement hours decreased by 9.5 percent from prior years, with the team's audit managers forecasting a further 20 percent reduction in future years. The audit team held more than ten biweekly planning and review meetings, which were attended by all available team members, including specialists. The information shared at these meetings facilitated the coordination of risk assessment where key processes and activities were linked to other areas of the engagement. Team members claimed that the new approach enabled early identification of problems and the involvement of the entire

team permitted a proactive response.

Overall, the claimed advantages of the SSA methodology—even in its first year of application—were apparent in KPMG's audit of the bank. The strategic-systems lens focused the auditors' attention on important social, political, economic, technological, and process risks that had been ignored in the past, while simultaneously reducing the attention paid to audit objective-based risks that were the focus of prior years' audits. In addition, the auditors significantly reduced the substantive tests of routine transactions and account details, replacing them with interview data, performance measurements, and tests focusing on only the most-complex transactions and riskiest loans. Finally, engagement hours were reduced by almost 10 percent, there was an increased use of interim audit work, and the audit team met much more frequently than in the past, thus facilitating improved intrateam communication. The researchers caution, however, that the stated impressions of the audit team members must be weighed carefully, since they are subjective and likely self-serving[6], perhaps reflecting the novelty of the new methodology rather than actual quality improvement.

Would an SSA have averted this audit failure?

Erickson et al. (2000) published a case study of the Lincoln Savings and Loan (LSL) audit, relying heavily on deposition testimony and audit working papers to study

[6] An individual who is motivated to reach a desired conclusion may rely on a biased set of cognitive processes to reach such a goal (Kunda 1990). That is, the individual searches memory for those beliefs and rules that could support their desired conclusion. The individual often does not realize that that their reasoning process is biased by their goals (Kunda 1990). In the context of the introduction of the SSA approach to the 1997 bank audit, KPMG's auditors may have been motivated to find reasons supporting the new approach's superiority while ignoring situations where it may have been less effective than the traditional audit.

and evaluate the audit procedures and decisions that led to this audit failure.[7] The authors concluded that the most significant shortcoming in the 1987 LSL audit was the auditor's failure to obtain and use knowledge of LSL's business, its industry, and the economic forces that affected them. They argue that had the auditors gained this understanding of their client's business, using data that were publicly available at the time of the audit, and applied it to the evaluation of the substance of LSL's sales of undeveloped land, they would have concluded that LSL's aggressive revenue recognition policies resulted in profit margins that were "too good to be true." The type of knowledge they believe would have been useful in uncovering this fraud is that which is normally gathered and used as audit evidence in an SSA audit. Thus, the crux of their argument is that an SSA audit provides more—and more reliable—audit evidence than a TBA, both in the presence and absence of management fraud.[8] The authors rightly suggest that research is needed to test their assertion that an in-depth understanding of a client's business provides an effective framework from which to assess risks, develop financial-statement expectations, and evaluate the proper accounting for transactions.

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[7] LSL was the largest savings and loan failure in U.S. history, reportedly costing taxpayers in excess of $2 billion in bailouts and resulting in litigation settlements by three then-Big Six auditors exceeding $135 million. LSL's failure involved management fraud, but many critics laid significant blame on its auditors, who did not prevent the release of "materially misstated" financial statements. All three audit firms settled out-of-court.

[8] Evidence gathered using the SSA approach is more reliable than TBA-based evidence in the sense that a higher proportion of audit evidence comes from sources external to the company, which are more reliable than internal evidence, especially when management fraud has occurred. For example, in the LSL case, the authors suggest that economic, real estate, and LSL market position data could have been gathered from a variety of external sources, such as the financial press and the local real estate board. This type of evidence would have been much more reliable than any internally generated figures regarding growth rates and profits, given that management had the need to disguise their fraudulent activities.

Determinants of Auditor Judgment Performance

Introduction

Libby and Luft (1993; see also Libby 1995), building on the results of prior research in accounting and other fields, suggested the following conceptual equation of the determinants of auditor decision performance:

Performance = f (Ability, Knowledge, Environment, Motivation).

They supplement the equation by specifying a model that details the antecedents and consequences of knowledge, with experience and ability directly affecting knowledge and ability and knowledge directly affecting judgment performance (see Figure 2 for an illustration of this model). A wide variety of studies have investigated specific links within the model, thus providing empirical support for the specified relations (e.g., Bonner and Lewis 1990; Bonner and Walker 1994; Tan 1995; Ricchiute 1999; Solomon, Shields, and Whittington 1999). Using structural equation modeling, Libby and Tan (1994) reanalyzed data gathered by Bonner and Lewis (1990) to simultaneously test all four links in the model. Their results support the general form of the model and, consistent with the underlying theory, suggest considerable variability in the determinants of performance on specific tasks.

In general, this dissertation is a study of auditor expertise, so many elements of the Libby and Luft (1993) model are applicable to this research. In particular, this study examines the relations among the audit environment (in the form of audit methodology), audit experience, auditors' knowledge, and their resulting judgment performance. Given the importance of the model to the research questions, these four elements of it are next discussed in more detail.

Environment

The auditing environment can be characterized as a complex sequence of judgments leading to the formation of an audit opinion, which are made by individuals working in hierarchical audit teams whose decision choices are guided or constrained by professional standards, firm policies and procedures (i.e., audit methodology), and decision support systems (Libby and Luft 1993). In the context of the present study, the pertinent environmental factor is audit methodology (i.e., SSA or TBA), which is posited to affect the type and quantity of evidence gathered, the procedures and tools used to analyze the evidence, and the information outputs used to form an audit opinion. Overall, elements of the audit environment affect auditor judgment by interacting with experience, knowledge, or ability or by altering the motivation of the auditor(s) performing the judgment task (Libby and Luft 1993).

Experience

Experience includes first-hand encounters such as audit-task completion and file review, as well as second-hand encounters via discussion, education, and firm training (Libby 1995). The significant conceptual and procedural differences between an SSA and a TBA obviously necessitate divergent training programs, and will likely result in substantively dissimilar inter- and intra-audit discussions with colleagues. Moreover, an SSA incorporates many audit tasks (e.g., strategic analysis, business process analysis) that are not necessarily part of a TBA, while also excluding (or limiting the extent of) many standard TBA tasks, such as balance confirmations and internal accounting control testing. So audit methodology differences will result in disparate first- and second-hand audit experiences.

Knowledge

Libby (1995) defines knowledge as information stored in memory, with knowledge including both general domain knowledge (e.g., how to apply the audit risk model) and subspecialty knowledge (e.g., software revenue recognition principles). In an audit context, knowledge of the client's business is essential, and here, too, we may expect differences between methodologies. As noted above, the SSA relies on an in-depth understanding of the client's business in forming expectations about the client's financial statements. This understanding comprises knowledge of the client's business strategies, the processes that implement and monitor the strategies, the risks associated with these strategies and processes, and management's controls over these risks. In principle, the TBA auditor could (and may) also collect and analyze these types of client knowledge. Indeed, most of the information used by an SSA auditor is listed in the Appendix of CICA Handbook Section 5140 (CICA 2001), a Section that was last updated in July 1996 when the SSA had yet to be introduced. A review of firms' audit manuals and leading auditing textbooks, however, suggests that in practice TBA auditors often do not collect the quantity or array of knowledge gathered by SSA auditors. The auditor's view of the client context in which this knowledge is considered also varies between approaches.

The SSA auditor views the client organization as being the core of a broad, complex economic web which comprises many interrelationships and interactions among such entities as suppliers, customers, capital markets, and many others (Bell et al. 1997). Figure 3 presents one view of this web of interrelationships. The SSA auditor develops knowledge about, and evidence in support of, the nature and strengths of these interrelationships, the rapidity and magnitude of changes in connectivity, and the viability

of the client's strategy (Bell et al. 1997). In contrast, the TBA auditor generally attends to only a subset of these interrelationships, and usually applies a more-piecemeal approach to their analysis. For instance, she may address the client-customer relationship by confirming accounts receivable, or examine interactions with related parties by reviewing and testing the transactions with these entities. In the end, methodology differences potentially result in an SSA auditor having a richly detailed, tightly interconnected body of knowledge about the client, whereas the TBA auditor may have a more impoverished model of client knowledge.

Judgment performance

Judgment performance is generally defined as the degree of correspondence between a judgment and some criterion value of effectiveness (e.g., an event outcome, a statistical norm, or the judgments of others) or efficiency (e.g., time to complete a task or cost per unit of information gained) (Libby 1995). The direct determinants of performance are ability and knowledge, in interaction with the audit environment and individual motivation (see Figure 2).

In the model, abilities are defined as the capacity to complete information encoding, retrieval, and analysis tasks that contribute to audit problem solving (Libby and Luft 1993). These abilities can be measured using psychometric measures of verbal and quantitative skills (e.g., the GMAT) and they tend not to be specific to accounting settings. That is, these abilities can be considered innate to the individual and are not affected by any of the salient factors within accounting settings, although individual differences in abilities do affect learning and judgment performance (Libby 1995).

Both knowledge content and knowledge organization can independently affect

auditor judgment performance (Libby and Luft 1993). This dissertation's research questions focus on audit methodology-related differences in auditors' knowledge content and organization, and any related variations in audit judgment. Therefore, the next section reviews the cognitive psychology theory underlying the content and organization of knowledge in memory and details the audit research that has investigated these concepts and their effects on audit judgment.

Knowledge Structures in Memory

Introduction

Concepts in long-term memory (or knowledge) can be seen as being stored in memory structures called schemas (Rumelhart and Ortony 1977), which contain clusters of organized expectations and represent abstract knowledge about some domain (Bower 2000). A schema allows for the encoding, storage, and retrieval of information related to that domain (Alba and Hasher 1983). Schemas can contain any number of concepts, with few or many links among them, and some schemas can be embedded within others. Through experience people acquire schemas for routine tasks, novel activities, and narrative forms.[9] Each schematized activity comprises an ordered sequence of actions to achieve a goal, and these actions are performed (and recalled in chunks) more or less automatically (Bower 2000). Structured schemas can be viewed as simply large clusters of elementary associated concepts, which "truly are the building blocks of cognition. They are the fundamental elements upon which all information processing depends"

[9] Examples of common, well-developed schemas include shopping for groceries, making a phone call, and visiting the dentist.

(Rumelhart 1980).[10]

Encoding knowledge in schemas

Only some of the concepts in a given event or message will be encoded in memory. Three schema-encoding principles determine what concepts are ultimately represented. Whether or not a piece of information is encoded first depends on the existence of a relevant schema (Alba and Hasher 1983). That is, previously acquired, relevant knowledge stored in a well-developed schema is critical to the acquisition of new knowledge. Mismatches between incoming knowledge and existing schemas can occur either because the structure of the incoming information differs from the relevant schema or because the individual lacks adequate knowledge of the relevant schema. Absent a concept-structure match, there is no available schema into which new information can be integrated, so it is sometimes lost because it has to be handled by less effective and efficient generic information processing actions. The encoding of new information is a mapping process, new onto old, which depends on a sufficiently well-developed knowledge base (Alba and Hasher 1983).[11]

Also necessary for the encoding of new information is the activation of the relevant schema. That is, the mere possession of adequate background knowledge is not sufficient for encoding; the knowledge must be activated at the time of encoding (Alba

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[10] Besides schemas, psychology research has postulated a number of alternative memory structures. For example, rather than viewing memory as a set of items combined with an addressing scheme that allows the items to be accessed, in connectionist models of memory, events are represented not by items but by patterns of activity across a set of connected neurons (McClelland 2000). As discussed in more depth below, audit judgment research has shown that various types of audit knowledge are stored in schema-type structures in auditors' memory. Thus, this dissertation focuses on schematic memory structures rather than one of the other alternative structures.

[11] Schemas are built up through experience, developing much like scientific theories (Rumelhart 1980). That is, when a person encounters a new event, object, or situation, he first tries to comprehend it using an existing schema. If the new data don't fit an existing schema, he will begin to construct a new one, specifying it further as more data (from more similar events, objects, or situations) become available.

and Hasher 1983). When knowledge structures lie dormant during encoding, new information cannot be easily assimilated. Even when a relevant schema is invoked, incoming knowledge may be improperly encoded. This can occur when the activated schema can be applied to only a subset of the incoming information, in which case the relevant information is encoded but the remainder will either be rejected or distorted to fit the existing schema. In either case, inconsistent information will not be well represented in memory (Alba and Hasher 1983).

Finally, the importance of the incoming information in the context of the relevant schema also affects encoding. The concepts that are most important to the theme of the information and that cannot be derived from previously encoded information will be given special attention and will be remembered best (Alba and Hasher 1983).

Retrieving knowledge from schemas

As a result of these three schema-encoding principles, the representation of a given information set is likely to be incomplete. Because of this, people cannot recall from memory an exact copy of the information set, even when motivated to do so (Alba and Hasher 1983). Three major factors influence what is recalled: (1) the nature of connections established during encoding, (2) differences in the number and distribution of rehearsals, and (3) the role of retrieval cues at recall (Alba and Hasher 1983).

Individual concepts within a schema can have either or both of two sets of relations: (a) hierarchical connections descending from the main theme of the schema and (b) associative connections that link concepts directly to others via shared arguments (Kintsch and van Dijk 1978). Frederick (1991) provides an example of an internal-control schema containing both hierarchical and associative connections. In his example (see

Figure 4), an individual accounting cycle (e.g., the purchasing-and-disbursements cycle) forms the superordinate level of organization, with the temporally associated flow of transactions within a cycle (e.g., purchasing, receiving, payables, disbursements, journal entries and reconciliation) forming the intermediate level in the hierarchy. At a subordinate level are the specific control procedures associated with each transaction at the intermediate level and with each other temporally. Thus, within an auditor's internal-control schema there are hierarchical links between cycles, transactions, and controls, as well as temporal associations between transactions and between controls at each of the lower levels in the hierarchy.

Concepts related to one another either hierarchically or associatively are easier to recall than are unrelated concepts, so the ability to relate concepts to one another during encoding is likely a determinant of recall ability (Alba and Hasher 1983). That is, if ideas are not or cannot be connected to a higher-order concept or to other concepts during encoding, recall will be poor. Thus, the components of each connection serve as (implicit or explicit) retrieval cues when an individual attempts to recall information from memory (Alba and Hasher 1983).

Kintsch and van Dijk's (1978) model of text comprehension provides a hierarchical algorithm useful in explaining this principle. If the first idea retrieved is the highest-level concept (or theme), then recall will occur in a top-down manner, with each concept cuing one or more below it in the schema. So items higher in the hierarchy are likely to be recalled before lower items, and lower level concepts will not be recalled unless the chain of ideas above is kept intact.

The model also offers an explanation of how important ideas are determined. The

more-important ideas in an information set (or text) are likely often referred to by other concepts in the set and thus spend more time in working memory than less-important ideas. As a consequence of these rehearsal processes, important ideas will tend to have connections to a greater number of other ideas than will unimportant ideas. Moreover, it is very possible that the theme of an information set is that proposition or concept that is most frequently rehearsed or referred to during encoding, thus its relatively easy retrieval.

Recent theoretical schema research

In a recent, influential theoretical paper by Ericsson and Kintsch (1995), schemas play a key role in the encoding and retrieval of data to and from long-term working memory (Gobet 1998).[12] In summary, the authors' long-term working memory theory proposes that domain experts encode information by elaborating long-term memory schemas, which are in turn stored within an integrated, hierarchical retrieval structure that relates pieces of information with each other, thus allowing rapid encoding of information into long-term memory. The authors argue that this type of memory structure overcomes the limited storage capacity of short-term memory (Miller 1956), thereby allowing domain experts to maintain access to large quantities of information during the performance of complex cognitive tasks. They support their claim by reviewing empirical evidence on memory in text comprehension and expert performance in domains such as mental calculation, medical diagnosis, and chess.

Accountants' knowledge structures

Drawing on the schema literature, Gibbins (1984) made several propositions regarding accountants' knowledge structures. He proposed that accounting experience

[12] As at April 2, 2004, the ISI Web of Science citation index shows 261 citations of the Ericsson and Kintsch (1995) article.

produces prestructured guides to judgment, which are stored in long-term memory and are shaped by the judgment environment. Calling these guides templates, he suggested that templates are more complete for more frequently experienced tasks and, in turn, that more-complete templates lead to more-efficient memory use. These templates are constantly updated through perceptual processes that continuously monitor the judgment environment, thus providing an up-to-date background against which judgments can be made. Gibbins also proposed that the judgment process begins with a search of long-term memory for a relevant template. This search is based on perceived salient aspects of the judgment task, with template selection ultimately depending on the fit between these aspects and the retrieval cues stored in the template. That is, the accountant (consciously or unconsciously) selects the template with the greatest number of retrieval cues matching the salient judgment circumstances. A variety of stopping rules (e.g., deadline nearing, all relevant information has been used) will terminate the search process if a suitable template cannot be found. Finally, the output of a template is a conscious response that specifies an action preference. In summary, through experience the accountant develops templates (or schemas) in long-term memory, which she accesses according to environmental demands and, if she finds a template that fits the perceived circumstances, she takes the preferred response from the template. She then evaluates the risks and constraints associated with this response prior to acting on it.

Contemporaneous with Gibbins (1984), Waller and Felix (1984) made several conjectures about auditors' knowledge structures, also drawing heavily on schema theory as well as theory on the categorical (or taxonomic) organization of knowledge. They argued that as an auditor gains experience he forms and develops categorical and

schematic organizations of declarative knowledge. For example, the basic categorical organization of accounting knowledge includes assets, liabilities, owners' equity, revenues, and expenses. Basic schemas include the double-entry representation of accounting events and skeletal forms of the balance sheet and income statement. Waller and Felix further suggest that these knowledge structures are brought to bear upon judgments at each step in the auditor's opinion formulation process, and that repeated experience in applying these steps leads to adaptations in the relevant knowledge structures.

Waller and Felix (1984) also make several specific conjectures regarding the auditor's knowledge of the client's business. They posit that this knowledge consists of both client-specific data and the auditor's generalized cognitive structures evoked to comprehend these data and incorporate them into her judgment processes. They argue that knowledge about client-environmental factors and their interrelationships is largely declarative in form, and thus is organized in categories and schemas. Professional experience, rather than formal education, is likely to be the primary determinant of these structures. They suggest that a reasonably well-formed categorical organization of client data pre-exists for the incipient auditor and learning this context involves merely internalizing this categorization. The development of client-environmental schemas, however, depends upon generalizations drawn from direct experiential observations, hearing or reading the analyses of specialists, and discussions with knowledgeable colleagues. Schemas for relations among environmental factors may range from simplistic stereotypes for client personnel to highly sophisticated representations of causal knowledge about accounting control features and economic conditions and their

respective error propensities. Pursuant to the propositions of Waller and Felix (1984) and Gibbins (1984), accounting researchers undertook experimental investigations to gather empirical evidence regarding these theoretical claims about auditors' knowledge structures.

Auditors' internal control knowledge

Central to an auditor's understanding of the inner workings of the client's business is her knowledge of the client's internal control system. Evidence related to how this client knowledge is stored in an auditor's memory may provide insight into how higher-level knowledge of the client's business is organized in memory. This sub-section reviews the key findings in the area of auditors' internal control knowledge.

In the only knowledge-structure study to precede the theoretical papers by Gibbins (1984) and Waller and Felix (1984), Weber (1980) examined how EDP auditors imposed organization on computer controls. He had internal and external EDP auditors as well as university students with some computing experience perform a free-recall task using 50 computer controls. Both groups of EDP auditors recalled controls in clusters closely corresponding to the superordinate categories (e.g., input, processing, output) used to initially formulate the list of 50 controls. Further, the external auditors recalled more controls per category than did the internal auditors, possibly reflecting their more-intensive training and exposure to a greater variety of computer systems across clients. The students showed no evidence of category clustering in their recall of the controls and they recalled significantly fewer controls than the experienced auditors. Thus, the results of Weber's study indicate that experienced EDP auditors organize their knowledge of controls in generally accepted superordinate categories whereas novice auditors have no

apparent organization of controls in memory. Also, experience-based differences between the internal and external auditors resulted in the external auditors having more-extensive categorical knowledge.

Next, Frederick (1991) examined how experienced and inexperienced financial statement auditors store and retrieve internal control knowledge. He employed auditors (mean four years' experience) and undergraduate accounting students in a recall task using 33 internal controls. The stimulus list was presented either taxonomically (i.e., controls grouped by internal control objective) or schematically (i.e., controls grouped by temporal transaction flow). Frederick's results showed that the experts recalled significantly more controls than the novices and that experts recalled more controls in the schematic condition than they did in the taxonomic condition. Novices, however, recalled a statistically equivalent number of controls in each condition. Further analysis showed that subjects in the schematic condition clustered more than those in the taxonomic condition. In the schematic condition, even the novices listed the few controls they remembered in a coherent sequence. These findings indicate that auditors have both taxonomic and schematic memory representations of internal controls, with the schematic representations becoming better developed with experience. The temporal structure of the schematic representation appears to provide more-effective memory-retrieval guides than the taxonomic structure, as indicated by the greater quantity of controls recalled by experts in the schematic condition.

Curtis and Viator (2000) examined the relation between knowledge organization and judgment performance in a study again involving computer controls. Their subjects (staff, senior, and manager levels) studied nine computer controls and assessed the

relatedness of each possible pair of controls. They then read a case and were asked to identify control weaknesses and their potential effects on the financial statements. The analysis revealed that the manager-auditors had three structural dimensions to their control knowledge, with processing flow being the dominant dimension, control objective the secondary dimension, and control method the other dimension. These results further confirm Weber's (1980) and Frederick's (1991) findings. Also consistent with Frederick's findings, Curtis and Viator found that staff-auditors had a more well-developed control-objective dimension than a transaction-flow dimension. Results also showed a positive association between the two dominant knowledge dimensions and the quantity of control weaknesses and financial statement errors identified, indicating that a more well-developed knowledge structure can lead to increased audit effectiveness.

In summary, these three studies of auditors' control-knowledge representations showed consistent evidence that controls are represented in memory along two main dimensions: a schematic dimension, which temporally organizes controls in a transaction-flow order, and a taxonomic dimension, which organizes controls categorically according to control objective. The schematic representation develops with experience and tends to dominate the taxonomic representation as it becomes better developed. The schematic representation also permits better retrieval of controls from memory, though both dimensions have been found to be positively and concurrently associated with audit performance. Weber's study also found richer knowledge structures in external EDP auditors compared to internal EDP auditors.

These findings have several implications for this dissertation's research questions. First, they suggest that higher-level client business knowledge may be stored in

categories or schemas in memory, similar to an auditor's knowledge of a client's internal controls. Second, they suggest that client business knowledge may become better organized as an auditor gains experience. Third, audit-methodology differences may result in one type of auditor (i.e., SSA or TBA) possessing richer knowledge structures than the other, similar to Weber's internal-external auditor differences.[13] Finally, any differences in the structure of client business knowledge may affect the audit judgments made based on that knowledge.

Auditors' going-concern knowledge

An auditor must have a thorough understanding of a client's business in order to make a proper assessment of the client's ability to continue as a going concern. Therefore, evidence related to how going-concern knowledge is organized in memory may suggest how client business knowledge in general is stored by auditors. This sub-section reviews the literature regarding the structure of auditors' going-concern knowledge.

Choo and Trotman (1991) were the first to investigate the structure of auditor's going-concern knowledge and how this structure affected related judgments. Expert (mean four years' experience) and novice (mean three months' experience) auditors read a partner memo describing issues related to a client's going-concern situation. They then recalled from memory the issues present in the memo, made likelihood judgments regarding the truth of inferences that were not explicitly stated in the memo, and judged the likelihood of the client failing within one year. The results showed that the experts

[13] Libby and Luft's (1993) model of auditor judgment performance (reviewed earlier) specifies that the audit environment, which includes a firm's audit methodology, can affect an auditor's knowledge. Thus, Weber's (1980) finding of differences between internal and external auditors' knowledge structures could be partially explained by the different methodologies employed by the two types of auditors.

tended to recall issues in clusters of typical (i.e., those that indicated the client would fail) and atypical (i.e., those that indicated the client would not fail) items, whereas novices showed no evidence of clustering, indicating that experts' going-concern knowledge is better organized than novices'. Results also showed that experts' inferences are contingent upon the degree to which they organize memory by a particular type of information. Finally, there was no direct correlation between items recalled and the auditors' going-concern judgments, indicating that the knowledge-performance relationship is mediated by the inferences made during the judgment process.

Ricchiute (1992) investigated how auditors' going-concern knowledge structures affect judgment. In the process, he also extended Frederick's (1991) finding of a memory organization-evidence organization interaction by examining the effect of this interaction on judgment. Audit partners read 60 evidence sentences one at a time, with the order of the evidence manipulated between subjects, and then made their going-concern judgment. The partners decided there was substantial doubt about the client's viability more often when the strongest evidence supporting this position was presented in causal order, least often when the strongest evidence was shown in working-paper order. These results indicate that partners store going-concern knowledge in causally ordered schemas and that a match—or mismatch—between knowledge organization and information organization can have important effects on auditors' judgment performance.

Choo (1996) employed a cognitive-script approach in an attempt to refine the understanding of the structure of auditors' going-concern knowledge. A cognitive script is a sequence of actions in an individual's knowledge structure that enables her to understand a specific situation or context and guides her behaviour in that situation or

context.[14] Differences among auditor's cognitive scripts are determined by the extent of their knowledge distinctiveness, abstractness, and contingency.[15] Choo proposed that there would be a positive association between each of these three script dimensions and auditors' going-concern judgments. Auditors with varying levels of experience on engagements with going-concern issues read a case with client background information and financial statements. They then listed the typical items (i.e., issues increasing the likelihood of failure) and atypical items (i.e., issues decreasing the likelihood of failure) gleaned from the given information, made a going-concern judgment, and prepared a memo justifying their decision. The results showed that all three dimensions were present in auditors' knowledge structures and that the larger the extent of these dimensions, the better an auditor's going-concern judgment. These findings provide us with insight into the richness of an auditor's going-concern knowledge structure and also show that such richness can improve judgment performance.

Overall, the findings from these three studies indicate that as auditors gain experience, their going-concern knowledge becomes better organized. More important, each of these studies showed a link between well-organized knowledge structures and improved going-concern judgments. In Choo and Trotman this relation was mediated by inference-making ability and in Ricchiute it was moderated by evidence presentation order. These findings have two main implications for this dissertation's research questions. First, they suggest that, in general, client business knowledge may become

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[14] A script (Schank and Abelson 1977) is a specific type of schema, which contains general information about a particular, frequently experienced event (e.g., a restaurant visit), as well as more-specific information about the contents of the event (e.g., being seated, ordering the meal, and so on).

[15] Knowledge distinctiveness refers to the extent of atypical actions and events in a script. Knowledge abstractness refers to the extent of general actions and events in a script. Knowledge contingency refers to the extent a script is represented by a tree-like hierarchical sequence of contingent actions and events.

better organized with experience. Second, judgments based on this knowledge may improve as the knowledge becomes better organized.

Auditors' financial-statement error knowledge

During an audit, the auditor must rely on error knowledge to design appropriate tests and procedures that will assist her in identifying actual and potential sources of financial statement errors. Because the number and types of errors can vary by client type, it is reasonable to assume that financial-statement error knowledge is a component of client business knowledge. Thus, reviewing the literature on auditors' error knowledge should provide insight into how client business knowledge is stored in memory.

Libby and Frederick (1990) were the first to investigate the structure of auditors' knowledge of financial-statement errors. They employed auditors with varying experience levels (from zero to five years, on average) in a task that required subjects to list errors that could be associated with given financial ratio fluctuations. Expert auditors recalled more errors than novices and also had both transaction-cycle and audit-objective dimensions to their error knowledge structures, whereas novices had only an audit-objective dimension. This indicates that an auditor's education and training facilitate development of the latter dimension, but that practical experience is necessary to develop the former dimension.

Tubbs (1992) replicated and extended the findings of Libby and Frederick (1990) by specifically investigating the nature of experience-related changes in auditor's knowledge of financial-statement errors. Auditors ranging in experience from student to manager level performed an unconstrained free recall of errors from memory and were then given several errors and were asked to make estimates of the probability of these

errors occurring conditional on the presence of another error. In addition to finding that the quantity and quality of auditors' error knowledge increased with experience, he found that the causal relationship between an error and the control objective violated became more salient with experience.

Frederick et al. (1994) sought to extend the work of both Libby and Frederick (1990) and Tubbs (1992) by directly examining how auditors' error category structures develop with experience and which structure—transaction cycle-based or audit objective-based—auditors prefer. They investigated these research questions using auditors with varying experience (students through managers), who were asked to sort 35 errors by either transaction cycle, audit objective, or however they desired. The results indicated that the structure of auditors' error knowledge is multidimensional and that these dimensions evolve with experience. The authors also note that managers seem to incorporate their knowledge of audit risk into their audit-objective dimension. Overall, these results showed that auditors' error knowledge becomes more complex with experience.

Nelson, Libby, and Bonner et al. (1995) employed the Frederick et al. findings to aid their investigation of how a mismatch between an auditor's error knowledge structure (organized by audit objectives) and an audit task's structure (organized by transaction cycle) affects audit planning. Auditors with a mean of three years' experience free sorted errors, viewed nine errors presented in varying frequencies, made conditional error-probability judgments, and made audit-effort allocation decisions.[16] Findings showed that

[16] The error-frequency presentation was an experimental proxy for errors encountered through actual audit experience. Prior research indicates that frequency knowledge is time-tagged in memory, so individuals are able to discriminate experimental frequencies from existing frequency knowledge.

the mismatch between error knowledge structure and planning-task structure hindered auditors' ability to draw on previously experienced error frequencies when estimating conditional probabilities and allocating audit effort. No such problem was found when the structures matched. These results again show the importance of knowledge structures to an auditor's judgment quality.

This series of studies provides several important insights into auditors' error knowledge structures and the effects of these structures on judgment. First, experienced auditors know more possible errors than less-experienced auditors. Second, the structure of auditors' error knowledge becomes more complex, taking on additional dimensions as experience is gained. Third, and most important, error knowledge structures affect judgment performance, with poor-quality decisions resulting if there is a mismatch between knowledge structure and task structure.

Considered together, these findings have several implications for this dissertation's research questions. First, we may expect an auditor's quantity of client business knowledge to increase with experience. Second, the structure of this knowledge in memory might become more complex as the auditor gains experience. Finally, the structure of client knowledge might have a differential effect on audit effectiveness depending on how it interacts with various audit task structures.

Pre- and post-cognitive structures

This dissertation investigates the complexity of auditors' client business knowledge and how varying levels of knowledge complexity affect judgment. Pratt (1982) studied the complexity of accountants' pre- and post-cognitive structures (i.e., knowledge structures) and their effects on information use and performance, so his

results should provide insight into how different levels of knowledge complexity influence accountants' judgments.

A pre-cognitive (post-cognitive) structure is an individual's cognitive structure before (after) exposure to a set of declarative facts, represented in Pratt's study by information in a corporate annual report. Pratt measured the complexity of advanced accounting students' cognitive structures before and after reading a low-, medium-, or high-complexity corporate annual report. He then related the complexity of these structures to the subjects' performance on a net-income prediction task and their self-reported use of 12 different sections of the annual report considered in making this prediction. Results showed a strong correlation between pre- and post-cognitive structure, but post-cognitive structure was more closely related than pre-cognitive structure to an individual's decision process and eventual decision. In addition, individuals with complex post-cognitive structures made more-accurate income predictions than their structurally simple counterparts as the complexity of the annual report increased. Thus, Pratt's results show a link between knowledge structures and judgment, with judgment quality improving as knowledge complexity increases.

Causal mapping

This sub-section provides details on causal mapping, a form of content analysis, which will be used to analyze and measure auditors' knowledge complexity when testing some of this dissertation's hypotheses. A causal map is a type of cognitive map, which is a representation of the elements of an environment and their interrelations as held in long-term memory (Shavelson 1972). Tolman (1948) first used cognitive maps as representations of the mental models of rats and humans. Both cognitive mapping and

causal mapping are methods of analyzing the content of a document to identify critical assertions dealing with causality, existence, or categorization (Huff 1990; Eden 1992).

Axelrod (1976) and his colleagues first used causal mapping to examine the cognitive structures of political leaders. Researchers in the areas of strategy and management began using cognitive and causal maps in the late 1980s to better understand the structure of strategic thought. A 1989 special issue of the *Journal of Management Studies* was devoted to mapping strategic thought, as was an edited book by Huff (1990). A 1994 special issue of *Organization Science* presented various methods of mapping managerial cognition, including causal mapping. Thus, given this dissertation's focus on auditors' cognitive structures, particularly their knowledge of client strategies and how this knowledge differs by audit methodology and experience, causal mapping seems to be an appropriate method to use because of its recent application in similar studies.

A recent study by Nelson et al. (Nelson, Nadkarni, Narayanan, and Ghods 2000) in *MIS Quarterly* shows how causal mapping can be used to investigate the cognitive structure of expertise. In particular, they examine the expertise of software-operations support personnel. Using data gathered from interviews with a variety of support staff in two organizations, they analyzed the content of the participants' responses using a causal mapping approach. The analysis revealed that support expertise comprises five major constructs: personal competencies (i.e., ability, experience, and knowledge), environmental factors, motivation, IS policies, and support personnel outcomes (i.e., performance). Note the similarity between these findings and Libby and Luft's (1993) model of auditor expertise as described earlier and shown in Figure 2. Thus, this recent study provides a specific example of how useful causal mapping should be when

studying auditor expertise. Details on the actual application of causal mapping are provided in Chapter 3.

Chapter summary

This chapter reviewed descriptive, theoretical, and empirical research findings that are relevant to examining this dissertation's research questions. First, evidence describing the major facets of the SSA approach were reviewed and important distinctions between this approach and the TBA approach were identified. Related, a series of empirical studies on the SSA methodology revealed potential problems with the effectiveness of this new approach, but generally found both improved auditor knowledge and judgment performance as a result of applying such an approach. This dissertation will examine the effects of some of the SSA-TBA distinctions on auditors' knowledge and judgment and may provide evidence that will clarify some of the surprising findings from the empirical studies. Third, given this dissertation's focus on auditor expertise, the most-pertinent elements of Libby and Luft's (1993) model of auditor judgment performance were reviewed in depth. Next, the cognitive psychology literature on schema theory was reviewed to highlight how an auditor's knowledge of the client's business may be encoded in, stored in, and retrieved from memory. Finally, several theoretical and empirical papers from the audit judgment literature were reviewed. In general, these papers showed that audit experience leads to well-organized knowledge structures in an auditor's memory and that better organized knowledge can improve judgment performance. All of the evidence reviewed in this chapter will be incorporated into this dissertation's hypotheses, which are developed in the next chapter.

CHAPTER 2 - HYPOTHESIS DEVELOPMENT

Introduction

The preceding chapter reviewed the theoretical, empirical, and descriptive literature that is directly related to answering this dissertation's research questions. This chapter synthesizes that literature and develops the hypotheses to be tested in providing empirical evidence regarding those questions. The first three hypotheses predict how experience- and methodology-related differences in the content and organization of client business knowledge in an auditor's memory affect the relative recall abilities of novice versus expert auditors and SSA versus TBA auditors. The next three hypotheses predict how experience and methodology affect the complexity of an auditor's client business knowledge. The final hypothesis predicts how differences in knowledge complexity affect auditors' risk assessments. The chapter concludes with a summary of the study's hypotheses.

Content and Organization of Client Business Knowledge in Memory

The auditor's mental representation of client knowledge

To gain an understanding of the client's business, the auditor engages in several cognitive processes, including searching for and retrieving information from external sources and from memory (Bonner and Pennington 1991). This information comprises knowledge about client-environmental facts and the interrelationships between and among these facts. Such knowledge is predominantly declarative and is thus likely organized in memory using categories and schemas (Waller and Felix 1984). Combined, this knowledge forms a mental representation of the client and its current situation (Bonner and Pennington 1991).

Client-environmental facts

Several broad categories of environmental facts are relevant to the construction of this mental representation: knowledge of the external economic, industry, and financial reporting environments in which the client operates; knowledge of the client's internal operating environment, including its ownership structure, corporate governance, and management personnel; and knowledge of its operational characteristics, including its major revenues and expenditures, capital structure, and other financial and administrative factors. Table 2 (drawn from the Appendix of CICA Handbook Section 5140 (CICA 2001)) presents a partial list of the individual facts within each of these three categories that might be of significance to the auditor when gathering knowledge of the client's business. The Appendix to International Standard on Auditing 310 (IFAC 2003) on knowledge of the client's business contains a similar categorical list of facts.[17] The auditor's mental representation of these facts is likely in the form of a reasonably well-formed categorical organization (Waller and Felix 1984).

Methodology-related differences in knowledge of client-environmental facts

The number and types of client-environmental facts gathered by the auditor may not differ across audit methodologies. That is, asked to gather information about a given company, it is possible that the TBA auditor and the SSA auditor could collect substantially similar quantities and types of facts. Indeed, Salterio and Weirich (2002) note that most of the information necessary for an SSA audit is listed in the Appendix of Section 5140 (see Table 2 for details on the contents of the Appendix). International

[17] CICA Section 5140 and ISA 310 have recently been replaced by Section 5141 and ISA 315, respectively. The participants who supplied data for this dissertation completed the study while 5140 and 310 were still in effect, however.

auditing standards (IFAC 2003) suggest a very similar list of facts could be gathered by the auditor in gaining an understanding of the client's business.

Thus, in principle, existing auditing standards do not discourage the TBA auditor from acquiring the same amount and types of client-environmental facts as the SSA auditor. Moreover, as discussed further below, the primary advantage of the SSA over the TBA is not that it uses a greater *quantity* of environmental data, but that it *organizes* this data in a more logical and useful way. So, it is argued here that the amount of client-environmental facts gathered may not differ between methodologies.[18] Research in auditing has shown that task-specific experience directly determines auditing knowledge (Libby and Luft 1993; Libby 1995), so differences in task-specific experience lead to differences in related knowledge. A corollary of this theoretical relation is that individuals with similar types and levels of task-specific experience will not greatly differ in related knowledge. If TBA auditors actually collect the same quantity and types of client-environmental facts as SSA auditors, then both types of auditors should possess similar experience with this specific task. As detailed in Chapter 1, an auditor's task-specific experience is a direct determinant of her audit knowledge content and structure (Libby and Luft 1993; Libby and Tan 1994). Hence, given their similar experiences with the task of collecting client facts, SSA and TBA auditors may have similar knowledge-acquisition schemas. Given that schemas determine the amount of information encoded and enable more-effective information retrieval (Alba and Hasher 1983), the similar schemas of SSA and TBA auditors as they pertain to gathering facts could lead to

[18] The term "gathering" as used here refers to the number and types of facts collected and not to the procedures used to collect these data. The procedures used to collect the information may differ between methodologies, but the end results of these procedures would be a substantially similar body of client facts.

auditors' recall of facts being equivalent across methodologies. This leads to the following hypothesis:

H1a: SSA auditors recall the same quantity of client-environmental facts as TBA auditors.[19]

While in principle there is no reason to expect differences in the quantity and types of facts gathered across methodologies, in practice it seems that there may be some differences between the approaches. A review of two leading auditing textbooks, each dealing almost exclusively with only one of the methodologies, suggests that the SSA auditor may routinely collect a greater quantity of facts from a broader array of categories than the TBA auditor. In their textbook detailing the traditional TBA approach, Arens et al. (Arens, Loebbecke, Lemon, and Splettstoesser 2000) spend only four pages outlining the client-environmental facts needed to gain an understanding of the client's business. This information falls into a few broad categories: industry background, operational background, significant policies and procedures, related parties, and legal obligations. In contrast, Knechel's (2001) text detailing the SSA approach contains two chapters outlining facts from a variety of categories: local, internal, and global environments; external forces and agents; resources and suppliers; markets, customers, and products; internal processes (including strategic management); and strategic partners. Thus, a comparison of these instructional texts indicates that the SSA auditor may regularly gather a greater quantity of facts from a wider variety of environmental categories than the TBA auditor.

A review of firms' audit manuals reinforces the client-knowledge differences

[19] The null of this hypothesis is: SSA auditors recall a lower quantity of client-environmental facts than TBA auditors or SSA auditors recall a greater quantity of client-environmental facts than TBA auditors.

noted in these texts. In the audit manual of one of the Big 4 firms currently using the SSA approach, it is suggested that auditors collect client-environmental facts very similar to those discussed in the Knechel SSA text. In contrast, an audit manual from the same firm, but from the era when the firm still applied a TBA approach, indicates that auditors should collect client facts similar to those suggested in the Arens et al. TBA text. Thus, when this Big 4 firm changed from a TBA to an SSA approach, they began to gather a more-thorough set of client facts. In addition, the audit manual from one of the Big 4 firms that still uses a TBA approach suggests that auditors collect a more-limited set of client facts similar to those in the Arens et al. text, indicating that much or all of the SSA-specific information from the Knechel text is not gathered by this firm. Thus, textbooks and audit manuals suggest that, in practice, SSA auditors may routinely collect more client facts than TBA auditors.

Erickson et al. (2000) argue that had the (TBA) auditors of Lincoln Savings and Loan collected the types of client-environmental facts normally gathered by SSA auditors, they may have avoided one of the most significant audit failures in the scandal-plagued savings-and-loan industry. This again suggests that SSA auditors tend to collect more client facts than TBA auditors. If SSA auditors actually collect a greater quantity and more types of client-environmental facts than TBA auditors, then this differential task experience should lead to knowledge differences across methodologies (Libby and Luft 1993; Libby 1995). Hence, SSA auditors may have richer, more complex knowledge-acquisition schemas than TBA auditors. Richly developed schemas lead to the encoding of more information than impoverished schemas, and also tend to make information retrieval easier (Alba and Hasher 1983). For example, Frederick (1991)

found that the well-developed internal-control schemas of expert auditors led to their ability to retrieve more controls from memory compared to novice auditors, who had poorly developed schemas. In a recent study, Kopp and O'Donnell (2005) found that novice accountants trained to apply an SSA-style approach had better category knowledge of internal controls compared to novices trained using a TBA-style approach. This latter result indicates that use of an SSA methodology may lead to better knowledge structures in memory, when compared to those of auditors who use a TBA methodology. Given the more-detailed schemas of SSA auditors as they pertain to gathering client-environmental facts, SSA auditors' recall of these facts could be greater than TBA auditors' recall. This leads to the following hypothesis:

H1b: SSA auditors recall a greater quantity of client-environmental facts than TBA auditors.[20]

Experience-related differences in knowledge of client-environmental facts

The number and types of client-environmental facts known by auditors may differ between expert and novice auditors. Bonner and Pennington (1991) report data that indicate 3.5 years of experience are required to gain an adequate understanding of a client's business.[21] The knowledge of an auditing student or a novice auditor is gained primarily from textbook-based university education and professional training sessions, with novice auditors having some practical audit experience as well. Thus, with little or no task-specific experience gathering client-environmental facts, the novice auditor's

[20] The null of this hypothesis is: SSA auditors recall the same quantity of client-environmental facts as TBA auditors or SSA auditors recall a lower quantity of client-environmental facts than TBA auditors.
[21] At the time of Bonner and Pennington's (1991) study only the TBA was in use in practice. Thus, this 3.5-year experience requirement refers only to TBA auditors. The SSA auditor's length of time required to gain an adequate understanding of the client's business may differ from this figure.

knowledge of these facts may be low.

The auditor's development of client business knowledge will be a function of audit experiences, discussion of audits with colleagues, supervision and review of work by superiors, additional firm training, and the use of audit plans and audit guides. Advanced-level tasks such as the actual collection and assimilation of client business knowledge, the use of this knowledge in designing audit plans, and the review and supervision of subordinates are likely to reinforce and enhance client business knowledge.

Research in a variety of domains has demonstrated that a person with more experience in a substantive area has more knowledge stored in memory (e.g., Chase and Simon (1973) in chess; Chi et al. (1981) in physics). In auditing, researchers have found that more-experienced auditors possess a greater quantity of financial-statement error knowledge (Libby and Frederick 1990; Tubbs 1992), internal-control knowledge (Weber 1980), and factors affecting going-concern judgments (Choo and Trotman 1991) than less-experienced auditors. In general, auditing knowledge increases commensurately with task-specific experience (Libby and Luft 1993; Libby 1995). Hence, more-expert auditors may have richer, more complex knowledge-acquisition schemas than novice auditors. As already noted, richer schemas tend to allow better retrieval of information from memory. Given the more-detailed schemas of experts, their recall of facts could be greater than novices' recall. This leads to the following hypothesis:

H2: Expert auditors recall a greater quantity of client-environmental facts than novice auditors.

Panel A of Figure 5 presents a graphical representation of H1a through H2,

wherein audit methodology is predicted to have either no effect (H1a) or a significant effect (H1b), and audit experience is predicted to have an increasing effect (H2) on the quantity of client-environmental facts known by auditors.

Interrelationships and interactions of client-environmental facts

Once the auditor has gathered the client-environmental facts deemed significant to a particular audit, she must then analyze the interrelationships and interactions (hereafter referred to collectively as relations) among these facts to further her understanding of the client's business. For example, when auditing a Canadian company with a significant number of American customers, the auditor may analyze how exchange-rate trends and trade-pact changes will affect the client's future sales to these customers. An auditor whose client manufactures automobiles may consider how interest-rate changes will affect sales and whether impending environmental regulations will force changes in car design, which in turn would affect research and development practices and production engineering. As these illustrations suggest, the facts involved in these relations are not necessarily confined to one subcategory of environmental facts, but rather may be drawn from several different categories. The causal nature of these intra- and inter-category relations suggests that schematic organizations are used to form the auditor's mental representation of the interrelationships and interactions of client-environmental facts (Waller and Felix 1984).

Methodology-related differences in mental representations of relations

The complexity of relations known by auditors may differ between

methodologies.[22] Specifically, the SSA auditor may possess more complex relational knowledge than the TBA auditor. This difference is expected because the SSA auditor generally considers far more relations than the TBA auditor, using formal techniques such as PEST Analysis and Porter's Five Forces Analysis to aid his examination of the complexities of the modern business environment (Thompson and Strickland 2001). Indeed, proponents of the SSA argue that its greatest advantage over the TBA is how it organizes and analyzes client-environmental facts, with the end result being a rich, highly developed client model which forms part of a chain of substantive audit evidence (Bell et al. 1997; Salterio and Weirich 2002). Figure 3 presents a partial graphical representation of the complex web of relations that is analyzed by the SSA auditor. This is not to suggest that the TBA auditor does not examine relations between and among client-environmental facts, merely that fewer of them are analyzed and that the analyses lack the depth and complexity of those performed by the SSA auditor.

As Alba and Hasher (1983) noted, through experience people acquire memory schemas for various tasks and activities. These schemas can contain any number of concepts, with few or many links among them, and some schemas can be embedded within others. In general, the complexity of a particular schema is determined by the complexity of the related task or activity that has been repeatedly experienced (Alba and Hasher 1983; Libby and Luft 1993). Because the TBA auditor's analysis of the interrelationships among client-environmental facts may be less-complex than the SSA

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[22] Pratt (1982) notes that the number of elements in a cognitive structure does not always determine its complexity. Therefore, in this study, the complexity of relational knowledge is considered to be a function of both the number of client-environmental facts and the number of interrelationships among these facts. Thus, it is possible for two individuals to know the same quantity of facts while at the same time possessing relational knowledge of differing complexity, with one individual knowing more interrelationships among these facts than the other.

auditor's analysis of facts, the TBA auditor may develop a relatively impoverished web of relations compared to the SSA auditor's web portrayed in Figure 3.

To illustrate the depth and complexity of the SSA auditor's analyses, Figure 1 presents a series of panels that outline how he might view the external forces and agents acting upon a retail client's operations. Panel A presents what the SSA auditor calls an entity-level business model (ELBM). The ELBM is a categorical representation of significant client-environmental facts, which in content—but not in organization—is not substantively different from the TBA auditor's collection of client business knowledge. The SSA auditor proceeds, however, to organize and analyze the facts within these categories in greater detail to bring out the interactions and interrelationships among them. For example, the macroenvironmental forces and external agents contained within the top box of the ELBM can be viewed spatially in the context of a strategic business risk framework. Panel B of Figure 1 presents a graphical representation of how these forces and agents bear down upon the facts contained within the lower categories of the ELBM. Panels C and D further decompose the strategic business risk framework into two constituent analyses: the PEST analysis, which analyzes the political, economic, social, and technological factors affecting the client; and the Five Forces analysis, which examines the relations among the client and its suppliers, customers, competitors, new market entrants, and potential product substitutes. Upon completing these analyses, the SSA auditor has a relation-rich, holistic representation of his client at the center of a complex web of external factors and agents. Similarly detailed analyses of the significant internal client factors, such as its critical business processes and related controls, are then conducted so that the core of the web is as well understood as the surrounding

environment.

Thus, it is argued here that the task of analyzing relations between and among client-environmental facts greatly differs between methodologies. Relative to the SSA auditor, the TBA auditor lacks task-specific experience related to analyzing these relations with the level of depth required by the SSA methodology. In particular, the complexity of relations analyzed is greater in the SSA than the TBA. Research in auditing has shown that task-specific experience directly determines auditing knowledge (Libby and Luft 1993; Libby 1995), so differences in task-specific experience lead to differences in related knowledge. Hence, given the specified differences in the task-specific experiences of SSA and TBA auditors as they pertain to analyzing relations among client-environmental facts, the SSA auditor's knowledge of these relations may be more complex than the TBA auditor's knowledge, controlling for any differences in factual knowledge predicted in Hypothesis 1b. This leads to the following hypothesis:

H3: Controlling for differences in factual knowledge, SSA auditors possess more-complex relational knowledge than TBA auditors.

Experience-related differences in mental representations of relations

The complexity of relations known by auditors may differ between relatively more-expert and novice auditors. Consistent with the arguments put forth above in respect of expert-novice differences in knowledge of client-environmental facts, the novice auditor has little or no task-specific experience analyzing the relations among client-environmental facts, so her knowledge of these relations may be lower and less complex than the expert's knowledge of relations. This leads to the following hypothesis:

H4a: Controlling for differences in factual knowledge, expert auditors possess

more-complex relational knowledge than novice auditors.

It is also expected that audit methodology will moderate this effect of experience on relational knowledge. Specifically, it is expected that the predicted expert-novice difference in relational knowledge will be greater for SSA auditors than for TBA auditors. As detailed in the preceding subsection, the task of analyzing client-environmental relations is more complex in the SSA than in the TBA. Bonner (1994) suggests that complex audit tasks tend to increase the quantity or decrease the clarity of information that must be considered in the input, processing, and output phases of the task, thus increasing the demands made on the auditor's cognitive capacity. Prawitt (1995) found that increased task complexity resulted in the assignment of more-experienced auditors to complete these tasks. Based on these findings, it is argued here that, on average, more experience is required to properly analyze many of the relations of interest to the SSA auditor—particularly the more-complex relations—than is necessary to analyze the relatively simpler relations of interest to the TBA auditor. Hence, in the SSA a significant proportion of the relation-analysis task must be performed by experts rather than novices, whereas in the TBA a comparatively larger proportion of the relation-analysis task may be performed by novices.

Therefore, within the SSA methodology the expert-novice difference in task-specific experience may be greater than it is in the TBA methodology. Research has shown that differences in task-specific experience lead to differences in related knowledge (Libby and Luft 1993; Libby 1995). So, the specified methodology-related expert-novice differences in task-specific experience are expected to result in a greater expert-novice difference in relational knowledge for SSA auditors when compared with

the expert-novice knowledge difference for TBA auditors. Therefore, as an auditor gains experience, his knowledge of relations may increase in complexity, with this increase being more pronounced for the SSA auditor than for the TBA auditor. This leads to the following hypothesis:

H4b: Controlling for differences in factual knowledge, the expert-novice difference in relational-knowledge complexity will be larger for SSA auditors than for TBA auditors.

Panel B of Figure 4 presents a graphical representation of H3 and H4, wherein both the SSA methodology (H3) and audit experience (H4a) are predicted to result in a greater complexity of relational knowledge, with these two factors interacting to result in greater experience-related differences in relational knowledge for SSA auditors than for TBA auditors (H4b).

Summary of knowledge-content-and-organization hypotheses

Considered together, these hypotheses make several predictions about auditors' mental representations of client business knowledge. This knowledge comprises internal and external client-environmental facts as well as the relations between and among these facts (Waller and Felix 1984; Bonner and Pennington 1991). Consistent with prior theoretical research in auditing (Gibbins 1984; Waller and Felix 1984; Libby and Luft 1993), it is expected that this knowledge is organized in long-term memory by means of categories and schemas and that the complexity of these structures varies with task-specific experience. In particular, consistent with prior empirical research in auditing (e.g., Weber 1980; Libby and Frederick 1990; Choo and Trotman 1991; Frederick 1991; Tubbs 1992), both audit methodology (i.e., SSA or TBA) and audit experience are

expected to influence the quantity and complexity of the facts and relations known by auditors.

More precisely, SSA auditors and TBA auditors may know the same number of client-environmental facts because in principle the quantities and types of facts gathered does not vary by methodology. Alternatively, a review of leading auditing textbooks and Big 4 audit manuals suggests that in practice SSA auditors may routinely collect significantly more client facts from a broader array of categories than TBA auditors, thus leading to the expectation that SSA auditors know a greater quantity of facts than TBA auditors.

Controlling for any differences in factual knowledge, methodological differences may also lead to SSA auditors knowing more-complex relations among these facts. This difference is expected because the task of examining these relations requires a greater breadth and depth of analysis in the SSA than in the TBA (see Figure 1 for a series of panels illustrating some of these analyses). Thus—even after controlling for any factual knowledge differences—the SSA auditor may have a richer, more-complex mental representation of client business knowledge compared to the TBA auditor's relatively impoverished mental representation of this knowledge.

In addition, novice auditors within each methodology may know fewer client-environmental facts and less-complex relations among these facts than their expert counterparts. Expert auditors in both methodologies have extensive experience gathering and analyzing client business knowledge, whereas novices have little experience beyond collecting these facts. Because more task-specific experience leads to greater related knowledge (Libby and Luft 1993), expert auditors are expected to possess a greater

quantity of more-complex client business knowledge compared to novices. Thus, compared to the highly populated and richer, more-complex mental representation of the expert auditor, the novice auditor is predicted to have a very impoverished mental representation of client business knowledge. Moreover, the expert-novice contrast in mental representations may be greater for SSA auditors than for TBA auditors because the task of analyzing client business knowledge is more complex in the SSA methodology than in the TBA methodology, thus requiring more-experienced auditors to perform a greater proportion of the analysis task in the SSA compared to the TBA.

The Effect of Knowledge Complexity on Risk Assessment

Risk assessment

Risk assessment is perhaps the most important task for an auditor because it affects the nature, extent, and timing of evidence accumulation (Arens et al. 2000). Indeed, in their analysis of financial-statement errors, Houghton and Fogarty (1991) concluded that inherent risk assessment is significantly important in judging the relative risk of errors. The auditor can do very little to influence a client's risks, so he must identify the factors that determine these risks, assess their severity (e.g., low, medium, or high risk), and then modify evidence accumulation accordingly.

According to Arens et al. (2000), the auditor should consider several major factors when assessing risk, among them being (1) the nature of the client's business, including its products and services; (2) management integrity; (3) client motivations; (4) related parties; and (5) nonroutine transactions. Empirically, Houghton and Fogarty (1991) found that auditors with a good understanding of their client's business can make good risk assessments with relative ease. They also noted that a knowledge of the client's industry

characteristics and non-routine transactions were useful in identifying risk factors. In developing a knowledge-based model to assist with risk assessment, Peters et al. (Peters, Lewis, and Dhar 1989) noted that auditors incorporate knowledge about changes in the client and the client's industry, management's motivations, and prior operating history into their assessment of risk. Thus, in general, knowledge of the client's business is essential to thorough risk identification and assessment.

Knowledge-related performance differences

Risk assessment may differ according to the complexity of auditors' relational knowledge of the client's business. As argued in detail above, audit experience and methodology may interact to affect the development of auditor's relational knowledge, resulting in some auditors possessing more complex mental representations of client business knowledge than others. In general, greater quantities of better organized knowledge lead to superior judgment performance (Libby and Luft 1993). For example, Curtis and Viator (2000) found a significant effect of experience on auditor's internal control knowledge structures, with the dimensions of these structures in turn having a significant effect on control weakness and error identification. They also found no significant relation between experience and weakness/error identification, suggesting that knowledge structures mediate the experience-judgment relationship, as specified in the Libby and Luft model. Kopp and O'Donnell (2005) have recently found that better category knowledge of a client's internal controls leads to improved risk assessments. Other research (e.g., Tubbs 1992; Libby and Tan 1994; Nelson et al. 1995; Choo 1996) has also found significant effects of knowledge structures on judgment performance. Thus, given the previously stated importance of client business knowledge to risk

assessment and the theoretical relation between knowledge and judgment performance, it follows that auditors with more complex relational knowledge of the client's business may make different risk assessments than those auditors with less complex relational knowledge. This leads to the following hypothesis:

H5: Auditors with more-complex relational knowledge will make different risk assessments than auditors with less-complex relational knowledge.

The theoretical model underlying this and the study's other hypotheses is displayed in Figure 6.

Chapter Summary

This chapter developed the hypotheses related to this dissertation's research questions, relying on a synthesis of the literature reviewed in Chapter 1. Hypotheses 1a and 1b are competing hypotheses, proposing that SSA and TBA auditors will either recall equivalent numbers of client-environmental facts or that SSA auditors will recall more facts than TBA auditors. Hypothesis 2 proposes that expert auditors will recall more facts than novice auditors, and is essentially a replication of earlier findings from the auditing literature. Hypothesis 3 predicts that SSA auditors will possess more-complex knowledge of the relations among client-environmental facts than TBA auditors. Hypothesis 4 predicts that expert auditors will possess more-complex knowledge of the relations among client-environmental facts than novices and that this difference will be greater for SSA auditors than for TBA auditors. Finally, Hypothesis 5 predicts that auditors with more-complex relational knowledge will make different risk assessments than auditors with less-complex relational knowledge. The next chapter details the research design that will be used to test these hypotheses.

CHAPTER 3 - RESEARCH METHOD

Introduction

This chapter describes the research design that was used to test the study's hypotheses, which were detailed in the preceding chapter. First, the participants recruited to take part in the study are discussed. Next, the tasks these participants were asked to perform are detailed, with particular attention paid to the construction of the tasks. Then, the study's administration and specific procedures are described. Finally, the measures generated by the participants and used as dependent variables for hypothesis testing are detailed, with a focus on how the participant-generated data were coded.

Participants

Methodology

One of this study's main objectives is to examine the effects of differences between audit methodologies on auditors' knowledge content and structure. Simply manipulating audit methodology in a laboratory setting would not be sufficient to determine how years of experience using one methodology affects knowledge and ultimately judgment. Four recent studies (Kotchetova 2002; O'Donnell 2003; O'Donnell and Schultz 2003; Kopp and O'Donnell 2005) have examined the effects of SSA vs. TBA methodology differences on knowledge or judgment by manipulating methodology in the laboratory. It is important to note, however, that methodology affects judgment by interacting with actual experience using such a methodology, as well as the knowledge gained from this experience (Libby and Luft 1993). These studies focused only on the direct, short-term effects of methodology on knowledge or judgment. Thus, it is difficult to draw firm conclusions about their results because important factors from the

underlying theoretical model were intentionally omitted from the experimental designs.

So, to examine the effects of methodology on knowledge and judgment in this study, auditors with actual audit experience applying one of three different audit methodologies were required. Because the methodology variable in this study is measured instead of manipulated, it was not possible to randomly assign participants to conditions. Random assignment achieves comparability among experimental conditions by probabilistically counterbalancing idiosyncrasies across groups so that the "average" participant within each condition is substantively equivalent except for the experimental manipulations of interest in the study (Cook and Campbell 1979). Thus, randomization facilitates strong causal inferences related to the effects of the manipulated variables on experimental outcomes. Hence, by not using randomization in this study, the internal validity of its results is reduced. Cook and Campbell (1979), however, advise that it is reasonable to sacrifice some internal validity if construct validity is thereby strengthened.

In this study, construct validity is enhanced because the threat of "construct underrepresentation" is largely avoided by treating methodology as a measured variable instead of a manipulated variable. Construct underrepresentation occurs when a researcher fails to include all the relevant dimensions in the construct (Cook and Campbell 1979). In this study, audit methodology is defined as the policies, procedures, and tools used by an audit firm to carry out financial statement audits. Further, it is hypothesized that it is an auditor's actual experience using this methodology that, over time, leads to the development of schemas to organize and store knowledge of the client's business. Given participants' time constraints, manipulating methodology in a lab setting would require exposing participants *over a very short period of time* to only *a very small*

subset of the policies, procedures, and tools used in a particular methodology. Instead, by allowing participants to perform the study's tasks while relying on their *years of experience* with *all aspects* of their firm's methodology, a more thorough representation of the methodology construct is attained.

Moreover, randomly assigning auditors to methodology conditions would result in auditors with experience using one methodology being assigned to a condition where they are asked to apply a different methodology, which could lead to these auditors using a methodology in the lab that they were not used to in practice. This could cause participant confusion, thereby clouding the study's results.

Finally, in two studies that examined the effects of structured versus unstructured audit methodologies on auditors' task perception and judgment, Bamber and his colleagues (Bamber and Snowball 1988; Bamber, Snowball, and Tubbs 1989) used auditors from firms that actually used one of these two methodologies to operationalize the methodology construct.

For these reasons, the auditors in this study were categorized into one of three methodology conditions, which were defined based on the extent to which their firm incorporated SSA techniques into its audit approach. The *SSA* condition includes any firm that uses a comprehensive version of the SSA approach similar to that described by Bell et al. (1997) in their original SSA monograph. Such an approach would include thorough analyses of a client's business strategy, key business processes, and key performance indicators, which are analyses that are critical to the implementation of the SSA and would thus be performed on the vast majority of audit engagements conducted by a firm employing such an approach. In contrast, the *TBA* condition includes firms that

focus their audit attention on the accounts and transactions underlying a client's financial statements and place little emphasis on analyzing a client's strategy, business processes, or performance indicators (i.e., the critical components of the SSA approach), and which would therefore perform these types of analyses relatively infrequently compared to SSA firms. The *SSA-TBA* condition includes firms that use a hybrid of the two approaches, which would consist primarily of an analysis of a client's business strategy (as in the SSA) combined with standard procedures from a TBA approach, with less emphasis on key business processes and key performance indicators. Information on the approaches employed by firms supplying participants for this study was obtained from discussions with partners and employees of the firms, firm training resources, a full-time faculty member at the author's institution who was familiar with firms' audit approaches, and published sources. Based on the preceding classification scheme and the methodology-related information reviewed, of the six firms that provided participants for this study, one was an *SSA* firm, two were *SSA-TBA* firms, and three were *TBA* firms.

Experience

This study also examines how audit experience affects the development of auditors' client business knowledge. Thus, to investigate the related research questions, it was necessary to have auditors with varying amounts of audit experience complete the study. According to Abdolmohammadi's (1999) taxonomy of audit tasks, of the 45 tasks usually performed in an audit's orientation (or planning) phase, 31 tend to be performed by seniors (two to five years' experience), with four performed by staff auditors (one to

two years' experience) and 10 by managers (five to 12 years' experience).[23] Based on these findings, auditors with three years of experience would have a reasonable background performing the vast majority of planning-related audit tasks, whereas auditors with less than one year of assurance experience would have less background overall and less exposure to the broad range of planning tasks. Therefore, the participants recruited as the experienced auditors for this study were those with roughly three years of assurance experience, whereas the less-experienced participants were accounting students with less than one year of assurance experience. Past studies of auditor expertise (e.g., Libby and Frederick 1990; Frederick 1991; Frederick et al. 1994) have tended to have three-to-four year spreads between their experienced and inexperienced auditors. So, with a spread of less than three years, the experience gap between participants in this study is not quite as large as those of prior studies. As noted above, however, auditors with levels of experience similar to those of the students in this study perform only four of the 45 audit planning tasks in Abdolmohammadi's (1999) taxonomy, compared to the 31 tasks typically performed by auditors with the experience of those in this study. Thus, there should be a significant enough difference in the amounts of task-specific experience held by the two experience-related participant groups in this study to investigate the related hypotheses.

Task Construction

Constrained-recall task

Hypotheses 1a, 1b, and 2 were tested using a variation of the memory-recall

[23] Abdolmohammadi's (1999) definition of orientation phase comprises three subphases: understanding the client's business, engagement risk assessment, and inherent risk assessment, which are also the three subphases of interest in this dissertation. For this reason, the experience levels related to the particular tasks within these subphases were useful in guiding the expert-novice participant selection in this study.

paradigm first used to study knowledge structures by Bousfield (1953), and later employed by many accounting researchers to investigate auditors' knowledge content and organization (e.g., Weber 1980; Libby and Frederick 1990; Frederick 1991; Tubbs 1992; Christ 1993; Solomon et al. 1999; Thibodeau 2003). This paradigm involves presenting participants with a stimulus list containing items from the knowledge domain of interest, letting them study the list for a pre-determined amount of time knowing they will be asked to recall the items later, and then finally having them recall from memory as many of the items as possible after performing a short distracter task to clear their short-term memory.

Although free recall is not one of the usual tasks of an auditor, it is a good experimental tool for eliciting the structures built up through experience (Craik and Lockhart 1972). For example, participants recall randomly presented categorized lists by category. This is not because they are accustomed to having to recall the items together, but rather, because they have organized the items together over time (Adelson 1981). In addition, Reitman and Rueter (1980) suggest that, given an unusual task, participants will very likely resort to using the structures and processing categories that they use most frequently. Given these findings and the extensive use of recall-based studies in accounting, it was believed that a recall task would be both useful and valid in the present study.

With the permission of one of the case's authors, the stimulus list for the recall task was adapted from the *Virtual Control Corporation* (VCC) SSA case by Wright et al. (Wright, Wright, and Gordon 2001). The case is based on a real company that manufactures computer joysticks. Thibodeau (2003) notes that most auditing and

accounting textbooks feature examples from the manufacturing industry, so all auditors are expected to have a basic level of manufacturing industry knowledge from their university education. Thus, the manufacturing industry provides a familiar context for the participants. To accommodate participants' limits on their time available to take part in the study, a subset of 60 pieces of information were selected from the 17-page VCC case.

To ensure that the 60 pieces of information chosen for the tasks were relevant to gaining an understanding of the client's business, 21 senior managers from three of the firms (12 from an SSA-TBA firm, four from an SSA firm, and five from a TBA firm) providing auditors for the main experiment rated the importance of each piece of information.[24] The senior managers had mean auditing experience of 10 years (s.d. = 2.34). They were asked to consider each piece of information's "importance within the context of gaining an understanding of a manufacturing client's business." Each piece of information was rated on a seven-point scale ranging from –3 (labelled Very Unimportant) to +3 (labelled Very Important), with the midpoint of 0 labelled Neutral. The mean ratings of the 60 pieces of information ranged from -0.64 to 2.73, with an overall mean importance rating of 1.29 (s.d. = 0.77). Only the lowest-rated piece of information (rating of –0.64, s.d. = 1.36) was significantly less than the Neutral midpoint of the Importance scale ($p = 0.04$), which indicates that only one out of 60 pieces of information could be construed as "unimportant". Of the remaining 59 pieces of information, 10 were rated as statistically equivalent to the Neutral midpoint ($p > 0.05$) and 49 were rated on the "important" half of the scale (i.e., significantly greater than the

[24] All of the senior managers who participated in this study completed their assigned tasks within a survey-style Excel file which was emailed to them, completed entirely in electronic form, and then returned to the researcher via email. The unequal number of senior managers across methodologies occurred due to difficulties encountered recruiting participants for this task.

Neutral midpoint; $p < 0.05$). Thus, only 2% of the pieces of information were rated as relatively unimportant while 82% were rated between important and very important, with the remaining 16% receiving a neutral rating. These ratings indicate that the vast majority of the 60 pieces of information were relevant to the task of gaining an understanding of the client's business. Table 3 presents the 60 pieces of information and their mean importance ratings.

To aid in ruling out serial-order effects on participants' recall (Bower 2000), each participant received the list of client information presented in one of two random orders and the first three and the last three pieces of information were held constant across these two random orders. The six pieces of information selected to begin or end the list were those receiving the lowest importance ratings by the senior managers.

Also, to inhibit participants' ability to use the surface features of the 60 pieces of information as an aid in recalling them, the repetition of key words across pieces of information was minimized. For example, instead of repeatedly using the word "competitors" or variants of it, the words "other manufacturers", "opposition", "other developers", and "rivals" were also used in pieces of information that referred to the competition. By varying the syntax in this way, participants had to rely more on whatever pre-existing knowledge structures they had in long-term memory to help them mentally organize the pieces of information for later recall, rather then simply use common terms as memory aids.[25] Finally, each of the 60 pieces of information was stated in 10 words or

[25] The use of common wording across pieces of information would allow participants to chunk pieces together in memory based on the common words, thereby aiding their recall of the information (Chase and Simon 1973) even if they lack an existing schema to help them organize the information in memory. Common wording would be particularly helpful to novice participants, who tend to use surface features to store knowledge (Chi et al. 1981). Therefore, this design feature permits a clean test of Hypotheses 1a, 1b,

less (mean = 8.5; SD = 1.3) to facilitate participants' ability to hold one entire piece of information in short-term memory (Miller 1956) while either studying or recalling the pieces of information.

The recall task was pretested using 73 Masters of Accounting students. The pretesting was done primarily to ensure that the task's instructions were clear, that the task itself was understandable, and that the data generated would be useful for testing the related hypotheses. No significant problems were found in any of these areas. Minor modifications to the task were made where necessary.

Risk-assessment task

To test Hypothesis 5, which pertains to the effect of knowledge complexity on risk judgments, a risk-assessment task employing the same 60 pieces of information as the recall task was used. This task required participants to study the list of client information and then assess the level of various risks associated with the fictional audit engagement. This task was modelled on past auditor judgment studies (e.g., Colbert 1988; Messier and Austen 2000) that examined differences in auditors' risk judgments. Thus, the data generated by this study's risk assessment task should be suitable for identifying differences among auditors' risk judgments (i.e., Hypothesis 5).

The risk-assessment task was constructed as follows. The same 21 senior managers who rated the importance of the 60 pieces of information were also asked to analyze the information and then identify any audit risks they felt were relevant to the audit of VCC (i.e., all risks were self-generated). From the full set of risks identified,

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and 2 because participants had to rely on their existing schemas (i.e., the memory structures hypothesized to affect participants' recall) rather than common words (i.e., a factor of no interest in this study) to help them organize and recall the information.

seven were selected for use in the risk-assessment task. To ensure that the risks selected for the task were highly relevant to the fictional audit and were representative of risks identified by senior managers from at least two of the three methodology conditions, the following selection criteria were used. Three of the risks selected were identified by a majority of both the SSA and SSA-TBA senior managers. Two of the risks selected were identified by a majority of the SSA-TBA senior managers, but by 50% or fewer of the SSA senior managers. The remaining two risks selected were identified by a majority of the SSA senior managers, but by 50% or fewer of the SSA-TBA senior managers.[26] Participants were also asked to make an assessment of the overall risk of material misstatement for the fictional engagement. Table 4 presents the seven specific risks, along with the proportion of SSA and SSA-TBA senior managers who identified each as a risk, and the one general risk used in the risk-assessment task.

To help test for order effects, the seven specific risk factors were presented to participants in one of two orders. One order had the two SSA-relevant risks first, followed by the three common risks, then by the two SSA-TBA risks (Table 4 presents the risks in the sequence used for this order). The second order simply reversed this sequence. These two risk orders were fully crossed with the two orders used for the client information. The general risk was presented immediately after the seven specific risk factors for all participants so that they could use their assessments of the specific risks as inputs in their overall risk assessment.

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[26] At the time the risk task was designed, it was thought that participants recruited for the main study would not be drawn from the TBA firm that supplied senior managers to help identify risk factors, so risks identified by these senior managers were not factored into the construction of the risk task. Only after the SSA participants completed the main study was it decided that participants from the TBA firm would be asked to take part in the study. At this point, obviously, the instrument could not be changed.

Risk-justification task

To examine Hypotheses 3, 4a and 4b, which involve the effects of methodology and experience on auditors' knowledge complexity, this study employed a risk-justification task similar to that used by Choo (1996) to investigate the complexity of auditors' cognitive scripts. Choo had his participants write a memo justifying the going-concern judgment they had just made and he then analyzed the contents of the memos to assess each participant's knowledge complexity. The present study uses a task that simply requires the participants to write a memo justifying the risk assessments they just made. Because this task is based on a prior audit judgment study examining a similar knowledge construct and because practising auditors typically document the basis for their judgments in justification memos, this task seems suitable for testing Hypotheses 3, 4a and 4b.

Again following Choo (1996), participants performed the risk-justification task immediately after the risk-assessment task. Choo conducted a second experiment to determine if having auditors prepare the justification memo before making their going-concern judgments had any effect on the content of the memos. He found no significant differences in content across task orders. Thus, it seemed reasonable to use only the assessment-then-memo order in the present study.

Both the risk-assessment and the risk-justification tasks were pretested using 11 Masters of Accounting students. The pretesting was done primarily to ensure that the task's instructions were clear, that the task itself was understandable, and that the data generated would be useful for testing the related hypotheses. No significant problems were found in any of these areas. Minor modifications to the task were made where

necessary.

Task Administration

All participants completed the study in the presence of the researcher, except for one group of SSA auditors, who completed it in the presence of the researcher's PhD supervisor. Two groups of participants completed the experiment during a firm training session, with the remaining participants completing it in group sessions at their respective firm's office or in university classrooms. The participants were given a packet of three envelopes containing the task materials. The materials included an introduction, general instructions, the tasks to be completed, and a demographic questionnaire. The introduction informed participants that the study was part of a project aimed at examining how auditors gain an understanding of a client's business. The confidentiality of responses and the importance of independent work were stressed. The demographic questionnaire requested information about the participant's amount and type of audit experience, their firm's audit methodology, and their reaction to the study. Further details on the task procedures are provided next. The entire instrument is provided in Appendix A.

Task Procedures

Recall task

After signing the participant consent form, participants removed the recall task from the first envelope. The task proceeded as follows. All the participants first read the brief introduction and some general instructions, which informed them of the study's purpose and stressed the confidentiality of their responses and the need for independent

work.[27] They were then informed that they would be presented with a set of 60 pieces of information about XTC Inc., a new manufacturing audit client, and would later be asked to recall these pieces of information from memory.[28] They were asked not to turn the page to begin reading the pieces of information until they were verbally told to do so. They were also asked not to make any written notes concerning the pieces of information they were about to read. When told to by the task administrator, all the participants then turned the booklet to the three pages where the 60 pieces of information were listed and studied the listing for 10 minutes.[29] At the end of the 10-minute study period, the administrator told the participants to immediately stop studying the information. The participants then placed the listing back in the first envelope and sealed it to prevent them from reviewing it during the recall phase.

Participants then removed the next two parts of the recall task from the second envelope. Before beginning to recall the information, participants first answered three multiple-choice accounting questions to clear their short-term memory.[30] Participants then placed the questions back in the envelope and proceeded to read the instructions for the recall portion of the task. The instructions stated that the participants were to recall the pieces of information "in the order in which they come to mind" and that key-word

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[27] Unless otherwise noted, all of the instructions described in the Task Procedures section were written instructions contained within the body of the study materials.

[28] The client's name was changed from VCC, which was itself a fictional name, to XTC Inc. for the purposes of the instrument.

[29] Ten minutes allowed participants to read and study each of the 60 facts for 10 seconds, an amount of time that is consistent with prior recall studies in accounting (e.g., Frederick 1991, who allowed nine seconds per item).

[30] The knowledge questions served as a distracter task in order to clear participants' short-term memory and minimize primacy and recency effects on recall. None of the three questions dealt with issues that were pertinent to the client in the experiment. In particular, the questions dealt with why auditors gather evidence, how to account for dividends, and which party is responsible for proper financial statement disclosure.

rather than verbatim descriptions of the pieces of information were acceptable as long as enough information was provided to make it clear which piece of information was being recalled. Participants were also asked not to revise the pieces of information once they had written them down. Three lined sheets were provided to them for their responses and they were asked to list only one piece of information per line. Participants were allowed to proceed through the task at their own pace, with no limit placed on how long they could spend recalling the pieces of information. To track how much time each participant spent recalling the pieces of information, participants were asked to write down the time immediately before and after completing the recall task. When they finished the recall task, they placed their recall lists back in the second envelope and sealed it. They then proceeded with the risk-assessment and risk-justification tasks in the third envelope.

Risk-assessment task

The risk assessment task proceeded as follows. Participants were told they would again be given the pieces of information pertaining to XTC so that they could review them and then assess the level of various risk factors that may be relevant to the audit of XTC.[31] They were also informed that after making the risk assessments, they would be asked to write a memo to the engagement partner, which provided the rationale for their assessments. To invoke more effortful and complete processing of task information and judgments (Tetlock 1985; Tan and Kao 1999), participants were told to make their "risk assessments and prepare the related memo as if you were on an actual audit. For example, you should consider your judgment subject to review by the engagement partner."[32] The

[31] For the risk task, the participants received the client facts in the same order as for the recall task.
[32] Admittedly, this is a weak form of accountability pressure, because participants were likely aware that no one but the author would be reviewing their memos.

participants were again allowed to complete these tasks at their own pace. They were asked to write down the time immediately before and after completing the risk-assessment task.

Once they had reviewed and analyzed the client information, participants were told, "During the client-acceptance phase of the XTC Inc. engagement, several risk factors were identified based on the pieces of client information that had been gathered to date." They were then asked to "assess the risk of material misstatement posed by each of these factors" based on their up-to-date knowledge of the client. After assessing each of the individual risk factors, they were also asked to "make an overall assessment of the risk of material misstatement on the XTC engagement."

Participants made their eight risk assessments (seven specific factors and one general assessment) on 100-point scales, with a scale presented immediately below each risk. The scales were anchored by 0 at the low end (labelled "Low Risk") and 100 at the high end (labelled "High Risk"), with the midpoint of 50 labelled "Moderate Risk". This scale format was adapted from Messier and Austen (2000), who used a very similar scale in their examination of auditors' inherent and control risk assessments.[33]

Once participants had made their risk assessments, they were asked to "prepare a memo to the engagement partner that provides the rationale for your risk assessments." These instructions are consistent with Choo (1996), who used the same task in his examination of auditors' going-concern judgments. Participants were provided with two lined pages to write their memo. Upon completing their memos, participants were asked to rate the case's realism, the usefulness of the client information in making the risk

[33] The only difference between the present study's scales and those used by Messier and Austen is that they labelled the low end of the scale "Little Risk" instead of "Low Risk".

assessments, the risk-assessment task's similarity to how they would perform it in practice, and their firm's use of decision aids to make risk assessments. When finished, participants placed the risk tasks in the third envelope and then completed a demographic questionnaire.

Demographic questionnaire

The demographic questionnaire elicited information on: participants' title, education, and professional training; their amount and types of audit experience, including the firms they have worked for; their experience with the specific tasks of gathering and analyzing client business knowledge; and their firm's audit approach. Upon completing the questionnaire, participants placed it in the third envelope, sealed it, and returned the packet of three envelopes to the administrator.[34] Participants were then debriefed on the purpose of the research and any questions were answered.

Dependent Variables

Hypotheses 1a, 1b, and 2

The dependent variable for Hypotheses 1a, 1b, and 2 was the number of pieces of information correctly recalled by each participant. Consistent with Bonner, Davis, and Jackson (1992), this can be interpreted as a measure of the quantity of declarative knowledge regarding the case information that has been stored in long-term memory. Each participant's recall protocol was coded to determine the number of pieces of information correctly recalled. Irrelevant intrusions and item repetitions were also coded

[34] To keep the three envelopes for each participant together, they were wrapped in an elastic band before being returned to the administrator. The three envelopes for each participant were also labelled with a numerical code in case they were subsequently separated.

accordingly.[35] Only recalled pieces of information that could be clearly matched to an originally presented piece of information were counted as "correct". The coding was done by comparing each piece of information in a participant's protocol to the 60 pieces of information from the stimulus list, which were numbered from one to 60 for coding purposes only. Each piece of information in the protocol that could be matched to one from the stimulus list was coded with the corresponding piece number and included in the total number of correctly recalled pieces of information. Intrusions were coded with an "X" and repeated pieces of information were simply coded with the corresponding piece number. Both were then excluded from the final total of correctly recalled pieces of information.

Because coding the recall protocols involved some judgment, albeit minimal, it was possible for researcher bias to influence their coding. To permit detection of any bias, an auditing professor who is a CPA with significant auditing experience also coded a significant subset of the protocols independently from the author.[36]

Hypotheses 3, 4a, and 4b

The testing of Hypotheses 3, 4a, and 4b required measures of the complexity of participants' relational knowledge. The participants' risk-justification memos provided

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[35] Irrelevant intrusions are facts that were not present in the stimulus list. For the purposes of this analysis, recalled facts that could not be clearly interpreted as relating to any of the initially presented facts were coded as intrusions. An item repetition is simply the recall of the same piece of information more than once in the same protocol.

[36] Extensive training of the independent coder was not necessary for the recall coding task, as little judgment was required in coding the protocols. The coder was given written instructions on the process to be followed and then practised coding on 20 memos. The coding of these memos was compared to the author's to identify any common causes of discrepancies between the two sets of coding. The only common cause was the independent coder's tendency to code as incorrect a recalled fact that did not resemble the verbatim wording of any original fact. As noted earlier, only the gist of a recalled fact had to be consistent with an original fact to be counted as correct; verbatim matches were not necessary. The independent coder incorporated this practice into his live coding of the protocols.

the raw data necessary for assessing this knowledge and causal mapping (Axelrod 1976) was used to analyze the data. Causal mapping involves analyzing the text of a document, looking specifically for statements containing cause-effect relationships. A simple example of this kind of statement is, "Stock options increase fraud risk", wherein the cause concept is "stock options", the effect concept is "fraud risk", and the relationship between them is positive. Not all causal relationships are this basic, so a detailed coding manual by Wrightson (1976), which provides numerous cases and examples of more-complex causal relationships, was used to assist in the coding process.

For each participant, the result of this causal-mapping analysis is a list of all the cause-effect statements used in their risk-justification memo, which can be used to determine the participant's knowledge comprehensiveness and density. Knowledge comprehensiveness is represented by the number of distinct cause or effect concepts appearing in the participant's memo. Knowledge density is determined by calculating the ratio of the number of distinct cause-effect statements (or relations) to the number of distinct cause and effect concepts (i.e., knowledge comprehensiveness). These two knowledge measures provide insight into the complexity of the participant's mental representation of client business knowledge, with higher comprehensiveness and density scores indicating more-complex knowledge representations.[37] These measures of knowledge complexity have been used in prior studies of mental representations (Carley and Palmquist 1992; Nadkarni 2003) and Nadkarni and Narayanan (2005) have recently shown that these constructs are valid measures of knowledge complexity.

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[37] The minimum possible density is 0.5, which indicates only one relation per distinct pair of concepts in a person's knowledge representation. Thus, density scores approaching this ratio imply very low relational knowledge complexity.

To illustrate, Figure 7 contains a risk-justification memo drawn from pretest results and Table 5 presents the corresponding causal-mapping analysis of the content of this memo. This analysis revealed that the participant's mental representation of client business knowledge contains 34 unique cause or effect concepts with 28 distinct causal relations among them, yielding knowledge comprehensiveness of 34 and knowledge density of 0.82. It is not difficult to visualize how much more complex this sample participant's relational knowledge is compared to, say, a second participant who had only 25 different concepts and 20 distinct relations in their mental representation.

The process of coding the memos was similar to that for conventional verbal protocol analysis (Ericsson and Simon 1984). As each memo was read, any cause-effect statements were cut and pasted into a coding table, with each distinct cause or effect concept labelled with a letter code.[38] (See Table 5 for an example of how each memo was coded.) It is important to note that, under this approach and as in Choo (1996), the quality of the reasoning in each individual cause-effect statement was not evaluated; all cause-effect statements in each memo were used to calculate the comprehensiveness and density scores, which served as the dependent variables for H3, H4a and H4b, and the independent variables for H5. To again permit detection of any researcher bias in coding, independent coding procedures were used to code roughly half of the memos. An accounting PhD student who is also a CA with auditing experience was trained to apply the coding method described above.[39]

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[38] The participants' handwritten memos were transcribed into Microsoft Word to simplify the coding process.

[39] It is important to note that significantly more judgment is required in coding the memos compared to coding the protocols. Neither the author nor the other coder had any experience performing this kind of coding. To gain experience prior to conducting any live coding, both coders read the Wrightson (1976)

Hypothesis 5

To identify differences among participants' risk judgments for the purpose of testing Hypothesis 5, their risk assessments made on the 100-point scales were used. Because there was no judgment involved in interpreting the participants' ratings in this respect, no independent coding procedures were necessary.

Chapter Summary

This chapter described the research design used to test the study's hypotheses, with a focus on participant recruitment, task construction and administration, and the measures to be used as dependent variables. The next chapter presents the statistical analysis of the data generated by the participants.

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manual in detail and then independently coded 10 memos from the pilot test of this study. Each pair of codings was then compared to identify discrepancies, inconsistencies with the Wrightson manual, and common causes of each of these types of problems. The coders then discussed these issues to clarify where each of them tended to err. Another 10 memos were then coded, and their discrepancies and inconsistencies were examined and discussed. At this point, both coders felt comfortable proceeding with the live coding.

CHAPTER 4 - RESULTS

Introduction

This chapter presents descriptive statistics regarding the participants in this study as well as statistical tests of this dissertation's hypotheses and a variety of related analyses of the data generated by the participants.

Participants

In total, 118 participants completed the study. Eighty-eight of these participants were staff or senior auditors from a variety of Big 4 and other national and regional accounting firms. The other 30 participants were students from two Ontario universities, all of whom had some co-op work experience at a variety of accounting firms.

Experience

For the purpose of testing the experience-related hypotheses in this study, participants were split into two groups with significantly different levels of assurance experience. Panel A of Table 6 presents details of the demographic characteristics of the study's participants by these two experience levels. The 88 practising staff and senior auditors, who had eight to 93 months of assurance experience (mean = 33.8, s.d. = 17.2), were collapsed into a single group of more experienced auditors (referred to hereafter as "auditors"). The 30 undergraduate and Masters accounting students with assurance experience ranging from one to 20 months (mean = 7.9, s.d. = 5.1) served as the "audit student" comparison group. The 26-month difference in mean assurance experience between these auditors and audit students is significant ($t = 12.58$, $p < 0.001$). In addition, 69% of the auditor participants had the title of senior auditor or equivalent, whereas only 10% of the audit student participants had this title ($\chi^2 = 31.72$, $p < 0.001$), with the

remaining participants in each group holding the title of staff auditor.[40] Of the 88 auditors, 51 (or 58%) had an accounting designation (CA or CPA). Given their status, none of the audit students had yet acquired a professional designation.

The two groups also significantly differed on each of five more-specific experience measures (all $p < 0.006$): number of assurance engagements completed; number of engagements in which they gathered client business knowledge; number of engagements in which they analyzed client business knowledge; number of engagements in which they identified client risk factors; and, the number of engagements completed involving clients in the high-tech industry. The auditor and audit student groups did not differ in terms of the number of engagements performed for first-time clients of their particular firm ($p = 0.339$), hence specific experience on first-time audits (i.e., the context of the case instrument) does not drive the results.

Based on these significant differences in general and task-specific experience levels, which have been employed in prior research comparing auditor and audit student participants, these groups are appropriate for testing the experience-related hypotheses in this study.

Methodology

For the purpose of testing the methodology-related hypotheses, only the 88 auditors were used because only a few of the student participants had assurance experience with the firms from which the auditor participants were drawn, making it impossible to statistically compare auditors and audit students within each of the

[40] Excluding the three auditing students who were seniors from the tests of H2, H4a, and H4b, which are the experience-related hypotheses in this study, resulted in the same pattern of results as reported below in the main tests of these hypotheses using the full sample of students.

methodology groups.[41] Forty-five of the auditor participants worked for a Big 4 firm which employs an SSA approach, 23 worked for one of two Big 4 firms which employ a hybrid SSA-TBA approach, and the remaining 20 worked for one of three firms which employ a TBA approach.

Panel A of Table 7 presents the detailed demographic, and general and task-specific experience levels of participants in each of the three auditor methodology groups. Twenty (44%) of the 45 SSA auditors were staff accountants, whereas one (4%) of 23 SSA-TBA auditors and six (30%) of 20 TBA auditors held that title, while the remaining participants in each group were senior or in-charge auditors. Twenty-three (51%) of the SSA auditors had an accounting designation (CA or CPA), whereas 14 (61%) of the SSA-TBA auditors and 14 (70%) of the TBA auditors had a designation. There was also variation across the methodology groups in terms of the seven general and task-specific experience measures (see Panel A of Table 7 for details on these measures).

Chi-square tests were used to investigate cross-methodology differences in the proportions of participants who were staff/senior accountants and who had/didn't have an accounting designation. For *Title* (i.e., staff vs. senior), the Chi-square of 11.51 was significant ($p = 0.003$), indicating a lower proportion of staff accountants in the SSA-TBA group than in the other two groups. For *Designation*, the Chi-square of 2.14 was insignificant ($p = 0.344$), indicating no significant differences in the proportions of participants with a CA or CPA designation across groups. Of the 21 correlations (not tabulated) between the seven general and task-specific experience measures, 16 were

[41] Of the 30 students, one worked for the SSA firm in this study, nine worked for one of the two SSA-TBA firms, three worked for one of the three TBA firms, and 13 worked for a variety of other local or regional firms.

significant (all $p < 0.028$), with only the five correlations involving the number of high-tech engagements performed being insignificant (all $p > 0.070$). Given this pattern of correlations, the six significantly correlated experience measures were examined in a one-way MANOVA (not tabulated). The MANOVA showed a significant overall difference across methodologies ($F = 42.79$, $p = 0.002$). Individual follow-up ANOVAs on the six experience measures revealed significant differences in four of the six measures: the number of assurance engagements performed ($F = 6.64$, $p = 0.002$); the number of first-time client assurance engagements performed ($F = 4.09$, $p = 0.020$); the number of engagements on which participants gathered client business knowledge ($F = 5.05$, $p = 0.008$); and the number of engagements on which participants identified risks ($F = 4.72$, $p = 0.012$). There was also a significant difference in the number of high-tech engagements performed ($\chi^2 = 40.11$, $p < 0.001$).[42] Given these six significant cross-methodology differences on demographic/experience measures, they were included as control variables in the hypothesis tests involving methodology as an independent variable (i.e., H1a, H1b, and H3). Including them in these tests using ANCOVA analyses, however, showed that none of these four variables was significant (all $p > 0.35$) either as a main effect or in interaction with the variable of interest. Hence, they have been excluded from the formal analyses of H1a, H1b, and H3 discussed in following sections of this chapter.[43]

In order to verify that the firms which provided the auditor participants for this

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[42] The Kruskal-Wallis non-parametric test was used here due to unequal variances across groups.

[43] As an additional check for task-specific experience effects on this study's knowledge measures, the mean of five experience measures (total audit engagements, first engagements, gathering engagements, analyzing engagements, and risk engagements), all of which loaded heavily on a single factor (all loadings > 0.68), was included as a covariate in the tests of H1a, H1b, and H3. This covariate was not significant (all $p > 0.10$), either alone or in interaction with the Methodology variable, in any of the tests. All other significant effects described later in the formal tests of these hypotheses remained in the presence of this additional covariate.

study used audit methodologies falling into one of the three pre-defined methodology categories (i.e., SSA, SSA-TBA hybrid, and TBA), participants were asked to indicate (using an 11-point scale) the extent to which their firm typically analyzed a client's business strategy, its key business processes, and its key performance.[44] The scales were anchored by "Never" (score of 0) and "Always" (score of 10), with the midpoint labelled "Sometimes". The ratings provided by participants are summarized in Panel B of Table 7. The SSA firm performs all three analyses quite frequently, with mean (s.d.) ratings of 7.8 (2.1) for client business strategy, 9.2 (1.4) for key business processes, and 8.0 (2.2) for key performance indicators. The TBA firms performed these three analyses relatively less frequently, with mean ratings of 4.5 (2.1) for client business strategy, 6.4 (2.5) for key business processes, and 5.6 (1.9) for key performance indicators, while the SSA-TBA firms fell between these two groups, with mean ratings of 6.2 (2.6), 7.7 (1.5), and 6.9 (2.0), respectively. Factor analysis (not tabulated) confirmed that all three of these measures loaded on a single factor that explained 66% of the variance, with factor loadings of 0.84 for the strategy measure, 0.72 for the business process measure, and 0.86 for the performance indicator measure. These relatively high loadings on a single factor provide evidence that the three measures are good indicators of the methodology construct.

A one-way MANOVA (not tabulated) with the three ratings as dependent variables and methodology (SSA, SSA-TBA, and TBA) as the independent variable yielded significant differences in the frequencies of analyses across methodologies ($F = 8.19$, $p < 0.001$). Individual ANOVAs (not tabulated) for each dependent variable yielded

[44] A definition of each of these three terms was provided so that all participants had a common understanding of what the terms meant.

significant methodological differences for all three types of analyses ($p < 0.001$ in each case). Bonferroni tests were used to make multiple comparisons among the three methodologies for each type of audit analysis.[45] Cross-methodology similarities and differences are summarized in Panel C of Table 7. The SSA firm analyzes a client's business strategy significantly more frequently than the SSA-TBA firms ($p = 0.038$), and the TBA firms do so significantly less frequently than both the SSA and SSA-TBA firms (both $p < 0.05$). Also, the SSA firm analyzes key business processes significantly more frequently than either of the other two types of firms (both $p < 0.005$), while the SSA-TBA firms do so marginally more frequently than the TBA firms ($p = 0.08$). The SSA and SSA-TBA firms analyze key performance indicators with similar frequency ($p = 0.17$), as do the SSA-TBA and TBA firms ($p = 0.157$), whereas the SSA firm does so significantly more frequently than the TBA firms ($p < 0.001$). Comparing the mean of these three measures across methodologies showed a significant overall effect of methodology ($F = 24.18$, $p < 0.001$, not tabulated). Multiple comparison tests showed significant differences between each of the three pairs of firms (all $p < 0.01$).

Overall, these results are consistent with the pre-defined methodology categories, with there being significant differences between the SSA and TBA firms on all measures, while there is some overlap between the hybrid SSA-TBA firms and the pure SSA and TBA firms on some measures. Thus, there is some assurance that significant methodology differences exist between these three categories of firms. Therefore, using this three-category classification scheme as the "methodology" variable for hypothesis-testing purposes is justified.

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[45] The less-conservative Tukey's HSD test was also used to examine these multiple comparisons. Any differences between the Bonferroni and Tukey tests are noted.

Task Realism

Participants provided feedback on three aspects of task realism using 11-point scales anchored by "Disagree" (a rating of –5) and "Agree" (a rating of 5), with the midpoint labeled "Neutral" (a rating of 0). Participants found the 60 client facts realistic (mean = 2.9, s.d. = 1.7) and useful for making risk assessments (mean = 3.3, s.d. = 1.6), and they thought the risk assessment task was reasonably similar to how they would have performed it in practice (mean = 1.7, s.d. = 2.3).[46] Two MANOVAs (not tabulated) showed that these ratings did not differ across methodologies ($F = 0.80$, $p = 0.573$) or across experience levels ($F = 1.49$, $p = .223$). Overall, these results indicate that the 60 client facts and risk assessment task combined to form a case exercise that was reasonably realistic when compared to all participants' practice experiences.[47]

Order Effects

In the presentation of the case materials, two orders of the 60 client facts were crossed with two orders of the seven specific risk factors in order to mitigate the chance that the order of presentation of either of these lists affected the variables of interest in this study. A one-way ANOVA (not tabulated) revealed that the order of the 60 client facts had no effect on the number of facts recalled ($F = 0.02$, $p = 0.877$).[48] Two-way (fact order x risk order) ANOVAs (not tabulated) showed no effects of order on either knowledge comprehensiveness or knowledge density (all $p > 0.10$). Finally, a two-way MANOVA (not tabulated) with the seven specific and one general risk factors as

[46] Each of these three means is significantly greater than the Neutral midpoint of 0 and the scale value of 1 (all $p < 0.01$).
[47] The recall-task component of the case instrument obviously has no practice analogue, so participants were not asked to assess the realism of this task. Pretest participants found the recall task very easy to understand (mean = 4.2, s.d. = 1.2) and were neutral as to its difficulty (mean = 0.5, s.d. = 2.6).
[48] Participants did not see the risk factors prior to completing the recall task, so the order of the risks is not relevant to recall performance.

dependent variables showed no effects of order on any of the risk assessments (all $p > 0.23$). Further testing for order effects is conducted in each of the hypothesis tests which follow.

Recall Performance

Participants took a self-reported average of 13.4 minutes (s.d. = 3.3) to recall as many of the 60 client facts as they could and there was a significant correlation between the number of facts recalled and the time taken to perform the recall task ($r = 0.44$, $p < 0.001$).[49] Table 8 reports the results for participants' performance on the recall task, both by methodology (Panel A) and by experience (Panel B). Participants correctly recalled from nine to 41 facts. The overall mean number of facts correctly recalled was 26.0 (s.d. = 6.5), with fewer than one incorrect or repeated fact recalled on average.[50]

Methodology-related differences

The time taken to recall facts significantly differed across methodologies ($F = 4.25$, $p = 0.017$, not tabulated), with the SSA auditors taking a mean (s.d.) of 12.8 (2.3) minutes, the SSA-TBA auditors 14.0 (3.9) minutes, and the TBA auditors 15.2 (3.8) minutes. Further discussion of this difference is provided in the tests of H1a and H1b below.

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[49] Nine auditors and one auditing student failed to provide the begin and/or end times for the recall task, so their completion times for this task could not be determined. All statistical tests involving recall performance time replaced the missing time data with the overall mean performance time of 13.4 minutes. Excluding these participants from the tests of H1a, H1b, and H2 resulted in the same pattern of results described in the formal tests of these hypotheses.

[50] One-hundred-and-thirteen of the 118 recall protocols were also coded by an independent coder. Of the 3,101 coding decisions made by both the author and the other coder, there were 224 differences. The vast majority of the differences were caused by one of the coders coding a recalled fact as not matching one of the facts from the original list, whereas the other coder did match it to a fact. Using the *kappa statistic* to measure the level of agreement between the two sets of codings showed a κ of 0.926. Given this very high level of agreement, the author's coding was used as the basis for the statistical tests reported here. As will be seen, none of the recall-related hypotheses are supported by the data, so there is no evidence that the author's coding was biased to support the hypotheses.

Hypotheses 1a and 1b propose that SSA auditors will either recall the same quantity of facts as TBA auditors (H1a) or a greater quantity of facts than TBA auditors (H1b). These are mutually exclusive hypotheses, so I expected to be able to reject the null for only one of H1a and H1b. Given the three methodology conditions in this study (SSA, SSA-TBA, and TBA), H1a's null would be rejected if there are no differences in the quantities of facts recalled across these groups, whereas H1b's null would be rejected in favour of H1b if the quantities of facts recalled are consistent with an SSA>SSA-TBA>TBA pattern. As can be seen in Panel A of Table 8, the quantities recalled form a TBA>SSA-TBA>SSA pattern, with the TBA auditors recalling a mean (s.d.) of 31.1 (6.4) facts, the SSA-TBA auditors recalling 28.0 (6.4), and the SSA auditors 23.1 (5.6) facts.[51] Given the significant correlation between recall time and facts recalled, as well as the significant difference in time taken across methodologies, the statistical tests of H1a and H1b included recall time both as a covariate and in interaction with Methodology.[52]

A one-way ANCOVA (see Table 9) yields a significant F-statistic of 4.68 ($p = .012$), indicating a significant effect of methodology on facts recalled, even with the presence of a significant time covariate ($p < 0.001$). This methodology effect is in the direction opposite of H1b, indicating that neither H1a nor H1b are supported by the recall data. We must, however, consider this methodology main effect in light of the significant interaction of the time covariate and methodology ($p = 0.023$), which violates the covariance assumption of homogeneous (parallel) regression. The significance of this interaction does not render the main effect uninterpretable, but requires multiple

[51] An examination of the Studentized residuals for showed that only two of them (one SSA and one SSA-TBA auditor) could be considered outliers on recall performance (Sresid > |2|).
[52] Including the order of facts as an additional covariate, alone and in interaction with Methodology, revealed no effect of order on recall ($p > 0.11$).

regression analysis to provide additional insight (Cohen and Cohen 1983). Entering the same set of ANCOVA variables into a hierarchical regression model with dummy variables to code methodology, and then examining the resulting regression equations for each of the three methodology groups (i.e., the prediction equations) reveals the nature of the interaction. The unstandardized B coefficient for the recall-time variable is 1.13 ($p = 0.001$) for both the SSA and TBA equations, indicating that recall time had the same effect on recall in both these groups. For the SSA-TBA group, however, this coefficient is only 0.06 ($p = 0.865$), indicating that recall time had no effect on recall performance for the SSA-TBA auditors. There is no obvious explanation for this pattern of results, and because recall time is not a variable of interest in this study, it will not be explored further.

As an alternative test (not tabulated) of H1a and H1b, the number of facts recalled was regressed on three variables: recall time, the mean of the three measures used to determine the frequency of each participant's use of SSA-style audit analyses (strategic analysis, business process analysis, key performance indicator analysis), and the product of these two continuous variables.[53] Results show that the coefficient on the continuous Methodology variable is –1.08 ($p = 0.002$), indicating that participants with high levels of SSA experience had significantly lower recall performance than those with low levels of SSA experience. This finding is consistent with that reported above using the categorical Methodology variable. The product term is not significant ($p = 0.407$), so there is no

[53] In this regression, the continuous variable formed by the mean of the three analysis measures acts as the Methodology variable and captures individual differences in participants' experience with SSA-style audit techniques. Such differences are not captured by the categorical measure of Methodology used in the main hypothesis test because each participant is classified as SSA, SSA-TBA, or TBA based on the *firm* they work for, regardless of how much personal experience each might have employing SSA-style audit techniques. Higher scores on this mean Methodology measure indicate greater experience applying SSA techniques in practice.

Time-Methodology interaction as is the case in the ANCOVA reported above.

Therefore, based on the above results and contrary to expectations, TBA auditors recalled significantly more client facts than SSA auditors. This surprising finding will be investigated further in Chapter 5.

Experience-related differences

Hypothesis 2 posits that more experienced auditors will recall more facts than auditing students. Panel B of Table 8 presents the recall data by experience level. The auditors took a self-reported 13.6 minutes on average (s.d. = 3.3) to correctly recall a mean of 26.2 facts (s.d. = 6.8), whereas the auditing students correctly recalled a mean of 25.3 facts (s.d. = 5.7) in an average self-reported time of 12.8 minutes (s.d. = 2.6). There was no difference in recall times across the two experience conditions ($F = 1.50$, $p = 0.223$, not tabulated). Given the significant correlation between recall time and facts recalled, the statistical test of H2 included recall time both as a covariate and in interaction with Experience.[54]

As reported in Table 10, the results of a one-way ANCOVA yielded an F-statistic of 0.01 ($p = 0.945$), indicating no difference in quantity of facts recalled between the auditors and auditing students, after controlling for the significant effect of time on recall ($F = 32.64$, $p < 0.001$).[55] Hence, there is no evidence allowing the rejection of the H2 null of no experience-related difference in the quantity of facts recalled.[56] I explore this surprising finding further in Chapter 5.

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[54] Including the order of facts as an additional covariate, alone and in interaction with Experience, revealed no effect of order on recall ($p > 0.23$).

[55] The interaction of Time and Experience was not significant ($p = 0.717$).

[56] Given the unequal cell sizes (N = 88 and 30), the ANCOVA may yield biased results. So, the variables of interest were also analyzed using regression analysis, which does not require equal N across comparison groups. The results were consistent with those of the ANCOVA.

Relational Knowledge Complexity

Participants took a self-reported average of 20.0 minutes (s.d. = 6.4) to assess the eight risks and write the justification memo.[57] Participants' memos contained from eight to 63 distinct cause or effect concepts, yielding mean knowledge comprehensiveness scores of 23.7 (s.d. = 9.0), and from six to 68 (mean = 25.8, s.d. = 11.2) causal assertions, resulting in relational-knowledge density scores (number of assertions divided by number of concepts) ranging from 0.68 to 1.63 (mean = 1.07, s.d. = 0.14). Table 8 reports the means for these knowledge measures, both by methodology (Panel A) and by experience (Panel B).[58]

There was a significant correlation of 0.498 ($p < 0.001$) between knowledge comprehensiveness and knowledge density, which are the two measures of relational-knowledge complexity being used in this study. Despite the significant correlation between these two dependent measures, MANOVA procedures will not be used to analyze the effects of methodology and experience on them because the density score is linearly dependent on comprehensiveness, therefore precluding such multivariate analysis. There was also a significant correlation of 0.412 ($p < 0.001$) between the time taken to perform the risk exercise and knowledge comprehensiveness, so time will be

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[57] Twenty-one auditors and five auditing students failed to report the begin and/or end times for the risk task, thus their completion times could not be determined. All statistical tests involving risk-task performance times replaced the missing time data with the overall mean performance time of 20.0 minutes.

[58] The author's coding of the memos was used as the data source. The independent coder coded 59 of the 118 memos used to generate data for this study. In total, the author and the independent coder identified 1,460 cause/effect concepts in these memos, and 1,479 causal relations. Of the concepts, 1,319 (90.3%) were identified by both coders, and of the relations, 1,162 (78.6%) were identified by both coders. To determine whether the author coded the memos in a way that would favour the hypotheses in this study, the coding differences were statistically examined. There were no significant differences in the number of coding differences either across methodology conditions or across experience conditions (all $p > 0.40$). Thus, there is no evidence of bias. In addition, as will be seen, none of this study's knowledge complexity-related hypotheses are supported by the data.

controlled for in tests involving this dependent measure.[59] There was not a significant correlation between time taken and knowledge density ($r = 0.169$, $p = 0.169$), but to be consistent with the tests of knowledge comprehensiveness, time will be controlled for in tests involving density as well.

Methodology-related differences

There was no difference in task performance time across methodology categories ($F = 1.78$, $p = 0.175$). Hypothesis 3 proposes SSA auditors will have more-complex relational knowledge than TBA auditors, after controlling for the number of client facts correctly recalled. Given the three methodology conditions in this study (SSA, SSA-TBA, and TBA), H3 would be supported if the mean comprehensiveness scores and the mean density scores of the three groups were consistent with an SSA>SSA-TBA>TBA pattern. As can be seen in Panel A of Table 8, just the opposite occurred, with both knowledge measures forming a TBA>SSA-TBA>SSA pattern.

TBA auditors used a mean (s.d.) of 30.4 (9.1) concepts, SSA-TBA auditors 25.4 (10.3) concepts, and SSA auditors 19.4 (7.8) concepts. A one-way ANCOVA (see Panel A of Table 11) yields an F-statistic of 4.11 ($p = 0.020$), indicating a significant effect of methodology on knowledge comprehensiveness, but in the direction opposite of H3.[60] This effect must, however, be considered in light of the significant interaction ($p = 0.006$) between methodology and quantity of facts recalled, which violates an important

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[59] There was no significant difference in time taken to complete the risk task across methodologies ($p = 0.175$).

[60] In addition to the number of facts correctly recalled and time taken to perform the risk task, risk order was also included as a covariate because of its significance when included in the model. Fact order was not significant ($p > 0.82$), so was excluded from the formal hypothesis test. In the formal hypothesis test, time to complete, recall quantity, and risk order were all significant ($p < 0.05$). There was no significant interaction between methodology and either time or risk order (both $p > 0.15$), so these interaction terms were excluded from the model. There was an interaction between recall quantity and methodology, which is discussed further in the main text.

assumption of the ANCOVA analysis. Entering the same set of ANCOVA variables into a hierarchical regression model with dummy variables to code methodology, and then examining the resulting regression equations for each of the three methodology groups (i.e., the prediction equations) reveals the nature of the interaction. The unstandardized B coefficient for the recall-quantity variable is insignificant ($p > 0.43$) for both the SSA and TBA equations. For the SSA-TBA group, however, this coefficient is 0.84 ($p = 0.002$). The relationship between recall performance and knowledge comprehensiveness is considered further at the end of this section.

As an alternative test (not tabulated) of knowledge comprehensiveness differences, the number of concepts was regressed on five variables: task time, facts recalled, risk order, the continuous Methodology measure discussed earlier, and the product of this measure and Facts recalled. Results show that the coefficient on the continuous Methodology variable is –1.01 ($p = 0.042$), indicating that participants with high levels of SSA experience had significantly lower knowledge comprehensiveness than those with low levels of SSA experience. This finding is consistent with that reported above using the categorical Methodology variable. The product term is not significant ($p = 0.463$), so there is no Recall-Methodology interaction as was the case in the ANCOVA reported above.

Thus, based on the preceding analyses and contrary to expectations, TBA auditors showed a higher level of knowledge comprehensiveness than their SSA counterparts.

The TBA auditors had a mean (s.d.) knowledge density of 1.11 (0.13), the SSA-TBA auditors a density of 1.09 (0.13), and the SSA auditors a density of 1.01 (0.13). A one-way ANCOVA (see Panel B of Table 11) yields an F-statistic of 4.85 ($p = .010$),

indicating a significant effect of methodology on knowledge density, but again in the direction opposite of H3.[61] Once again, however, there was a significant interaction between the time covariate and methodology, thus violating a key ANCOVA assumption. Entering the same set of ANCOVA variables into a hierarchical regression model with dummy variables to code methodology, and then examining the resulting regression equations for each of the three methodology groups (i.e., the prediction equations) reveals the nature of the interaction. The unstandardized B coefficient for the time variable is insignificant ($p > 0.37$) for both the SSA-TBA and TBA equations. For the SSA group, however, this coefficient is 0.01 ($p = 0.013$). There is no obvious explanation for this pattern of results, and because recall time is not a variable of interest in this study, it will not be explored further.

As an alternative test (not tabulated) of knowledge density differences, the density score was regressed on four variables: task time, facts recalled, the continuous Methodology measure discussed earlier, and the product of this measure and task time. Results showed that the coefficient on the continuous Methodology variable was –0.08 ($p = 0.003$), indicating that participants with high levels of SSA experience had significantly lower knowledge density than those with low levels of SSA experience. This finding is consistent with that reported above using the categorical Methodology variable. The product term was also significant ($B = 0.003$, $p = 0.008$), so there was a Time-Methodology interaction as was the case in the ANCOVA above.

Thus, contrary to expectations, TBA auditors showed a higher level of knowledge

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[61] The covariates (the number of facts correctly recalled and the time taken to perform the risk task) were not significant (both $p > 0.27$). The recall covariate in interaction with methodology was not significant ($p = 0.198$). Including risk order and fact order as additional covariates, alone and in interaction with methodology, revealed no significant effects of order on knowledge density (all $p > 0.11$).

density than their SSA counterparts. Considered together, this pair of results indicate that the TBA auditors possessed a significantly higher level of relational-knowledge complexity than the SSA auditors.

As an additional test of the effects of methodology on auditors' knowledge complexity, a composite measure of knowledge complexity was constructed by taking the average of the three individual knowledge measures for each participant: the quantity of facts correctly recalled, the number of cause or effect concepts from the risk memo, and the number of causal assertions from the risk memo. Factor analysis (not tabulated) showed that these three measures loaded onto a single factor (all loadings > 0.63), with this factor explaining 75% of total variance. [62] Given this result, averaging the three scores to form a composite measure of knowledge is appropriate. The SSA auditors had a mean (s.d.) composite knowledge score of 20.8 (6.2), the SSA-TBA auditors one of 27.1 (8.7), and the TBA auditors one of 31.9 (7.3).

An ANCOVA (not tabulated) with this composite knowledge measure as the dependent variable revealed the same significant effect of methodology on knowledge that was found when testing recall quantity, comprehensiveness, and density ($F = 19.83$, $p < 0.001$).[63] This test provides further support that the TBA auditors possessed a higher level of more-complex knowledge than their SSA counterparts. Additional post-hoc analyses in Chapter 5 will explore these unexpected results.

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[62] The factor analysis was conducted using all 118 participants, not just the auditors being studied in this section.

[63] The covariates for this analysis were time taken to complete the risk task and risk order (fact order and recall time were not significant and nor were any of the interactions between methodology and the covariates). Both covariates were significant at $p < 0.02$. Regression analysis revealed consistent results.

Experience-related differences

Hypothesis 4a posits that auditors will have more-complex relational knowledge than auditing students, after controlling for the number of client facts correctly recalled. The auditors identified a mean of 23.5 (s.d. = 9.8) concepts, whereas the auditing students identified 24.4 (6.3) concepts (see Panel B of Table 8 for details). A one-way ANCOVA (see Panel A of Table 12) yields an F-statistic of 6.49 (p = .02), indicating a significant effect of experience on knowledge comprehensiveness, but in the direction opposite of H4a.[64] Thus, contrary to expectations, auditing students showed a higher level of knowledge comprehensiveness than their auditor counterparts.

The auditors had a mean knowledge density of 1.05 (s.d. = 0.14) and the auditing students a density of 1.11 (0.15). A one-way ANCOVA (see Panel B of Table 12) yields an F-statistic of 4.96 (p = .028), indicating a significant effect of experience on knowledge density, but in the opposite direction to that hypothesized.[65] Thus, auditors possessed a significantly lower level of knowledge density than their auditing student counterparts.

As an additional test of experience on knowledge complexity, the composite knowledge measure discussed previously was also examined for experience effects. The auditors had a mean (s.d.) composite knowledge score of 25.0 (8.4) and the students one of 25.7 (6.0). An ANCOVA (not tabulated) again revealed a significant effect of

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[64] The two covariates, number of facts correctly recalled and time taken to perform the risk task, were also significant ($p < 0.001$). The covariates were not significant in interaction with experience ($p > 0.50$), so the interaction terms were excluded from the formal test of H4a. Neither risk order nor fact order were significant when included as additional covariates, either alone or in interaction with experience ($p > 0035$). Regression analysis revealed consistent results.

[65] None of the covariates was significant ($p > 0.10$). The interactions of experience with each covariate were not significant ($p > 0.135$). When fact order and risk order were included as additional covariates, alone and in interaction, none was significant (all $p > 0.11$). The regression analysis showed consistent results.

experience on knowledge ($F = 4.83$, $p = 0.030$), but in the unexpected direction.[66] Considered together, this set of results provides no support for the hypothesis that the auditors possess a significantly higher level of relational-knowledge complexity than auditing students, which is a very puzzling finding that will be explored further in Chapter 5.

Interaction of Methodology and Experience

Hypothesis 4b predicts that the knowledge complexity differences between auditors and auditing students predicted in H4a will be larger for SSA auditors than for TBA auditors. Given the pattern of results found when testing H3 (i.e., SSA auditors having significantly less-complex knowledge complexity than TBA auditors) and H4a (i.e., no significant difference in knowledge complexity between auditors and auditing students), it is clear that H4b will not be supported by the data. Nevertheless, this interaction is analyzed so that further insight may be gained into the unexpected results found thus far.

Contrast tests were used to compare the knowledge complexity measures of each of the three methodology groups to those of the group of students. For comparison purposes, Panel A of Table 13 presents the mean knowledge comprehensiveness and density scores for these four groups as well as the differences in these scores between each of the methodology groups and the auditing students. Compared to the auditing student mean score of 24.4, the mean knowledge comprehensiveness scores differed as follows: -5.0 for the SSA auditors, 1.0 for the SSA-TBA auditors, and 6.0 for the TBA

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[66] Covariates in the model were the times taken to perform the recall and risk tasks and both were significant (both $p < 0.05$). The interactions of each of these covariates with experience were not significant and nor were risk order or fact order (all $p > 0.44$), so they were excluded from the test. Regression results were consistent.

auditors. The trend was the same for knowledge density scores compared to the auditing students' mean of 1.11: -0.10 for SSA, -0.02 for SSA-TBA, and 0.00 for TBA.

The results of the contrast tests on the knowledge comprehensiveness scores are reported in Panel B of Table 13. They reveal that the SSA auditors' knowledge comprehensiveness is significantly less than the auditing students' ($t = -3.76$, $p < 0.001$), whereas the SSA-TBA auditors ($t = -0.95$, $p = 0.374$) and TBA auditors ($t = 0.00$, $p = 0.993$) do not significantly differ from the auditing students.[67] Panel C of Table 13 reports the results of the knowledge density contrast tests, which showed that the SSA auditors' knowledge density was significantly lower than the auditing students ($t = -3.29$, $p = 0.001$) and that neither the SSA-TBA auditors ($t = -0.62$, $p = 0.576$) nor the TBA auditors ($t = 0.50$, $p = 0.720$) significantly differed from the auditing students in terms of knowledge density.[68] Testing the contrasts using the composite knowledge measure as the dependent variable revealed the same pattern of results as those for comprehensiveness and density. Combined, these results indicate that the experienced SSA auditors had the least-complex relational knowledge of the four groups in the study, while neither the SSA-TBA nor the TBA auditors significantly differed from the auditing students in terms of knowledge complexity.

Risk Assessments

Hypothesis 5 proposes that auditors with more-complex relational knowledge will make different risk assessments than auditors with less-complex knowledge. Table 14 presents the mean ratings for each of the eight risks assessed by the participants as well as

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[67] These contrast tests controlled for both number of facts recalled and time taken to perform the risk task, just as in the regular tests of knowledge comprehensiveness and density reported earlier.

[68] These tests controlled for the number of facts recalled, just as in the regular tests of knowledge density reported earlier.

the correlations between these risk assessments and the relational knowledge comprehensiveness and density scores. Eleven of the 16 correlations are insignificant ($p > 0.18$). Knowledge comprehensiveness is significantly correlated with three of the eight risks: the fact that family members hold all senior management positions ($r = -0.21$, $p = 0.021$); the fact that overseas production may cause production and quality problems ($r = 0.26$, $p = 0.005$); and the risk due to the implementation of a new SAP/inventory management system ($r = 0.19$, $p = 0.04$).[69] The correlation between knowledge comprehensiveness and the fact that the client is not staying current with technological development is marginally significant ($r = 0.16$, $p = 0.079$). Knowledge density is significantly correlated with the risk assessment relating to the fact that this was a first-year engagement for the auditing firm ($r = 0.21$, $p = 0.023$). Given that only five of the sixteen correlations between the knowledge complexity measures and the risk assessments are significant (marginally in one case), H5 is only very weakly supported.[70]

As a supplemental analysis, exploratory factor analysis (not tabulated) was conducted on the seven specific risk factors to see if they could be reduced in number. The seven risks loaded on three factors (all loadings > 0.48) that explained 62% of total variance. Of the risks in Table 14, the inaccurate budgeting system, first-year audit, and new SAP system risks loaded on one factor and the family management risk loaded on its own. The other three specific risks (overseas production, poor technological

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[69] Two-sided tests of Pearson correlations are presented here. Results are the same when Spearman correlations are used, except that knowledge comprehensiveness is now marginally significantly correlated with the risk of this being a first-audit for the firm ($r = 0.17$, $p = 0.06$), but is no longer significantly with the risk of not staying current with technological development ($r = 0.15$, $p = 0.102$).

[70] Correlating the composite knowledge measure used in the supplementary tests of H3, H4a, and H4b with the eight risk factors revealed two significant (family management and overseas production, $p < 0.05$) and two marginally significant (new SAP system and overall risk, $p < 0.10$) correlations. Spearman correlations showed that these four risks remained (marginally) significant and that the correlation with first-year audit risk was also significant ($p = 0.043$).

development, and obsolescence problems) loaded on the third factor.

For the two factors with multiple risk loadings, composite risk measures were constructed by averaging the risks that loaded on each of these two factors.[71] These composite risks were then correlated with knowledge comprehensiveness, density, and the composite knowledge measure. The first composite risk factor (inaccurate budgeting system, first-year audit, and new SAP system risks) was marginally significantly correlated with density ($r = 0.18$, $p = 0.052$) and the other composite risk factor (overseas production, poor technological development, and obsolescence problems) was significantly correlated with comprehensiveness ($r = 0.24$, $p = 0.01$) as well as the composite knowledge measure ($r = 0.21$, $p = 0.02$). The other three correlations were not significant (all $p > 0.29$).[72] These results provide no extra support for the previously noted weak relation between knowledge and risk judgment.

Chapter Summary

This chapter presented the results of a study involving 118 participants, 88 of whom were classified as "auditors" based on their roughly three years of assurance experience with firms using one of three audit methodologies that varied in the extent to which they incorporated SSA techniques into their audit approaches. The other 30 participants, classified as "auditing students", were university accounting students with mean assurance experience of seven months. Contrary to expectations, TBA auditors recalled significantly more client facts than SSA auditors (H1a and H1b) and also

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[71] Because the family management risk loaded on its own and its correlations with all three knowledge measures have already been reported and discussed, there is no need to analyze any supplemental correlations for this factor.

[72] Spearman correlations revealed the same pattern of results, except that the first composite risk factor was no longer significantly correlated with anything (all $p > 0.10$).

displayed significantly more-complex relational knowledge than their SSA counterparts (H3). In addition—and also unexpectedly—the auditors did not recall significantly more facts than the auditing students (H2), nor did they display significantly more-complex relational knowledge than their less-experienced counterparts (H4a). Most surprisingly, the SSA auditors in this study possessed the least-complex relational knowledge of any of the four groups in this study, even the auditing students (H4b). Weak support was found for the relation between relational knowledge complexity and auditors' risk judgments (H5), with just four of 16 correlations between the two complexity measures and the eight risk judgments being significant. This rather puzzling set of results will be investigated further in the next chapter, which presents some post-hoc analyses of the data.

CHAPTER 5 – SUPPLEMENTARY ANALYSIS

Introduction

The results presented in the previous chapter revealed that none of the study's hypotheses were supported by the data. Indeed, I observed statistically significant methodological differences that were in the opposite direction of what was expected (i.e., H1 and H3). Furthermore, the expected relationships between experience and knowledge were not obtained (i.e., H2, H4a, and H4b), and there was only weak support for a link between knowledge and judgment (i.e., H5). In this chapter, I concentrate mainly on the methodology-related differences among the experienced auditors because the lack of success with the experience-related hypotheses may be attributed to the relatively large amount of experience that the auditing students had, which may have lead to a substantial overlap in knowledge between the two groups.

Factual Knowledge Recall

In this section I summarize the pair-wise cross-methodology differences in factual knowledge found and also examine the possible explanation that the recall differences could be attributed to a focus on the more-important facts by the SSA auditors during the study phase of the recall task.

Recall performance

To further explore the significant main effect of methodology on recall performance found in Chapter 4, three pair-wise multiple comparisons were made using Bonferroni tests.[73] With a mean (s.d.) recall performance of 23.1 (5.6) facts, the SSA

[73] The multiple comparisons in this chapter were also examined using Tukey's HSD test, which is less conservative than the Bonferroni test, and using ANCOVA, which allows for inclusion of the covariates

auditors recalled significantly fewer facts than both the SSA-TBA auditors ($p = 0.005$), who recalled 28.0 (6.4) facts, and the TBA auditors ($p < 0.001$), who recalled 31.1 (6.4) facts. There was no significant difference between the SSA-TBA and TBA auditors ($p = 0.308$). See Panel B of Table 15 for a summary of the results of these multiple comparison tests.

Fact Importance and Recall Performance

One possible explanation for the SSA auditors recalling fewer facts than the other groups of auditors is that when studying the facts, they ignored facts that did not fit into their existing knowledge acquisition template. To the extent that this focused the SSA auditors on the more-important facts in the list, these are the only ones they would have encoded and would have been subsequently able to recall.[74] Bell et al. (1997) suggest that one of the advantages of the SSA is that it helps an auditor identify the high risk areas of a client's operations, so he can focus most of his audit attention on these areas while spending little effort on low risk areas of the engagement. Eilifsen et al. (2001) note this result in their field study of KPMG's 1997 SSA audit of a Czech bank. If this is what occurred with the SSA participants in the present study, then their increased attention to the more important facts may have allowed them to recall a higher number of them than the other auditors (Kahneman 1973; Lynch and Srull 1982; Libby and Lipe 1992), but a lower number of facts overall.

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used in the corresponding hypothesis tests in Chapter 4. In the cases where the results of either or both of these additional tests differ from those of the Bonferroni tests, the differences are footnoted.

[74] This possibility is greatly lessened by the fact that all participants were instructed to study the *entire* list of 60 facts so they could later attempt to recall *as many as possible* from memory. Also, during both the study and recall phases of the memory task, none of the participants knew they would later be asked to use the same set of facts in the risk assessment task. Thus, there were no explicit or implicit reasons for any of the participants to focus only on what they believed to be the most important facts in the list of 60. Indeed, given the stated goal of the recall task, doing so would have knowingly hindered their performance on the task.

As described in more detail in Chapter 3, 21 senior managers rated the importance of each of the 60 facts used in the study.[75] The highest possible rating a fact could receive was 3, which indicated they thought the fact was "Very Important" to understanding the client's business. Thus, facts receiving a mean rating of 2 or higher (including those with ratings less than, but insignificantly different from 2; $p > 0.05$) could be construed as being highly important to the auditors. Table 16 presents the fifteen facts that received such ratings (see Table 1 for the full list of facts and their mean ratings).[76]

Panel A of Table 17 presents the mean number of important facts recalled by auditors in each methodology. The pattern of results here is the same as that found for the full set of 60 facts, with the SSA auditors recalling a mean (s.d.) of 6.8 (2.1) important facts, the SSA-TBA auditors 7.9 (2.3) facts, and the TBA auditors 8.3 (1.5) facts. An ANCOVA (see Panel B of Table 17), with the total number of important facts correctly recalled as the dependent variable and methodology as the independent variable (and controlling for time spent on recall task), showed a significant effect of methodology ($F = 5.30$, $p = 0.042$). As in the test of H1a and H1b, there was also a marginally significant interaction between time and methodology ($F = 2.30$, $p = 0.10$).

Weighting the important facts correctly recalled by their respective mean importance ratings and using the sum of these weights as the dependent variable yielded the exact same pattern of results as for the unweighted facts (see panel A of Table 17 for

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[75] Twelve of the senior managers were from one of the SSA-TBA firms that supplied participants for the main study, while five came from one of the TBA firms and four from the SSA firm. The ratings were made in an Excel spreadsheet, which was sent and returned via email.

[76] If only the ratings of the SSA senior managers are used to determine the 15 most important facts, seven of the fifteen facts in Table 16 would be different. The results of the statistical tests described next, however, are the same if these SSA-only facts are used.

a summary).[77] The SSA auditors recalled a weighted mean (s.d.) of 14.3 (4.4) important facts, the SSA-TBA auditors 16.7 (5.0) facts, and the TBA auditors 17.5 (3.2) facts. An ANCOVA (see Panel C of Table 17) showed a significant effect of methodology ($F = 3.50$, $p = 0.034$) and a marginally significant interaction between time and methodology ($F = 2.60$, $p = 0.078$).

Thus, considering fact importance when analyzing recall performance does not alter the main findings in the tests of H1a and H1b: the SSA auditors recalled significantly fewer facts overall, significantly fewer important facts, and significantly fewer weighted important facts than the TBA auditors. Paired-comparison tests (Bonferroni, Tukey, and ANCOVA) revealed no significant differences between the SSA-TBA auditors and either of the other two auditor groups on either the raw or weighted number of important facts recalled (all $p > 0.10$, not tabulated).

Relational Knowledge Complexity

In this section I summarize the pair-wise cross-methodology differences in relational knowledge complexity using the knowledge comprehensiveness, knowledge density, and composite knowledge measures used in the tests of H3 in Chapter 4. Panel A of Table 15 presents the means of these measures by methodology and Panel B of the Table shows the results of the Bonferroni tests.

Knowledge comprehensiveness

To further explore the significant main effect of methodology on knowledge

[77] More specifically, each important fact correctly recalled by a participant was multiplied by its corresponding fact rating from Table 16. The sum of these weights formed the dependent variable for this test. For example, a participant who correctly recalled the first and last facts in Table 16 would have a weighted recall score of 4.63, whereas someone who recalled the first two in the list would have scored 5.06.

comprehensiveness found in Chapter 4, three pair-wise multiple comparisons were made using Bonferroni tests. With mean (s.d.) knowledge comprehensiveness of 19.4 (7.8), the SSA auditors scored significantly lower than the SSA-TBA auditors ($p = 0.029$), who scored 25.4 (10.3), and the TBA auditors ($p < 0.001$), who scored 30.4 (9.1). There was no significant difference between the SSA-TBA and TBA auditors ($p = 0.197$).

Knowledge density

To further explore the significant main effect of methodology on knowledge density found in Chapter 4, three pair-wise multiple comparisons were made using Bonferroni tests. With mean (s.d.) knowledge density of 1.01 (0.13), the SSA auditors scored significantly than the SSA-TBA auditors ($p = 0.029$), who scored 1.09 (0.13), and the TBA auditors ($p = 0.009$), who scored 1.11 (0.13). There was no significant difference between the SSA-TBA and TBA auditors ($p = 1.00$).

Knowledge composite measure

To further explore the significant main effect of methodology on composite knowledge found in Chapter 4, three pair-wise multiple comparisons were made using Bonferroni tests. With mean (s.d.) composite knowledge of 20.8 (6.2), the SSA auditors scored significantly less than the SSA-TBA auditors ($p = 0.003$), who scored 27.1 (8.6), and the TBA auditors ($p < 0.001$), who scored 31.9 (7.3). There was no significant difference between the SSA-TBA and TBA auditors ($p = 0.101$).[78]

Thus, consistent with the pattern of results for recall performance, the SSA auditors possessed significantly less-complex relational knowledge than both the SSA-TBA and TBA auditors, while the latter two groups did not significantly differ in their

[78] The Tukey HSD test showed a marginally significant difference between the SSA-TBA and TBA auditors ($p = 0.084$).

relational knowledge.

Correctness of Causal Relations

When coding the causal relations in the participants' memos, all causal statements were included when calculating the knowledge comprehensiveness and density measures used in the relational-knowledge hypothesis tests, regardless of whether a causal statement was logical or correct in light of the existing case facts. Conceptually, including invalid causal statements in the determination of knowledge complexity may not make sense because a memory schema populated with invalid concepts and relations, while appearing complex, may result in poor decision-making in cases where such invalid relations are relied upon. Therefore, it is possible that the measures of knowledge complexity for some participants may be higher than warranted if the validity of the statements is considered.

For example, consider two participants, one who initially had 25 concepts and 25 causal statements in his memo and another who initially had 27 concepts and 29 statements. The latter fictional participant here shows a higher level of knowledge complexity, with a knowledge comprehensiveness score two units higher (27 vs. 25) and a knowledge density score of 1.07 compared to one of 1.0. But, now assume that all of the first participant's causal statements were logical and correct, leaving his complexity scores the same, whereas the second had seven incorrect or illogical statements, which resulted in revised counts of only 24 concepts and 22 statements. The latter participant would now have a comprehensiveness score of 24 and a density score of 0.92, which are both lower than the first participant's scores. Thus, after considering the validity of the causal statements, the first participant has higher relational knowledge complexity than

the latter participant.

It is possible, therefore, that the results of this study's hypothesis tests involving knowledge complexity would change if one or more of the participant groups displayed significant numbers of invalid causal statements compared to the other groups. To examine this possibility, all of the originally coded causal statements from each of the 30 student memos were analyzed for correctness. The student group was chosen for this analysis because theory suggests that, due to their significantly lower levels of general and task-specific audit experience, they may have included more invalid causal statements in their memos than their experienced auditor counterparts (Libby and Luft 1993). In performing this analysis, any causal statement that the author considered illogical or incorrect in light of the case facts and/or the relevant conceptual framework (e.g., the audit risk model) was excluded when calculating revised knowledge comprehensiveness and density scores for each student.

The results of this analysis shows that the mean number of invalid causal statements per memo was 1.1 (s.d. = 2.31), which led to a mean reduction of 0.8 (s.d. = 1.8) cause/effect concepts per memo. Thus, overall, the students had few incorrect statements in their memos. Deducting the number of incorrect statements and concepts from the knowledge complexity measures for each student results in a mean comprehensiveness score of 23.6 (6.2) and a mean density score of 1.09 (0.16). The original scores on these measures were 24.4 (6.3) and 1.11 (0.15), respectively. Using these revised measures in the tests of H4a, which compared the knowledge complexity of the auditors and students, shows there are no significant differences in comprehensiveness ($p = 0.907$) or density ($p = 0.125$) between the two groups. The

students scored significantly higher on both measures in the original tests that ignored statement validity. Thus, there is still no support for H4a, which proposed that auditors would have significantly more-complex relational knowledge than the students.

Given that there were only 1.1 incorrect statements per student memo, that we would expect even fewer "errors" in the auditors' memos, and that the TBA auditors (SSA-TBA auditors) had an average of 34 (28) causal statements in their memos compared to only 20 in the SSA memos, it is unlikely that removing incorrect statements from the auditors' complexity measures would alter the results of the original tests of H3. As reported above in the analysis of H3, the SSA auditors showed significantly less-complex relational knowledge than the SSA-TBA and TBA auditors. Therefore, it seems reasonable to conclude that failing to consider the correctness of the causal statements when coding the memos and conducting the complexity-related hypothesis tests does not contribute to the puzzling results of this study.

Direct Effects of Methodology on Risk Assessment

It is possible that differences in audit methodology may result in different risk assessments, after controlling for auditors' knowledge differences. Indeed, some recent studies (Kotchetova 2002; O'Donnell 2003; O'Donnell and Schultz 2003; Kopp and O'Donnell 2005) that have manipulated methodology in the lab have found that SSA vs. TBA methodology differences have resulted in different audit judgments. Using auditor-participants from a TBA firm, O'Donnell and Schultz (O'Donnell 2003; O'Donnell and Schultz 2003) found that performing risk tasks using an SSA structure led the auditors to identify more risks and make higher risk assessments compared to auditors who performed the tasks using a TBA structure. Kotchetova (2002), who also used auditors

from TBA firms as participants, found that in some cases SSA-type information and analysis led to better risk judgments, but in others a basic TBA-type understanding of the client's business led to judgments that were just as accurate as those made using extensive strategic information. Moreover, participants with the TBA-type understanding made better substantive planning decisions than those with SSA-type information. Using students in their first undergraduate accounting course, Kopp and O'Donnell (2005) found that presenting internal control information in an SSA structure led participants to identify more control risks than participants who received the information in a TBA structure. Thus, studies that have manipulated methodology in the lab have found SSA vs. TBA differences in risk assessment, with mixed results on which methodology leads to better judgments. It therefore seems worthwhile to look for direct effects of methodology on judgment in this dissertation, while controlling for knowledge differences that may also affect those judgments. Table 18 presents the mean risk assessments by methodology and overall.

Assessment of specific risks

To examine cross-methodology differences in the assessments of the seven specific risk factors rated by participants, a one-way MANCOVA with Methodology as the independent variable, the three knowledge measures as controls, and the seven specific risk assessments as dependent variables was run using the data from the 83 auditors.[79] The results of this analysis are presented in Panel A of Table 19. The MANCOVA showed a marginally significant effect of methodology on the specific risk assessments ($F = 1.55$, $p = 0.099$), whereas none of the knowledge covariates was

[79] None of the interactions between each of the three covariates and Methodology was significant, so the interaction terms were excluded from the analysis.

significant (all $p > 0.18$).[80] Individual follow-up ANCOVAs revealed significant differences for only two of the seven specific risk factors: first-year audit ($p = 0.030$) and the new SAP system ($p = 0.010$).[81] None of the other five risk ratings differed across auditor groups (all $p > 0.11$).

Multiple comparison tests showed that, as can be seen descriptively in Table 18, it is the SSA-TBA group driving these significant differences.[82] With a mean rating of 82.8, the SSA-TBA auditors rated the risk of it being a first-year audit significantly higher than both the SSA auditors (rating of 65.8, $p = 0.024$) and the TBA auditors (rating of 64.8, $p = 0.051$), while the difference between the SSA and TBA auditors was not significant ($p = 1.000$). For the risk related to the new SAP system, the SSA-TBA auditors' mean rating of 72.3 was significantly higher than the SSA auditors' rating of 52.0 ($p = 0.002$), but not the TBA auditors' rating of 62.1 ($p = 0.414$), while the SSA and TBA ratings again did not differ ($p = 0.285$).

Overall risk assessments

Panel B of Table 19 reports the results of an ANCOVA, with the same covariates and independent variable as in the preceding MANCOVA, and the auditors' overall assessment of the risk of material misstatement as the dependent variable. The effect of

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[80] Using the composite knowledge measure as a covariate in place of the three individual measures resulted in the same pattern of results, except there was now a marginally significant difference between the ratings of the risk related to the inaccurate budgeting system ($p = 0.096$).

[81] Using the composite risk measures developed in Chapter 4 resulted in the same pattern of results as found here. The composite risk measure formed by averaging the means of the inaccurate budgeting, first-year audit, and new SAP system assessments (i.e., the first three specific risks just found to significantly differ across methodologies) differed across methodologies ($p = 0.001$), whereas the measure formed by averaging the means of overseas production, poor technological development, and obsolescence problems did not differ ($p = 0.901$). As the family-run business risk loaded on its own factor, the result is the same as above when it is included in a MANCOVA with the two composite measures.

[82] Bonferroni tests were used for the multiple comparison tests. The less-conservative Tukey HSD test, as well as pair-wise ANCOVAs, which could control for the three knowledge measures used in the overall MANCOVA, revealed the same pattern of results.

methodology on these overall assessments was significant ($F = 5.80$, $p = 0.004$), and as in the MANCOVA, none of the three knowledge covariates was significant (all $p > 0.29$).[83] Bonferroni tests showed that the SSA-TBA auditors' overall rating of 84.4 was significantly higher ($p < 0.001$) than the SSA auditors' rating of 70.3, but not significantly different from the TBA rating of 79.0 ($p = 0.607$). The TBA auditors' rating was marginally significantly higher than the SSA auditors' rating ($p = 0.058$). Panel C of Table 19 summarizes the risk assessment differences found in the above analyses.

Thus, based on this set of findings and after controlling for knowledge differences (none of which had a significant effect on risk assessments), there was a significant effect of methodology on three of the eight risk assessments made by the auditors in this study. The effect was driven primarily by the SSA-TBA auditors, who rated two specific risks and the overall risk significantly higher than one or both of the SSA and TBA groups. To a very limited extent, this finding is consistent with new assurance standards recently issued by the CICA (2005, Section 5141), which require auditors to gain an enhanced understanding of their client's business, with particular emphasis on strategic-risk analysis and increased testing of internal controls. The hybrid SSA-TBA methodology used by one of the three auditor groups in this study most closely resembles the approach required by these new standards. Because the goal of the new standards is improved risk assessment by auditors, we might expect the SSA-TBA auditors employing such an approach in this study to make different risk assessments than auditors using a pure SSA or pure TBA approach, which is what was found in three of eight cases.

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[83] Using the composite knowledge measure as the covariate in place of the three individual knowledge measures resulted in the same finding.

Demographic Similarities and Differences

This section examines similarities and differences between each of the three auditor groups and the student group on the task-specific experience measures discussed in Chapter 4. Overall, the 88 auditors in the study had significantly more experience on each of the six task-specific measures than the 30 students. It is possible, however, that the puzzling findings of H2 and H4a, in which the students recalled the same number of facts as the auditors and possessed higher relational knowledge than the auditors, may be explained by similarities in task-specific experience levels between the students and one or more of the auditor groups. Table 20 presents the task-specific experience levels for all four of the groups in this study.

The TBA auditors have performed more audit engagements than each of the other three groups (all $p < 0.05$).[84] The TBA auditors have also performed more first-time audit engagements than all other groups (all $p < 0.09$). The TBA auditors also have more experience gathering knowledge of the client's business than all others (all $p < 0.03$) and more experience analyzing this knowledge than the students ($p = 0.014$). The TBA auditors have identified risks on more engagements than any other group (all $p < .065$). Finally, the SSA auditors have worked on more engagements for high-tech clients than any of the other three groups (all $p < 0.01$). Overall, the greatest areas of overlap in task-specific experience are between the SSA auditors and students (same on five of six measures) and the SSA-TBA auditors and students (same on all six measures). This finding lends credence to the possibility that similarities in task-specific experience

[84] The multiple comparisons in this section were done using Bonferroni tests. Only significant differences are discussed in the main text. All other pair-wise comparisons on each measure were not significant ($p > 0.10$).

between 68 of the 88 auditors and the 30 students accounts for the lack of higher factual and relational knowledge among the auditors when compared to the students.

To further explore this possibility, the experience-related hypotheses were examined using only the TBA auditors as the experienced group and comparing them to the students on recall performance, knowledge comprehensiveness, knowledge density, and the composite knowledge measure. The results of these four tests (not tabulated) revealed no significant differences between the significantly more experienced TBA auditors and the students on any of the knowledge measures (all $p > 0.32$), except that the TBA auditors recalled more facts ($p = 0.043$). Thus, it appears that even the overlap in task-specific experience between 68 of the 88 auditors and the students does not adequately explain the failure to find significant experience-related knowledge differences.

Chapter Summary

This chapter presented several supplementary statistical analyses intended to provide additional insights into the series of puzzling results found in Chapter 4. Three sets of tests showed that the TBA and SSA-TBA auditor groups each recalled more facts and possessed higher relational knowledge complexity than the SSA group of auditors. Another set showed that considering only the recall of the 15 most important facts in the list of 60 presented to the auditors did not alter the results of recall performance: the SSA auditors recalled fewer of these facts than both the other groups. Controlling for these cross-methodology differences in knowledge and examining the direct effect of methodology on the auditors' risk assessments showed that the SSA-TBA auditors made significantly higher risk assessments than either or both of the other two groups for three

of the eight risks assessed. This finding is somewhat consistent with recent changes to assurance standards, which require a hybrid SSA-TBA approach to understanding the client's business and making risk assessments. Finally, tests revealed that even though the SSA and SSA-TBA auditors had very similar levels of task-specific experience compared to the students, this experience overlap between 68 of the 88 experienced auditors could not explain the failure to find higher levels of factual and relational knowledge among the auditors as compared to the students: the students possessed similar levels of factual and relational knowledge compared to even the significantly more experienced TBA auditors. The next chapter concludes this dissertation by summarizing and discussing its purpose and results, and noting its limitations.

CHAPTER 6 - DISCUSSION, LIMITATIONS, AND CONCLUSIONS

Dissertation Summary

This dissertation was designed to investigate the effects of audit methodology and experience on the content and organization of knowledge in an auditor's long-term memory, and, ultimately, on their risk judgments. More specifically, it examined how differences between the strategic-systems audit approach and the traditional, transaction-based audit approach affect the content and complexity of client business knowledge in long-term memory, how these mental representations develop with experience, and how the representations affect risk assessment. Knowledge of the client's business is essential to conducting an effective and efficient audit, but researchers have devoted little attention to how this knowledge is represented in memory, how these representations develop with experience, and what effect they have on audit judgment. Moreover, proponents of the strategic-systems approach argue that this approach leads to the formation of a more-complex client business model and results in better audit judgments than the transaction-based approach (Bell et al. 1997). This study cannot—and was not intended to—determine which type of audit methodology is most effective, but merely to provide evidence on how knowledge and judgment varies across methodologies. Its results, however, could provide a base from which to pursue further research on the overall effectiveness of different audit methodologies.

Relying on a synthesis of the memory, knowledge and judgment literatures in psychology and accounting, as well as existing professional and academic work related to recent changes in audit methodologies, seven hypotheses were developed in connection with the dissertation's research questions. Hypotheses 1a and 1b were competing

hypotheses, proposing that SSA and TBA auditors would either recall equivalent numbers of client-environmental facts, or that SSA auditors would recall more facts than TBA auditors. Hypothesis 2 proposed that experienced auditors would recall more facts than their less-experienced counterparts. Hypothesis 3 predicted that SSA auditors would possess more-complex knowledge of the relations among client-environmental facts than TBA auditors. Hypothesis 4a predicted that experienced auditors would possess more-complex knowledge of the relations among client-environmental facts than less-experienced auditors, and Hypothesis 4b proposed that this experience-related difference would be greater for SSA auditors than for TBA auditors. Finally, Hypothesis 5 predicted that auditors with more-complex relational knowledge would make different risk assessments than auditors with less-complex relational knowledge.

To provide the data needed to investigate these hypotheses, 118 participants completed an instrument that included a series of short exercises involving a fictional first-year audit client. Eighty-eight of the participants were practicing auditors who had roughly three years of assurance experience with firms using one of three audit methodologies that varied in the extent to which they incorporated SSA techniques into their audit approaches. The auditors in these three methodology groups were used to test the methodology-related hypotheses (H1a, H1b, H3, and H4b) and also, as a single group, served as the experienced-auditor group for purposes of testing the experience-related hypotheses (H2, H4a, H4b). The other 30 participants were 4th-year university accounting students with mean assurance experience of about seven months, and they served as the less-experienced comparison group for H2, H4a, and H4b. All participants completed an instrument that required them to first study a list of 60 facts about a fictional audit client

and then recall as many of these facts as possible after performing a short distracter task. They then again studied the same list of 60 facts, but this time for the purpose of assessing the level of risk associated with seven specific and one general risk factor. They then had to write a memo justifying their risk assessments and finished by providing demographic information about their education, experience, and audit methodology.

Contrary to expectations, TBA auditors recalled significantly more client facts than SSA auditors (H1a and H1b) and also displayed significantly more-complex relational knowledge than their SSA counterparts (H3). In addition—and also unexpectedly—the auditors did not recall significantly more facts than the auditing students (H2), nor did they display significantly more-complex relational knowledge than their less-experienced counterparts (H4a). Most surprisingly, the SSA auditors in this study possessed the least-complex relational knowledge of any of the four groups in this study, even the auditing students (H4b). Weak support was found for the relation between relational knowledge complexity and auditors' risk judgments (H5), with four of 16 correlations between the two complexity measures and the eight risk judgments being significant.

Controlling for cross-methodology differences in knowledge and examining the direct effect of methodology on the auditors' risk assessments showed that the SSA-TBA auditors made significantly higher risk assessments than either or both of the other two groups for three of the eight risks assessed. This finding is somewhat consistent with recent changes to assurance standards, which require a hybrid SSA-TBA approach to understanding the client's business and making risk assessments. Despite the significant differences in factual and relational client knowledge between the TBA and SSA

auditors, these two groups differed on only one of eight risk assessments: the TBA auditors rated the overall risk of material misstatement as being significantly higher than the SSA auditors.

Discussion

A variety of supplementary analyses were conducted to further explore and possibly explain the puzzling results of the hypothesis tests. Three sets of multiple comparison tests showed that the TBA and SSA-TBA auditors each recalled more facts and possessed higher relational knowledge complexity than the SSA auditors. One possible explanation for the lower recall performance of the SSA auditors is that when studying the list of 60 facts, they paid particular attention to what they perceived to be the most important client facts, while focusing less on the perceived less-important facts. This attention to the most-important facts during the encoding phase of the recall task may have led them to recall a higher proportion of these facts than the other auditors, but a lower number of facts overall. Tests showed, however, that considering only the recall of the 15 most important facts in the list of 60 (as determined by 21 senior audit managers) presented to the auditors did not alter the results of recall performance: the SSA auditors recalled significantly fewer of these important facts than both the other groups. Thus, considering fact importance cannot explain the unexpected cross-methodology recall results.

Another possibility was that ignoring the validity of causal statements in the participants' memos when initially determining knowledge complexity measures resulted in misstated knowledge comprehensiveness and density scores, thus clouding the results of the related hypothesis tests. Analysis showed, however, that it was very unlikely that the TBA and SSA-TBA auditors would have made incorrect causal statements in

quantities significant enough to lower their comprehensiveness and density scores to levels that would be the same or lower than the SSA auditors. Thus, removing incorrect statements from the knowledge complexity measures would not alter the results.

It is possible that varying levels of participant motivation could have affected the results (Libby and Luft 1993). Less-motivated participants may have put less effort into the recall and memo tasks than other more-motivated participants, thus leading to lower recall and knowledge complexity measures, regardless of actual knowledge differences. Indeed, the SSA auditors spent significantly less time on the recall task than the other two groups of auditors, which may indicate lower mean motivation in the SSA group. The recall hypothesis tests (H1a and H1b), however, controlled for time spent performing the recall task (or motivation) and still found a significant effect of methodology on recall. In addition, there were no significant differences between the three auditor groups in time spent performing the risk task and the methodology effect was significant even after controlling for time on this task. Also, the auditors spent significantly more time performing the risk task than the students, but the students showed significantly higher knowledge complexity after controlling for time. Based on this set of results, it seems apparent that motivation is not a factor that can explain the unexpected findings of this study.

The auditors completed the study in varying settings, so it is possible this variation affected the results across groups. The SSA auditors completed the study in two groups of 20-25 while attending a training session, as did 20 of the 23 SSA-TBA auditors, while the remaining SSA-TBA auditors and all the TBA auditors completed it in groups of two to ten in their office boardrooms. It seems, however, that the varying study

settings can be ruled out as a factor affecting the results because all the SSA and 20 of the 23 SSA-TBA auditors completed the study in similar conditions, but the latter group of auditors had significantly higher scores on all three of the knowledge measures used in this study. In addition, a vast majority of the SSA-TBA auditors completed the study in conditions that differed from all the TBA auditors, but these two groups scored the same on all three knowledge measures. Thus, it is unlikely that the varying study conditions can explain the puzzling results.

There were also significant differences in task-specific experience across auditor groups, with the TBA auditors having significantly more experience than the SSA (SSA-TBA) auditors on five (six) of six audit tasks, while the SSA and SSA-TBA auditors had the same amount of experience on all six tasks. Including a measure of task-specific experience as a covariate in the relevant hypothesis tests did not alter the findings in any way, however. Thus, these task-specific experience differences cannot account for the unexpected results.

The experience-related hypotheses in this dissertation (H2 and H4a), in which experienced auditors were expected to possess higher factual and relational knowledge complexity than their less-experienced counterparts, were essentially replications of earlier experience-related studies of auditor knowledge, but in this case examining a type of knowledge (i.e., client business knowledge) that had yet to be investigated. These earlier studies (e.g., Weber 1980; Bonner and Lewis 1990; Frederick 1991; Tubbs 1992) all found significant differences in the amount and/or organization of knowledge, with experienced auditors possessing higher levels of better organized knowledge than their junior colleagues. Thus, it was very surprising to not find such differences in this

dissertation, but instead to see similar levels of recall performance between the two groups and *higher* levels of relational knowledge complexity in the students than in the experienced auditor group. Further analyses showed that the SSA and SSA-TBA auditors had very similar amounts of task-specific experience compared to the students, thus providing a possible explanation for the puzzling experience-related results. That is, because of the significant overlap in task-specific experience between 68 of the 88 experienced auditors and the 30 students, the experience gap between the auditors and the students may not have been large enough to lead to significant knowledge differences.

To further explore this possibility, the SSA and SSA-TBA auditors were dropped from the experienced group, and the experienced TBA auditors, who possessed significantly higher levels of task-specific experience on six of six measures, were compared to the students. Again, there was no significant difference in recall performance between the two groups. There was also no significant difference in relational knowledge complexity between the two groups. So, while the students no longer had higher levels of relational knowledge complexity than the auditors, as they did in the test of H4a, nor were any knowledge differences detected between the significantly more experienced auditors and the students. Thus, the earlier experience-related empirical findings cannot be replicated, even after ensuring significant experience differences exist between the two groups in this study.

Limitations

Theory suggests another possible explanation for the unexpected results of this dissertation, but because the data needed to explore this possibility was not obtained from participants, this is also a limitation of the study. The theoretical model of Libby and Luft

(1993), which underlies all of this dissertation's hypotheses, proposes that in addition to experience, another important determinant of both knowledge and judgment performance is a person's innate ability for things like problem solving, and encoding and retrieving information from memory. Thus, individual differences in ability can also lead to knowledge and judgment differences, beyond any effects of experience and methodology on these measures (e.g., Bonner and Lewis 1990; Libby and Tan 1994).

So, if there were a higher proportion of lower-ability auditors in the SSA group compared to the TBA and SSA-TBA groups, this might account for the lower recall performance and knowledge complexity of the SSA auditors. Similarly, if there were a higher proportion of higher-ability individuals in the student group compared to the auditor group, this might explain the failure to detect experience-related knowledge differences, particularly if combined with a disproportionate number of lower-ability SSA auditors. Admittedly, such a possibility may be remote; it is, however, possible because participants were not randomly assigned to conditions in this study. Instead, they were placed into the methodology and experience groups into which they naturally fell based on their backgrounds. The individual participants' abilities were not measured because to do so would have added perhaps 10 minutes to a study that already took upwards of one hour to complete. Thus, given limits on the participants' time, as well as potential fatigue issues, ability was not measured. Because of this limitation, the possibility of ability affecting the knowledge measures in this study cannot be explored.

Another major limitation is that all the SSA participants were drawn from U.S. offices of the participating SSA firm, whereas participants in all other groups were from Canadian offices of their respective firms. Therefore, it is possible that cross-national

differences may have influenced the results, thus confounding the effects of methodology, and perhaps experience, on knowledge and judgment. The most likely confound relates to accounting education and training differences between the two countries. All 43 of the Canadian auditors (i.e., all the SSA-TBA and TBA auditors) worked in Ontario offices of their respective firms, and it can be safely assumed that the vast majority of these participants were educated in Ontario universities. Therefore, the vast majority of these auditors were educated and trained according to the guidelines set by the Institute of Chartered Accountants of Ontario, the professional body that oversees CA certification in Ontario. The 45 SSA auditors were drawn from offices all over the U.S., and because CPA education and training requirements differ on a state-by-state basis (e.g., some require 150 semester-hours of accounting education, some require less; some require two years of practice experience, some require none), there is likely a greater inconsistency in training and education among the U.S. participants compared to the consistent background of the Canadian auditors. So, it is likely that some of the U.S. participants had education and training backgrounds similar to those of the Canadian auditors (i.e., those U.S. participants that came from states with requirements similar to Ontario's), while many others did not. To the extent that the education and training of some of the U.S. participants could be construed as inferior to that of the Canadian participants, such a difference may partially explain the lower levels of knowledge displayed by the SSA auditors in this study given that education and training are important determinants of knowledge (Libby and Luft 1993). This type of information was not gathered from participants, so it is not possible to further investigate this limitation.

Another possible limitation is that the case used as the basis for the study's recall and risk tasks could be construed as a "novice task" in the context of Libby and Frederick's expertise paradigm (Libby and Frederick 1986; Libby 1995). This paradigm basically states that, when examining expert-novice differences in knowledge and judgment, a researcher should use a task that is difficult enough that one would expect to find differences in knowledge and performance between the two experience levels. That is, the task should not be so basic that a novice auditor could be expected to perform as well as an expert on the given task (i.e., it should not be a novice task). In this study, the case facts were drawn from an undergraduate auditing case, so it is possible that the case facts and context were basic enough that the student participants were able to perform at levels comparable to those of the auditor participants, which is what actually occurred. Thus, it is possible that this novice-task limitation can explain the unexpectedly high levels of knowledge displayed by the students in this study compared to their auditor counterparts.

This dissertation has a variety of other limitations. First, all participants completed case exercises based around a common set of fictionalized client facts. While this was necessary to enhance internal validity, it is possible that different results may have been found had participants worked from client facts they were familiar with from practice. Related to this, no client financial statements were provided in the set of information provided to participants, as they would be on every real audit. While some critical financial results were included as facts in the information provided, the lack of complete financial statements may have hindered the performance of some participants in the study. Third, to help secure the participation of various accounting firms and mitigate

participant fatigue, participants were given roughly one hour to complete the exercises. To properly study, analyze, and integrate a set of client facts and then make related risk judgments would take much more time than this in practice, so performance on the exercises may have differed had participants been given more time to complete them.

Conclusions

In light of these limitations, and given the puzzling pattern of results that could not be satisfactorily explained after many supplementary analyses, caution should be used when interpreting or applying the findings of this dissertation. In particular, definitively concluding that the SSA-TBA and TBA methodologies result in higher levels of factual and relational knowledge than the SSA methodology is too strong a conclusion to draw from this dissertation's results. It does seem reasonable to conclude, however, that the SSA methodology does not lead to higher levels of factual and relational client knowledge than the TBA methodology. The TBA auditors recalled a mean of eight more facts than the SSA auditors (31 vs. 23) and recalled just over half of the 60 client facts originally presented. In addition, the TBA auditors' risk memos contained a mean of 11 more cause/effect concepts (30 vs. 19) and 14 more causal statements (34 vs. 20) than the SSA auditors' memos. Given these sizable knowledge differences between the two groups, it is difficult to imagine that a different group of SSA auditors, perhaps one drawn from Ontario offices of the SSA firm that supplied participants for this study, would perform significantly better than the TBA auditors who completed this study. Therefore, conservatively interpreting this dissertation's results leads to the conclusion that—contrary to the claims of some SSA proponents (e.g., Bell et al. 1997)—the SSA methodology does not result in an auditor possessing an enhanced knowledge of the

client's business compared to that possessed by an auditor employing a traditional audit approach.

Unfortunately, the opportunities for future research to follow-up on these unexpected results are severely limited by the fact that international and Canadian assurance standards now *require* auditors to apply a methodology very similar to those used by the SSA-TBA auditors in this study. Therefore, all firms must now incorporate SSA-type evidence and analyses into their audit approaches, making it impossible to investigate the types of SSA vs. TBA research questions that were examined in this dissertation. These changes also make such questions somewhat moot, because standard setters have clearly decided that an SSA-based methodology is better than a pure TBA approach. Two recent studies (Ballou et al. 2004; O'Donnell and Schultz 2005), however, have exposed potential flaws in the SSA approach. Given the questionable SSA-related knowledge gains identified in this dissertation and these recently identified problems with the SSA approach, it seems that future research should address other needed changes or improvements to the approach that will actually improve an auditor's knowledge of the client's business and mitigate flawed judgments.

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APPENDIX A - TABLES AND FIGURES

Table 1

Comparison of Transaction-based and Strategic-Systems Audit Approaches

Transaction-based Approach	Strategic-Systems Approach
Transaction Orientation Based on the notion that the whole can be discerned by examining the parts	*Holistic Orientation* Based on the belief that the broader context infuses meaning into the parts
Focus on the Information Process Through an understanding of the interrelationships among reported information, one is able to develop a sound expectation model about performance	*Focus on the Business Processes* Presumes the objectives of the business strategy are delivered through key processes; therefore a sound expectation model must be based on a review of strategy and process indicators
Expert Knowledge of Accounting and Auditing Relies on in-depth understanding of auditing procedures and accounting rules predominantly to enable the attester to verify consistencies and detect anomalies	*Expert Knowledge of Business* Considers a broader understanding of the entity and its environment to contribute significantly to the attester's ability to verify consistencies and detect anomalies
Discrete Systems Comprehends systems as disconnected from one another, generating unrelated transactions that can be reviewed by individuals working independently	*Networked* Understands the organization as a dynamic network whose systems cannot be examined in isolation
Audit Risk Based on belief that opinions about financial statements can be issued independently from a commentary on the client business risk	*Business Risk* Considers the financial-statement opinion to be inextricably connected to a broader assessment of client business risk

Adapted from Bell et al. (1997, p. 72).

Table 2

Partial List of Client Business Factors with Potential Audit Significance

BUSINESS ENVIRONMENT

Nature of the business
- Profit-oriented
- Government
- Government organization
- Not-for-profit organization

General economic factors
- General level of economic activity
- Interest rates
- Inflation
- Foreign currency rates, controls and revaluation
- Government policies

Industry conditions affecting the entity's business
- Adverse conditions
- Favourable conditions
- Changes in technology
- Cyclical or seasonal activity
- Energy supply and cost
- Laws and regulations affecting industry/sector
- Industry / sector-wide norms

Financial reporting environment
- Regulatory financial reporting requirements
- Accounting policies and disclosure issues peculiar to the industry / sector
- Audit reporting requirements

OPERATING CHARACTERISTICS

Revenue
- Services or products and markets (e.g., major customers and contracts; market share; competitors; pricing policies; reputation of products; warranties; marketing strategy and objectives; manufacturing processes)
- Tax revenues; grants; contributions; fees
- Constraints imposed by legislation, regulation or contract on fees / prices charged, revenue sources or frequency of service
- Method of service delivery

Expenditures
- Facilities
- Production methods
- Employees
- Important suppliers of goods and services
- Legal advice
- Inventories
- Research and development

OWNERSHIP AND MANAGEMENT

Beneficial owners
- Form of ownership

Related parties
- Names
- Nature and extent of relationship
- Types of transactions normally undertaken

Board of directors or equivalent
- Composition
- Business reputation and experience of members
- Degree of independence from, and control over, operating management
- Frequency of meetings
- Scope of audit committee responsibilities
- Attitude toward control environment and other aspects of corporate governance

Operating management
- Experience and reputation
- Objectives (e.g., philosophy; strategic plans)
- Authority, responsibilities, accountability
- Management structure
- Amount of turnover
- Quality of accounting department staff
- Types of incentive or bonus plans
- Pressures on management

OPERATING CHARACTERISTICS cont'd

Finance
- Sources, methods and availability of financing
- Capital structure
- Debt structure
- Derivative financial instruments
- Credit risk exposure
- Interest rate risk exposure
- Liquidity risk exposure
- Foreign exchange risk exposure
- Acquisitions, mergers, or disposals
- Restricted assets and revenues
- Borrowing restrictions imposed by legislation

Administration
- Organizational structure
- Information systems, including use of current information technology
- Franchises, licenses, patents
- Taxation (e.g., tax status; unique taxation issues)
- Internal audit function

Source: CICA Handbook Section 5140 (CICA 2001)

Table 3

Client Information used in Recall and Risk Tasks (with Mean and SD of Importance Ratings)

Piece of Information	Mean[a]	SD
XTC may be going public	2.73	0.70
XTC's revenues have shrunk by one third since 2000	2.36	0.79
XTC's budgeting has been inaccurate in recent years	2.27	0.63
XTC needs more capital to compete with larger joystick makers	2.23	1.02
XTC's defect rate is 25% higher than industry average	2.14	0.77
XTC's inventory turnover has decreased while competitors' turnovers increased	2.14	0.83
The industry is characterized by short product life cycles	2.14	0.99
85% of current revenues are from consumer joystick sales	2.09	0.81
XTC has lost half of its high-end market share	2.05	0.84
XTC is currently converting to an SAP platform	2.05	0.95
Net income is 10% of its fiscal 2000 level	2.05	1.13
XTC buys majority of raw materials from overseas	1.95	0.79
Other manufacturers have introduced technologically advanced digital joysticks	1.95	1.17
Return on equity declined 82% in past two years	1.95	1.17
The company manufactures consumer and industrial joysticks	1.86	1.08
Fiscal 2001 is your firm's first year auditing XTC	1.82	1.50
XTC's current ratio is significantly below the industry average	1.77	1.02
Core business processes are R&D, inventory management, and distribution	1.77	1.02
XTC has 10 direct competitors, including Logitech and Microsoft	1.77	1.07
In past five years, XTC significantly decreased development efforts	1.73	1.08
Industry observers expect joystick market growth to slow	1.73	1.08
Joysticks are subject to rapid technological changes	1.73	1.28
Family members hold all senior executive positions	1.68	0.84
Significant portion of joystick sales occur during Christmas season	1.64	1.05
XTC is a privately-owned company	1.64	1.29
XTC's industrial joysticks much more profitable than consumer joysticks	1.50	0.86
XTC's new information system should improve inventory management	1.50	0.86
Management constantly monitors patent applications, inventory turnover, and defects	1.50	1.26
XTC will enter mass market with lower-cost products	1.45	1.01
New strategy is being a "one-stop gaming-device shop"	1.45	1.06
Accurate sales estimates critical to timely delivery and inventory management	1.45	1.18
XTC is based in Ontario, with branches in US	1.41	0.96

Table 3 continued

XTC's offshore purchases require long lead times	1.41	1.40
XTC sells only analog joysticks	1.36	1.40
XTC has no patents; other developers average four each	1.32	1.04
XTC has no bank debt	1.32	1.49
Joysticks are predominantly sold through stores like Wal-Mart	1.27	0.98
XTC has relatively few joystick/software bundling arrangements	1.23	1.11
Customers typically have very tight, strict delivery deadlines	1.23	1.34
Rivals offer more products and command more shelf space	1.23	1.57
CEO is also company president and founder	1.05	1.25
XTC's R&D expenditures are considerably lower than other manufacturers	1.05	1.29
XTC's low-end joysticks will be produced in Taiwan	1.05	1.29
Retaining skilled workforce is essential to XTC's success	0.86	1.36
Merchants negotiate prices based on large purchasing volumes	0.86	1.39
XTC must constantly check the quality of raw materials	0.77	1.54
Price is a significant factor for consumers	0.73	1.32
Good retailer relationships essential for adequate promotion and shelf space	0.64	1.36
Common industry practice is to package joysticks with software	0.59	1.30
Resource management processes are Human Resources, treasury, and information management	0.59	1.56
XTC asks suppliers for bids to get competitive prices	0.45	1.22
In the past, XTC developed leading-edge joysticks	0.45	1.60
XTC's joysticks were formerly the benchmark for gaming excellence	0.41	1.65
Opposition's well-established distribution channels reduce their costs	0.23	1.60
Consumer joystick purchases are discretionary	- 0.09	1.87
Management favours group discussion over formal goal-setting processes	- 0.14	1.55
Large competitors have sophisticated sales forecasting and tracking systems	- 0.23	1.31
End users are mostly low-to-middle income earners	- 0.36	1.68
XTC's original goal was producing high quality, innovative joysticks	- 0.55	1.84
The industry's target demographic is 18-35 year-old males	- 0.64	1.36
Overall Mean and SD	**1.29**	**0.77**

[a] Twenty-one senior managers from three firms (one SSA, one TBA, and one SSA-TBA firm) that also provided participants for the main study rated the importance of each piece of information within the context of gaining an understanding of a manufacturing client's business. A seven-point scale anchored at the low end (-3) by "Very Unimportant" and at the high end (+3) by "Very Important" was used to rate each piece of information.

Table 4

Risks used in Risk-Assessment and Risk-Justification Tasks

	Proportion of SSA Senior Managers who Identified Risk	Proportion of SSA-TBA Senior Managers who Identified Risk
Specific risks		
XTC's budgeting system has produced inaccurate results in recent years.	75%	50%
This is our firm's first year auditing XTC.	75%	50%
XTC is implementing an SAP/inventory management platform.	100%	100%
Family members hold all senior management positions.	100%	67%
The overseas production situation may cause production shortfalls or quality problems.	100%	67%
XTC is not staying current with its technological development.	50%	75%
XTC may experience significant inventory obsolescence problems.	25%	75%
General risk		
Please assess the overall risk of material misstatement on the XTC engagement.	N/A	N/A

Table 5

Causal-Mapping Analysis of Risk-Justification Memo in Figure 7

	Cause Concept	Effect Concept	
A[1]	short product life cycle	inventory obsolescence [risk][2]	B
C	poor inventory management system	inventory obsolescence [risk]	B
D	XTC doesn't have any patents	put [XTC's] products behind competitors	E
F	decline in R&D efforts in recent years	put [XTC's] products behind competitors	E
E	put [XTC's] products behind competitors	adversely affect sales	G
H	Family members holding management positions	Won't increase [risk]	J
AB	Family members holding management positions	[Our firm] should assess [family management's] knowledge	AD
AB	Family members holding management positions	[Our firm] should assess [family management's] capability of carrying responsibilities	AE
AB	Family members holding management positions	[Our firm] should assess [family management's] capability to run business effectively	AF
AG	[The firm] should be concerned with implementation of SAP	[to ensure] proper change in info systems	AH
AG	[The firm] should be concerned with implementation of SAP	[to ensure] completeness of documentation	AI
AG	[The firm] should be concerned with implementation of SAP	[to ensure] info wasn't tampered with during change	AJ
AG	[The firm] should be concerned with implementation of SAP	[to ensure] info wasn't lost during change	AK
K	low current ratio	going concern risk	L
M	decreased revenues	going concern risk	L
N	ROE down 82%	going concern risk	L
O	performance behind competitors	going concern risk	L
P	overseas production	risk	J
P	overseas production	delay in delivery of items	Q
Q	delay in delivery of items	XTC sales will suffer	G
Q	delay in delivery of items	[XTC's] relationship with distributors will suffer	R
G	XTC sales will suffer	Risk	J
R	[XTC's] relationship with distributors will suffer	Risk	J
S	first time audit	need to gain understanding of internal controls	U
V	Assess if internal controls are effective	[planned] audit procedures	W
X	[increased] control risk	audit risk	Y
Z	[increased] inherent risk	audit risk	Y
AA	the nature of industry XTC operates in	Inherent risk	Z

Notes:
1. Concepts with same letter code denote a single concept used in multiple relations.
2. Words in brackets are editorial changes made to enhance clarity.

Table 6

Participants' Demographic Information by Experience Level

	Auditors	Auditing students	Overall
General and Task-specific Experience	n = 88	n = 30	n = 118
Number (%) of participants with title of *Staff* auditor	27 (30.7)	27 (90.0)	54 (45.8)
Number (%) of participants with title of *Senior* auditor	61 (69.3)	3 (10.0)	64 (54.2)
Number (%) of participants with a CA or CPA designation	51 (58.0)	0 (0.0)	51 (43.2)
Months of assurance experience [Mean (SD)]	33.8 (17.2)	7.9 (5.1)	27.2 (18.8)
Number of audit engagements performed	23.2 (19.9)	14.9 (11.0)	21.0 (18.4)
Number of *first-time* audit engagements performed	2.5 (3.0)	2.0 (2.3)	2.4 (2.8)
Number of engagements in which *gathered* knowledge of a client's business	13.5 (17.2)	6.5 (6.6)	11.7 (15.4)
Number of engagements in which *analyzed* knowledge of a client's business	13.7 (18.2)	6.0 (5.5)	11.7 (16.3)
Number of engagements in which *identified* risks	10.0 (14.2)	2.6 (3.7)	8.1 (12.8)
Number of engagements performed involving clients in *high-tech* industry	4.6 (6.6)	1.3 (2.0)	3.7 (6.0)

Table 7

Participants' Demographic Information by Methodology

	SSA	SSA-TBA	TBA	Overall
Panel A: General and Task-specific Experience	n = 45	n = 23	n = 20	n = 88
Number (%) of participants with title of *Staff* auditor	20 (44.4)	1 (4.3)	6 (30.0)	27 (30.7)
Number (%) of participants with title of *Senior* auditor	25 (55.6)	22 (95.7)	14 (70.0)	61 (69.3)
Number (%) of participants with a CA or CPA designation	23 (51.1)	14 (60.9)	14 (70.0)	51 (58.0)
Months of assurance experience [Mean (SD)]	30.5 (17.6)	37.1 (18.0)	37.2 (14.3)	33.8 (17.2)
Number of audit engagements performed	18.0 (16.6)	21.6 (14.6)	36.6 (25.8)	23.2 (19.9)
Number of *first-time* audit engagements performed	2.3 (2.4)	1.7 (3.2)	4.2 (3.4)	2.5 (3.0)
Number of engagements in which *gathered* knowledge of a client's business	10.1 (13.1)	11.0 (12.4)	23.9 (24.7)	13.5 (17.2)
Number of engagements in which *analyzed* knowledge of a client's business	11.8 (17.0)	11.3 (13.4)	20.3 (24.0)	13.7 (18.2)
Number of engagements in which *identified* risks	6.9 (7.8)	8.6 (11.8)	18.2 (22.7)	10.0 (14.2)
Number of engagements performed involving clients in *high-tech* industry	7.7 (7.7)	2.2 (3.9)	0.6 (1.2)	4.6 (6.6)
Panel B: Frequency of Audit Analyses [Mean (SD)]				
Extent to which your firm analyzes a client's business strategy[1]	7.8 (2.1)	6.2 (2.6)	4.5 (2.1)	6.7 (2.5)
Extent to which your firm analyzes a client's key business processes[1]	9.2 (1.4)	7.7 (1.5)	6.4 (2.5)	7.6 (2.5)
Extent to which your firm analyzes a client's key performance indicators[1]	8.0 (2.2)	6.9 (2.0)	5.6 (1.9)	7.0 (2.4)
Average of preceding three frequencies	8.3 (1.4)	6.9 (1.6)	5.5 (1.7)	7.1 (2.0)
Panel C: Methodological Similarities and Differences				
Extent to which your firm analyzes a client's business strategy[2]	A	B	C	
Extent to which your firm analyzes a client's key business processes[2]	D	E	F	
Extent to which your firm analyzes a client's key performance indicators[2]	G	G, H	H	

Note 1: Responses were on a scale from 0 (Never) to 10 (Always), with the midpoint (i.e., 5) labeled "Sometimes".

Note 2: For each analysis, the same letter code indicates no cross-methodology difference in frequency ($p > .10$); different letter codes indicate cross-methodology difference ($p < .10$).

Table 8

Descriptive Statistics

	SSA	SSA-TBA	TBA	Overall
Panel A: By Methodology	n = 45	n = 23	n = 20	n = 88
Minutes taken to perform recall task	12.8 (2.3)	14.0 (3.9)	15.2 (3.8)	13.6 (3.3)
Number of facts correctly recalled	23.1 (5.6)	28.0 (6.4)	31.1 (6.4)	26.2 (6.8)
Minutes taken to perform risk task	20.4 (4.4)	19.9 (5.8)	22.9 (8.0)	20.7 (5.8)
Knowledge comprehensiveness[1]	19.4 (7.8)	25.4 (10.3)	30.4 (9.1)	23.5 (9.8)
Number of causal assertions	20.0 (9.5)	28.0 (11.8)	34.1 (11.4)	25.3 (12.0)
Knowledge density[2]	1.01 (0.13)	1.09 (0.13)	1.11 (0.13)	1.05 (0.14)

	Auditors	Auditing students	Overall
Panel B: By Experience	n = 88	n = 30	n = 118
Minutes taken to perform recall task	13.6 (3.3)	12.8 (2.6)	13.4 (3.1)
Number of facts correctly recalled	26.2 (6.8)	25.3 (5.7)	26.0 (6.5)
Minutes taken to perform risk task	20.7 (5.8)	17.5 (4.2)	19.9 (5.6)
Knowledge comprehensiveness[1]	23.5 (9.8)	24.4 (6.3)	23.7 (9.0)
Number of causal assertions	25.3 (12.0)	27.4 (8.8)	25.8 (11.2)
Knowledge density[2]	1.05 (0.14)	1.11 (0.15)	1.07 (0.14)

Note 1: Knowledge comprehensiveness = the total number of distinct cause or effect concepts appearing in a participant's risk memo.

Note 2: Knowledge density = (Number of causal assertions) divided by (Knowledge comprehensiveness).

Table 9

The Effect of Audit Methodology on Recall Performance (H1a and H1b)

Source of Variance	df	F-statistic	p-value
Intercept	1	38.54	< 0.001
Time taken to perform recall task (covariate)	1	17.13	< 0.001
Methodology	2	4.69	0.012
Methodology x Time	2	3.96	0.023
Error	82		
Total	88		

Table 10

The Effect of Experience on Recall Performance (H2)

Source of Variance	df	F-statistic	p-value
Intercept	1	28.96	< 0.001
Time taken to perform recall task (covariate)	1	32.64	< 0.001
Experience	1	0.01	0.945
Error	115		
Total	118		

Table 11

The Effects of Methodology on Relational Knowledge Complexity (H3)

Source of Variance	df	F-statistic	p-value
Panel A: Knowledge Comprehensiveness as Dependent Measure			
Intercept	1	1.26	0.266
Number of facts correctly recalled (covariate)	1	4.23	0.043
Time taken to perform risk task (covariate)	1	40.16	< 0.001
Presentation order of risk factors (covariate)	1	5.32	0.024
Methodology	2	4.11	0.020
Methodology x Number of facts correctly recalled	2	4.45	0.015
Error	80		
Total	88		
Panel B: Knowledge Density as Dependent Measure			
Intercept	1	140.73	< 0.000
Number of facts correctly recalled (covariate)	1	0.42	0.518
Time taken to perform risk task (covariate)	1	1.22	0.272
Methodology	2	4.85	0.010
Methodology x Time taken to perform risk task	2	3.10	0.051
Error	81		
Total	88		

Table 12

The Effect of Experience on Relational Knowledge Complexity (H4a)

Source of Variance	df	F-statistic	p-value
Panel A: Knowledge Comprehensiveness as Dependent Measure			
Intercept	1	1.15	0.287
Number of facts correctly recalled (covariate)	1	22.92	< 0.001
Time taken to perform risk task (covariate)	1	40.58	< 0.001
Experience	1	6.49	0.012
Error	114		
Total	118		
Panel B: Knowledge Density as Dependent Measure			
Intercept	1	197.23	< 0.001
Number of facts correctly recalled (covariate)	1	2.16	0.144
Time taken to perform risk task (covariate)	1	2.70	0.103
Experience	1	4.96	0.028
Error	114		
Total	118		

Table 13

The Effects of Methodology and Experience on Relational Knowledge (H4b)

	SSA	SSA-TBA	TBA	Student
Panel A: Knowledge differences compared to auditing students				
Mean (s.d.) knowledge comprehensiveness	19.4 (7.8)	25.4 (10.3)	30.4 (9.1)	24.4 (6.3)
Difference in mean knowledge comprehensiveness compared to auditing students	-5.0	1.0	6.0	N/A
Mean (s.d.) knowledge density	1.01 (0.13)	1.09 (0.13)	1.11 (0.13)	1.11 (0.15)
Difference in mean knowledge density compared to auditing students	-0.10	-0.02	0.00	N/A
Panel B: Contrast tests of knowledge comprehensiveness differences				
Contrast estimate (std. err.)[1]	-6.4 (1.7)	-1.7 (1.9)	0.2 (2.1)	N/A
t-statistic	-3.76	-0.95	0.00	N/A
p-value	0.000	0.374	0.993	N/A
Panel C: Contrast tests of knowledge density differences				
Contrast estimate (std. err.)[1]	-0.1 (0.04)	-0.02 (0.04)	-0.02 (0.04)	N/A
t-statistic	-3.29	-0.62	0.50	N/A
p-value	0.001	0.576	0.720	N/A

Note 1: The contrast tests compared each of the three methodology groups to the auditing student group and controlled for number of facts recalled and time taken to perform the risk task.

Table 14

Relations between Knowledge Complexity and Risk Assessments (H5)

	Mean Risk Assessment (std. dev.)[1]	Correlation with Knowledge Comprehens-iveness	Correlation with Knowledge Density
Specific risks			
XTC's budgeting system has produced inaccurate results in recent years.	67.8 (21.6)	-0.06	0.07
This is our firm's first year auditing XTC.	74.0 (23.7)	0.09	0.21**
XTC is implementing an SAP/inventory management platform.	60.6 (24.8)	0.19**	0.10
Family members hold all senior management positions.	68.3 (25.9)	-0.21**	-0.08
The overseas production situation may cause production shortfalls or quality problems.	62.5 (22.6)	0.26***	0.05
XTC is not staying current with its technological development.	68.7 (23.5)	0.16*	0.05
XTC may experience significant inventory obsolescence problems.	79.1 (16.5)	0.10	0.05
General risk			
Overall risk of material misstatement on the XTC engagement.	77.3 (14.3)	0.12	0.09

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

Note 1: The risk assessments were made using scales anchored by 0 at the low end ("Low Risk") and 100 at the high end ("High Risk"), with the midpoint of 50 labelled "Moderate Risk".

Table 15

Cross-Methodology Multiple Comparison Tests of Knowledge Differences

	SSA	SSA-TBA	TBA	Overall
Panel A: Knowledge Measures by Methodology	n = 45	n = 23	n = 20	n = 88
Minutes taken to perform recall task	12.8 (2.3)	14.0 (3.9)	15.2 (3.8)	13.6 (3.3)
Number of facts correctly recalled	23.1 (5.6)	28.0 (6.4)	31.1 (6.4)	26.2 (6.8)
Minutes taken to perform risk task	20.4 (4.4)	19.9 (5.8)	22.9 (8.0)	20.7 (5.8)
Knowledge comprehensiveness	19.4 (7.8)	25.4 (10.3)	30.4 (9.1)	23.5 (9.8)
Number of causal assertions	20.0 (9.5)	28.0 (11.8)	34.1 (11.4)	25.3 (12.0)
Knowledge density	1.01 (0.13)	1.09 (0.13)	1.11 (0.13)	1.05 (0.14)
Composite knowledge	20.8 (6.2)	27.1 (8.6)	31.9 (7.3)	25.0 (8.4)
Panel B: Results of Bonferroni Tests (p values)	**Factual Recall**	**Knowledge Comp.**	**Knowledge Density**	**Composite Knowledge**
SSA vs. SSA-TBA	***	**	**	***
SSA vs. TBA	***	***	***	***
TBA vs. SSA-TBA	n.s.	n.s.	n.s.	n.s.

*** $p < 0.01$ ** $p < 0.05$

Table 16

Fifteen Most Important Client Facts as Rated by Senior Managers (with Mean and SD of Importance Ratings)

Fact	Mean[a]	SD
XTC may be going public	2.73	0.70
XTC's revenues have shrunk by one third since 2000	2.36	0.79
XTC's budgeting has been inaccurate in recent years	2.27	0.63
XTC needs more capital to compete with larger joystick makers	2.23	1.02
XTC's defect rate is 25% higher than industry average	2.14	0.77
XTC's inventory turnover has decreased while competitors' turnovers increased	2.14	0.83
The industry is characterized by short product life cycles	2.14	0.99
85% of current revenues are from consumer joystick sales	2.09	0.81
XTC has lost half of its high-end market share	2.05	0.84
XTC is currently converting to an SAP platform	2.05	0.95
Net income is 10% of its fiscal 2000 level	2.05	1.13
XTC buys majority of raw materials from overseas	1.95	0.79
Other manufacturers have introduced technologically advanced digital joysticks	1.95	1.17
Return on equity declined 82% in past two years	1.95	1.17
The company manufactures consumer and industrial joysticks	1.86	1.08

[a] Twenty-one senior managers from three firms (one firm from each methodology condition) that also participated in the main study rated the importance of each fact within the context of gaining an understanding of a manufacturing client's business. A seven-point scale anchored at the low end (-3) by "Very Unimportant" and at the high end (+3) by "Very Important" was used to rate each fact.

Table 17

Cross-Methodology Differences in Recall of 15 Most-Important Facts

	SSA	SSA-TBA	TBA	Overall
Panel A: Descriptive Statistics [Mean (SD)]	n = 45	n = 23	n = 20	n = 88
Minutes taken to perform recall task	12.8 (2.3)	14.0 (3.9)	15.2 (3.8)	13.6 (3.3)
Raw number of most-important facts recalled[1]	6.8 (2.1)	7.9 (2.3)	8.3 (1.5)	7.4 (2.1)
Weighted number of most-important facts recalled[2]	14.3 (4.4)	16.7 (5.0)	17.5 (3.2)	15.6 (4.5)

Panel B: ANCOVA on Raw Most-Important Facts	df	F-statistic	p-value
Intercept	1	31.87	< 0.001
Time taken to perform recall task (covariate)	1	5.16	0.026
Methodology	2	3.30	0.042
Methodology x Time	2	2.30	0.100
Error	82		
Total	88		

Panel C: ANCOVA on Weighted Most-Important Facts	df	F-statistic	p-value
Intercept	1	31.27	< 0.001
Time taken to perform recall task (covariate)	1	5.30	0.023
Methodology	2	3.50	0.034
Methodology x Time	2	2.60	0.078
Error	82		
Total	88		

Note 1: Represents the mean number of important facts from Table 16 recalled by auditors in each group.
Note 2: Each fact from Table 16 that was correctly recalled by an auditor was weighted by the importance rating appearing beside the corresponding fact in the Table, and these weights were then summed to form this measure.

Table 18

Risk Assessments by Methodology [Mean (s.d.)][1]

	SSA	SSA-TBA	TBA	Overall
Specific risks				
XTC's budgeting system has produced inaccurate results in recent years.	63.5 (24.2)	73.7 (19.3)	60.8 (18.9)	65.5 (22.2)
This is our firm's first year auditing XTC.	65.8 (24.4)	82.8 (17.5)	64.8 (29.0)	69.9 (24.9)
XTC is implementing an SAP/inventory management platform.	52.0 (23.8)	72.3 (20.5)	62.1 (20.2)	59.4 (23.6)
Family members hold all senior management positions.	75.3 (23.5)	72.1 (23.5)	56.3 (18.6)	70.1 (23.5)
The overseas production situation may cause production shortfalls or quality problems.	59.9 (23.8)	62.1 (21.6)	68.8 (20.4)	62.5 (22.6)
XTC is not staying current with its technological development.	68.4 (23.8)	70.9 (21.6)	70.0 (26.0)	69.4 (23.5)
XTC may experience significant inventory obsolescence problems.	78.3 (18.9)	82.0 (9.3)	83.5 (14.7)	80.4 (16.0)
General risk				
Overall risk of material misstatement on the XTC engagement.	70.3 (16.6)	84.4 (10.8)	79.0 (7.5)	75.9 (14.8)

Note 1: The risk assessments were made using scales anchored by 0 at the low end ("Low Risk") and 100 at the high end ("High Risk"), with the midpoint of 50 labelled "Moderate Risk".

Table 19

Cross-Methodology Differences in Risk Assessments

Panel A: MANCOVA on Seven Specific Risks	**df**	**F-statistic**	**p-value**
Intercept	7	6.58	< 0.001
Number of facts recalled	7	0.32	0.942
Knowledge comprehension	7	1.48	0.186
Knowledge density	7	0.73	0.650
Methodology	14	1.55	0.099
Error	450		
Total	478		

Panel B: ANCOVA on Overall Risk	**df**	**F-statistic**	**p-value**
Intercept	1	30.26	< 0.001
Number of facts recalled	1	1.11	0.296
Knowledge comprehension	1	0.23	0.636
Knowledge density	1	0.03	0.862
Methodology	2	5.80	0.004
Error	82		
Total	88		

Panel C: Summary of Risk Assessment Differences[1]	**SSA**	**SSA-TBA**	**TBA**
This is our firm's first year auditing XTC.	A	B	A
XTC is implementing an SAP/inventory management platform.	C	D	C, D
Overall risk of material misstatement on the XTC engagement.	E	F	F

Note 1: For each risk listed, the same letter code indicates no cross-methodology difference in risk assessments ($p > .10$); different letter codes indicate cross-methodology difference ($p < .10$).

Table 20

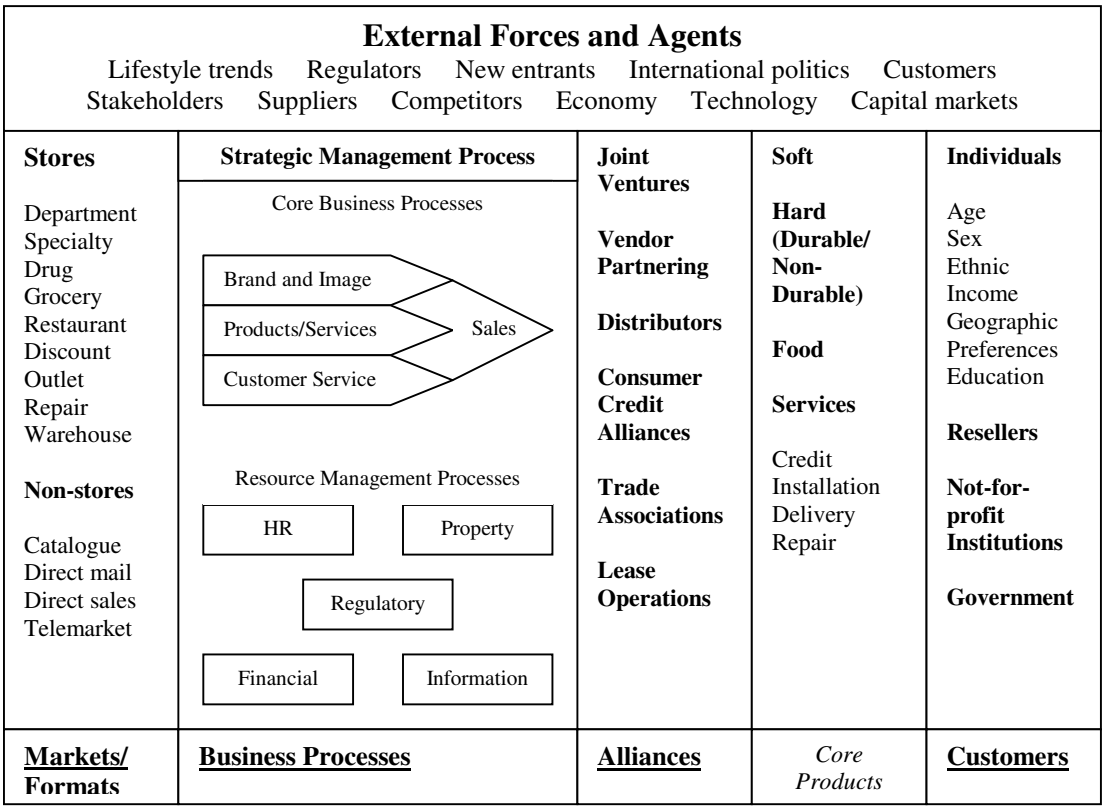
Task-Specific Experience Similarities and Differences

	Students	SSA	SSA-TBA	TBA
Number of audit engagements performed	14.9 (11.0)	18.0 (16.6)	21.6 (14.6)	36.6 (25.8)
Number of *first-time* audit engagements performed	2.0 (2.3)	2.3 (2.4)	1.7 (3.2)	4.2 (3.4)
Number of engagements in which *gathered* knowledge of a client's business	6.5 (6.6)	10.1 (13.1)	11.0 (12.4)	23.9 (24.7)
Number of engagements in which *analyzed* knowledge of a client's business	6.0 (5.5)	11.8 (17.0)	11.3 (13.4)	20.3 (24.0)
Number of engagements in which *identified* risks	2.6 (3.7)	6.9 (7.8)	8.6 (11.8)	18.2 (22.7)
Number of engagements performed involving clients in *high-tech* industry	1.3 (2.0)	7.7 (7.7)	2.2 (3.9)	0.6 (1.2)

Figure 1

The SSA Auditor's Organization of Client Business Knowledge

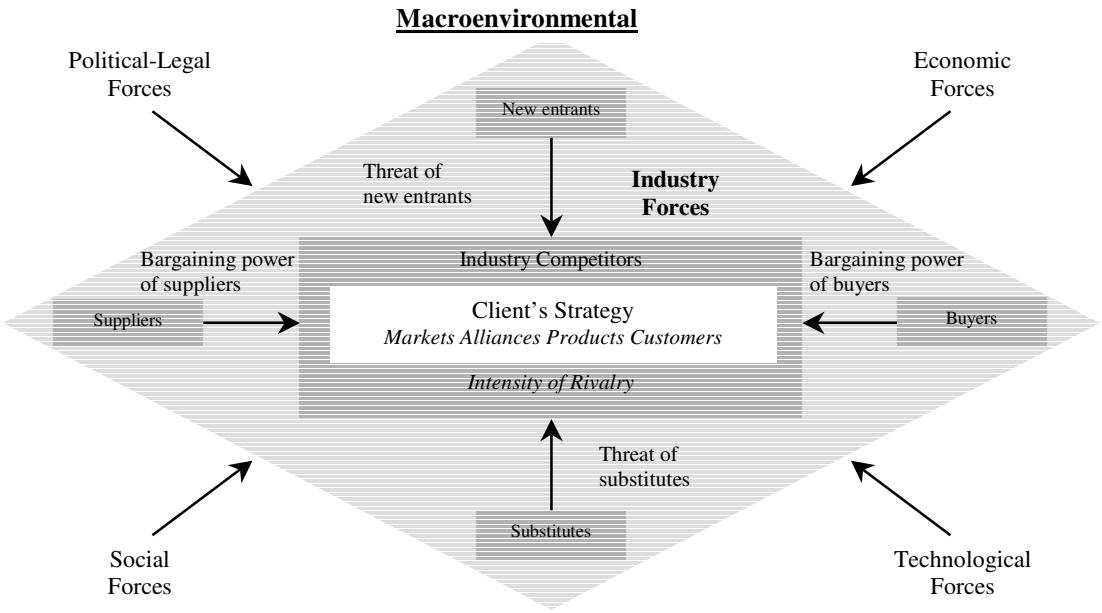
Panel A: Entity-Level Business Model



Adapted from Bell et al. (1997, p. 41)

Note: This business model is not generic, but is one that may be used for a large retailing organization.

Figure 1, Panel B: Strategic Business Risk Framework



Adapted from Knechel (2001)

Panel C: PEST Analysis

Factors that are germane to a PEST analysis include:

1) *Political factors*: (a) government stability, (b) taxation policy, (c) government spending, (d) government relations with other countries, (e) industrial policy (e.g., towards privatization, regulation and nationalization).
Legal factors: (a) employment law, (b) monopolies and mergers legislation, (c) environmental protection laws, (d) foreign trade regulations.

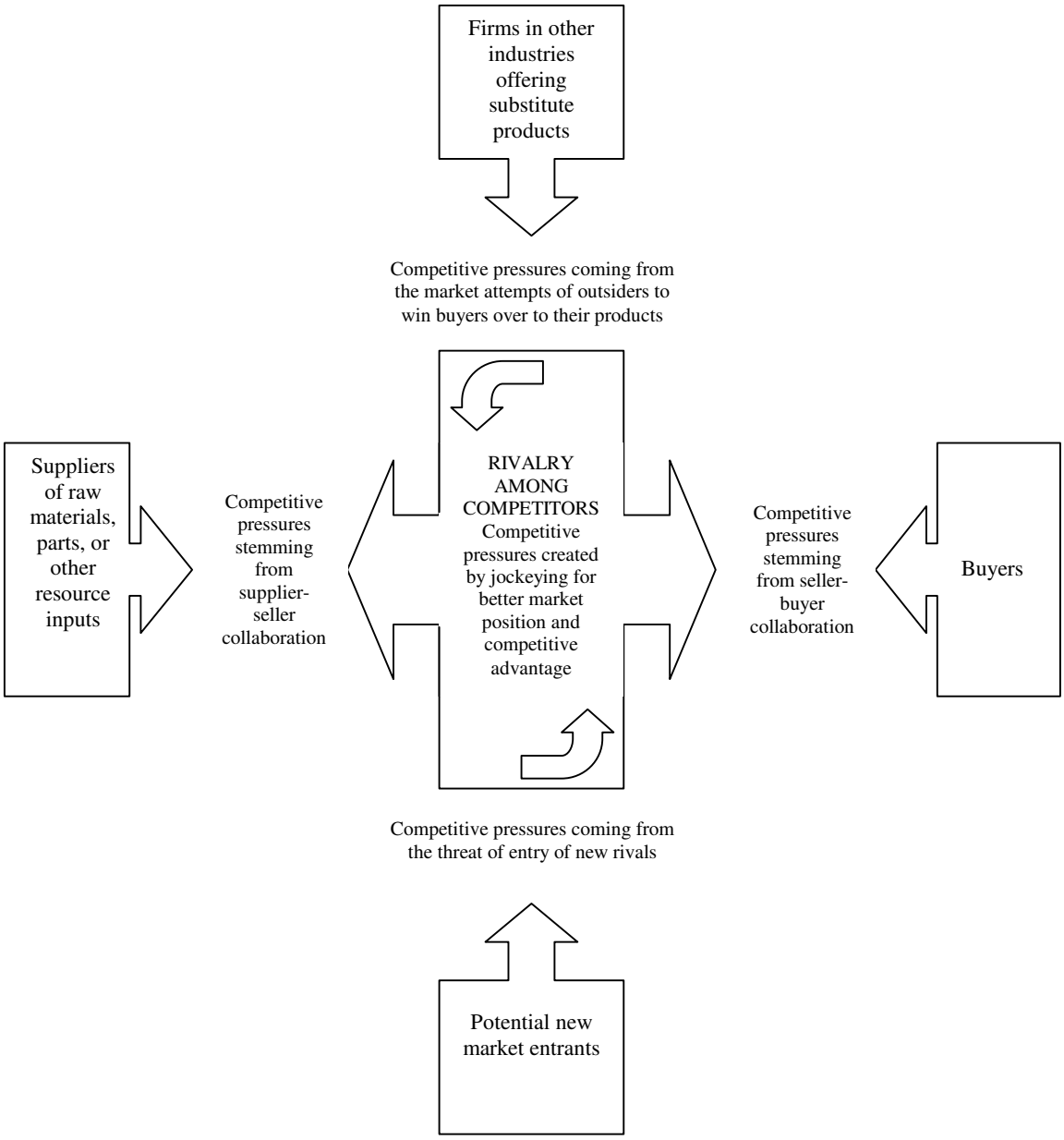
2) *Economic factors*: (a) inflation, (b) employment, (c) disposable income, (d) business cycles, (e) interest rates, (f) GNP growth rates, (g) exchange rates, (h) energy and basic raw materials prices.

3) *Social and cultural factors*: (a) population demographics, (b) income distribution, (c) levels of education, (d) lifestyle changes, (e) attitudes to work and leisure, (f) consumerism, (g) social mobility.

4) *Technological factors*: (a) new discoveries/developments in our own or related (e.g., supplier) industry, (b) speed of technology transfer (diffusion), (c) government spending on research, (d) rates of obsolescence.

Adapted from Salterio and Weirich (2002)

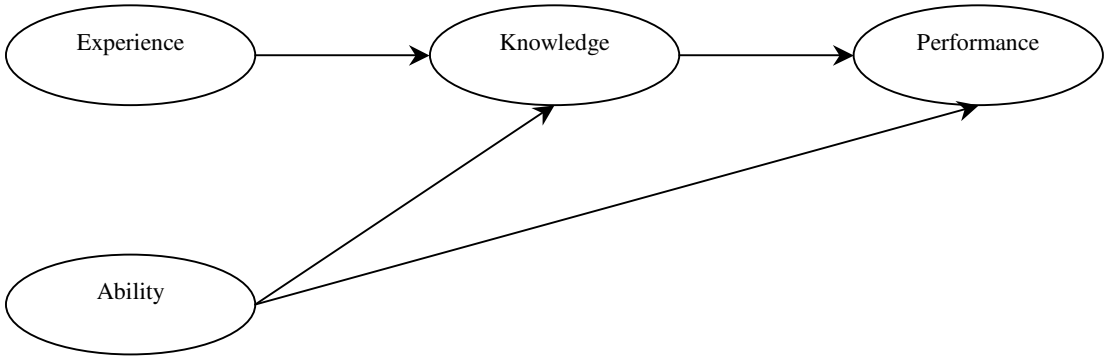
Figure 1, Panel D: Five Forces Analysis



Adapted from Porter (1979)

Figure 2

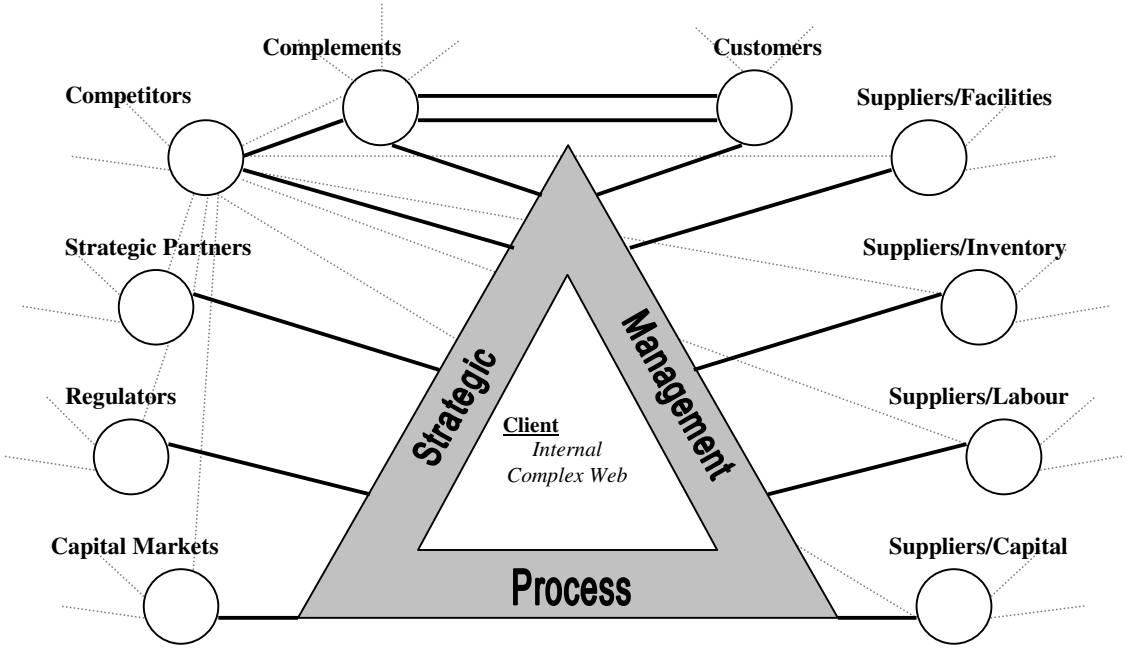
The Determinants of Auditor Expertise



Source: Libby and Luft (1993)

Figure 3

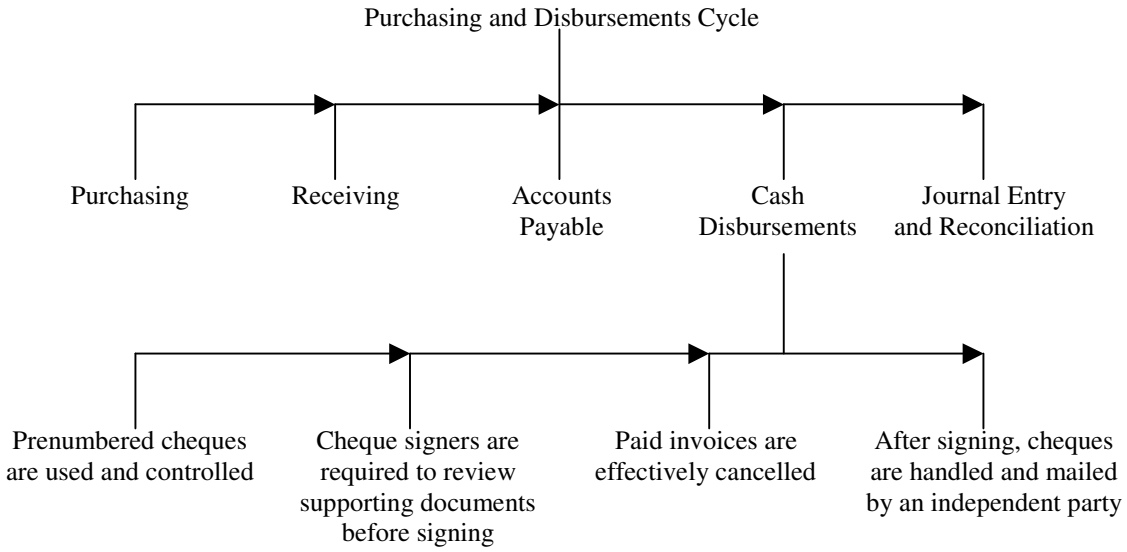
The Client as a Complex Web of Interrelationships



Source: Bell et al. (1997, p. 19)

Figure 4

Partial Internal-Control Schema

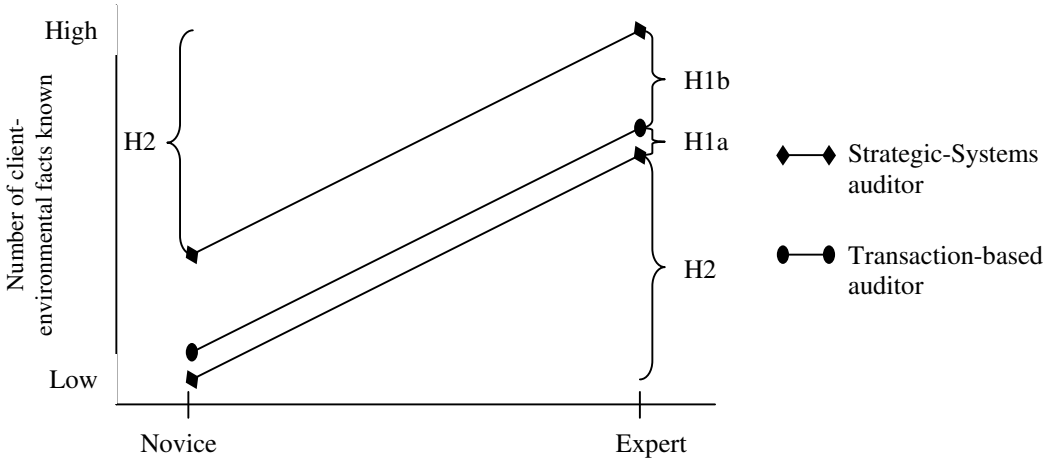


Source: Frederick (1991, p. 243)

Figure 5

Graphical Representations of Hypotheses

Panel A: Hypotheses 1a - 2



Panel B: Hypotheses 3 - 4b

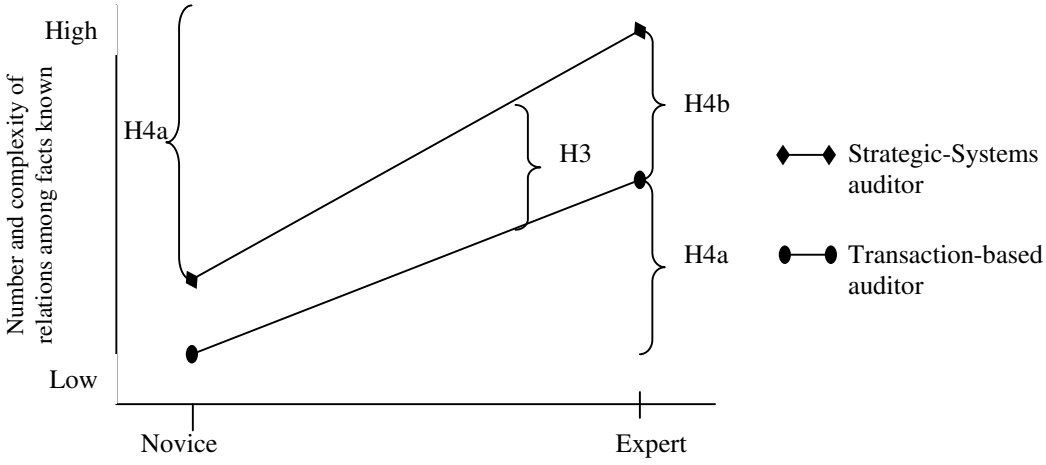


Figure 6

Theoretical Model Underlying Research Hypotheses

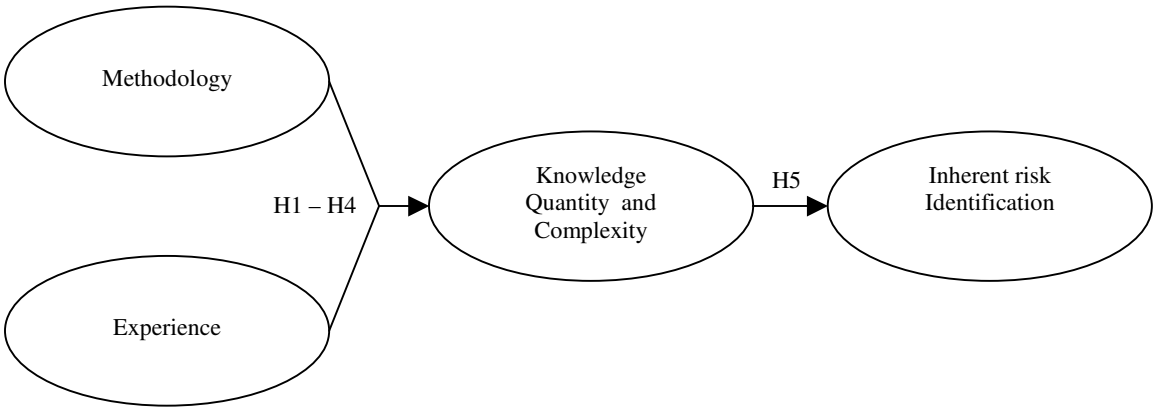


Figure 7

Sample Risk-Justification Memo

- inventory obsolescence high because short product life cycle and poor inventory management system
- Due to the fact that XTC doesn't have any patents and decline in R&D efforts in recent years, may put their products behind competitors
- this may adversely affect sales

- Family members holding management positions is appropriate since it is privately owned
- however, we should assess their knowledge and capability of carrying responsibilities and to run business effectively, especially if XTC is planning to go public

- we should be concerned with implementation of SAP to ensure proper change in info systems and completeness of documentation
- in addition, to ensure that info wasn't tampered with or lost during the change

- going concern due to low current ratio, decreased revenues, ROE down 82%, performance behind competitors
- the overseas production increases risk because if delay in delivery of items, XTC sales will suffer as well as its relationship with distributors

As a first time audit, we need to gain understanding of internal controls, especially that it it's run by family.
Assess if internal controls are effective before planning audit procedures.

The audit risk is high due to the expected high control risk as well as inherent risk. Inherent risk is high considering the nature of industry XTC operates in.

Note: See Table 5 for the related causal-mapping analysis of this memo.

APPENDIX B – CASE INSTRUMENT

INTRODUCTION TO THE STUDY

This study focuses on how auditors gain an understanding of a client's business. Please follow the instructions and complete all parts of the exercises. Please complete these exercises without any aids or assistance. Your responses will be held in strict confidence; both you and your firm will remain anonymous.

General Instructions

The study has five components:

Exercise #1: Learning about a new client

Exercise #2: Accounting knowledge questionnaire

Exercise #3: Recall from memory the pieces of information presented in Exercise #1

Exercise #4: Audit case exercise

Exercise #5: Assurance experience questionnaire

You will receive written instructions prior to completing each of these exercises.

Thank you very much for participating in this study.

Exercise #1

The next three pages contain a listing of 60 pieces of information about XTC Inc. (XTC). XTC is a new audit client in the manufacturing industry. *Please do not turn the page until instructed to do so*. Please study these pieces of information for 10 minutes. You may unstaple the three pages to facilitate your review of them. *Please do not make any written notes regarding the pieces of information presented on the following pages*. You will later be asked to recall these pieces of information from memory. You will be informed when 10 minutes have elapsed. *Upon receiving this notification, please stop reading the list, place the list in Envelope A, and seal it*. Please then proceed with Exercise #2, which is in Envelope B.

The industry's target demographic is 18-35 year-old males

Consumer joystick purchases are discretionary

End users are mostly low-to-middle income earners

XTC has no bank debt

Net income is 10% of its fiscal 2001 level

XTC has 10 direct competitors, including Logitech and Microsoft

Rivals offer more products and command more shelf space

Accurate sales estimates critical to timely delivery and inventory management

XTC has relatively few joystick/software bundling arrangements

Opposition's well-established distribution channels reduce their costs

85% of current revenues are from consumer joystick sales

Customers typically have very tight, strict delivery deadlines

XTC is a privately-owned company

Industry observers expect joystick market growth to slow

Price is a significant factor for consumers

Joysticks are predominantly sold through stores like Wal-Mart

XTC buys majority of raw materials from overseas

XTC's joysticks were formerly the benchmark for gaming excellence

In the past, XTC developed leading-edge joysticks

XTC is currently converting to an SAP platform

The industry is characterized by short product life cycles

CEO is also company president and founder

Family members hold all senior executive positions

XTC sells only analog joysticks

Resource management processes are Human Resources, treasury, and information management

Other manufacturers have introduced technologically advanced digital joysticks

Merchants negotiate prices based on large purchasing volumes

XTC's low-end joysticks will be produced in Taiwan

Fiscal 2003 is your firm's first year auditing XTC

XTC's offshore purchases require long lead times

XTC may be going public

XTC is based in Ontario, with branches in the US

XTC's budgeting has been inaccurate in recent years

XTC's current ratio is significantly below the industry average

Joysticks are subject to rapid technological changes

XTC's revenues have shrunk by one third since 2001

XTC's industrial joysticks much more profitable than consumer joysticks

Good retailer relationships essential for adequate promotion and shelf space

The company manufactures consumer and industrial joysticks

Significant portion of joystick sales occur during Christmas season

XTC's new information system should improve inventory management

Management constantly monitors patent applications, inventory turnover, and defects

XTC has lost half of its high-end market share

XTC has no patents; other developers average four each

New strategy is being a "one-stop gaming-device shop"

Core business processes are R&D, inventory management, and distribution

Common industry practice is to package joysticks with software

In past five years, XTC significantly decreased development efforts

XTC's R&D expenditures are considerably lower than other manufacturers

Retaining skilled workforce is essential to XTC's success

Return on equity declined 82% in past two years

XTC needs more capital to compete with larger joystick makers

XTC will enter mass market with lower-cost products

XTC must constantly check the quality of raw materials

XTC asks suppliers for bids to get competitive prices

XTC's defect rate is 25% higher than industry average

XTC's inventory turnover has decreased while competitors' turnovers increased

XTC's original goal was producing high quality, innovative joysticks

Large competitors have sophisticated sales forecasting and tracking systems

Management favours group discussion over formal goal-setting processes

<u>When told to stop, please place this list in Envelope A, seal the envelope, and then proceed with Exercise #2, which is in Envelope B.</u>

Please remove all contents of Envelope B. Before proceeding with Exercise #2, please ensure the list from Exercise #1 is sealed in Envelope A.

Exercise #2

Please circle the best response to each question. These questions have been derived from a variety of sources. The questions vary in difficulty by design.

1. The major reason an independent auditor gathers audit evidence is to:

a. Form an opinion on the financial statements
b. Detect fraud.
c. Evaluate management.
d. Assess control risk.

2. A company declared a cash dividend on its common stock in December 2002, payable in January 2003. Retained earnings would:

a. Increase on the date of declaration.
b. Not be affected on the date of declaration.
c. Not be affected on the date of payment.
d. Decrease on the date of payment.

3. The primary responsibility for the adequacy of disclosure in the financial statements and footnotes rests with:

a. The partner assigned to the audit engagement.
b. The senior or in-charge auditor.
c. The audit staff member who drafts the statements and footnotes.
d. The client's management.

Once you have answered all three questions, please place Exercise #2 in Envelope B. Do not seal Envelope B. Then proceed with Exercise #3, which was also in Envelope B.

Exercise #3

Attached to this sheet are several blank, lined pages. When ready, please turn the page and begin listing the pieces of information you recall about your audit client, XTC Inc. *Please list these pieces of information in the order in which they come to mind. List only one piece of information per line*. You do not have to recall the pieces of information verbatim, but provide enough key words so that it is clear what pieces of information you have remembered. *Once you have written a piece of information, do not go back and revise it*.

Before you begin this exercise, please write down the current time: _____

Now please immediately turn the page and proceed with listing the pieces of information you recall about XTC.

Exercise #4

Before you begin this exercise, please write down the current time: _____

Listed on the next three pages are the same pieces of information about XTC Inc. that were presented in Exercise #1. For this next exercise, please review the pieces of information presented and then provide an assessment of the level of risk associated with several risk factors that may be relevant to the audit of XTC. *You may refer to the pieces of information as you assess the risks and may make any notes you wish as you review the information and assess the risks*. After you have assessed all the risks, you will be asked to prepare a memo to the engagement partner that reports the rationale for your risk assessments.

You should make your risk assessments and prepare the related memo as if you were on an actual audit. For example, you should consider your judgment subject to review by the engagement partner.

You may separate the three pages of information from the attached response sheets to facilitate your review of the pieces of information and your assessment of the risk factors.

Now please immediately proceed with the risk assessment exercise. When you have finished this exercise, please proceed with the concluding questionnaire, which is also included in Envelope C.

The industry's target demographic is 18-35 year-old males

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XTC has no bank debt

Net income is 10% of its fiscal 2001 level

XTC has 10 direct competitors, including Logitech and Microsoft

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XTC's offshore purchases require long lead times

XTC may be going public

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XTC's current ratio is significantly below the industry average

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XTC's new information system should improve inventory management

Management constantly monitors patent applications, inventory turnover, and defects

XTC has lost half of its high-end market share

XTC has no patents; other developers average four each

New strategy is being a "one-stop gaming-device shop"

Core business processes are R&D, inventory management, and distribution

Common industry practice is to package joysticks with software

In past five years, XTC significantly decreased development efforts

XTC's R&D expenditures are considerably lower than other manufacturers

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XTC needs more capital to compete with larger joystick makers

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XTC must constantly check the quality of raw materials

XTC asks suppliers for bids to get competitive prices

XTC's defect rate is 25% higher than industry average

XTC's inventory turnover has decreased while competitors' turnovers increased

XTC's original goal was producing high quality, innovative joysticks

Large competitors have sophisticated sales forecasting and tracking systems

Management favours group discussion over formal goal-setting processes

During the client-acceptance phase of the XTC Inc. engagement, several risk factors were identified based on the pieces of client information that had been gathered to date. Based on your up-to-date knowledge of the client, please assess the risk of material misstatement posed by each of these factors. Once you have rated each of the individual risk factors, please also make an overall assessment of the risk of material misstatement on the XTC engagement. Please rate each factor on a scale from 0 (Low risk) to 100 (High risk) by placing a slash (/) at that point on the scale that best indicates your perception of the level of misstatement risk associated with the factor.

Risk factor: XTC's budgeting system has produced inaccurate results in recent years.

Rating: 0 10 20 30 40 50 60 70 80 90 100

| | | | | | | | | | | |

Low Risk — Moderate Risk — High Risk

Risk factor: This is our firm's first year auditing XTC.

Rating: 0 10 20 30 40 50 60 70 80 90 100

| | | | | | | | | | | |

Low Risk — Moderate Risk — High Risk

Risk factor: XTC is implementing an SAP/inventory management platform.

Rating: 0 10 20 30 40 50 60 70 80 90 100

| | | | | | | | | | | |

Low Risk — Moderate Risk — High Risk

Risk factor: XTC's budgeting system has produced inaccurate results in recent years.

Rating: 0 10 20 30 40 50 60 70 80 90 100

| | | | | | | | | | | |

Low Risk — Moderate Risk — High Risk

Risk factor: The overseas production situation may cause production shortfalls or quality problems.

Rating: 0 10 20 30 40 50 60 70 80 90 100

Low Risk — Moderate Risk — High Risk

Risk factor: XTC is not staying current with its technological development.

Rating: 0 10 20 30 40 50 60 70 80 90 100

Low Risk — Moderate Risk — High Risk

Risk factor: XTC may experience significant inventory obsolescence problems.

Rating: 0 10 20 30 40 50 60 70 80 90 100

Low Risk — Moderate Risk — High Risk

Overall assessment of risk of material misstatement on this engagement

On the scale below, please assess the overall risk of material misstatement on the XTC engagement.

Rating: 0 10 20 30 40 50 60 70 80 90 100

Low Risk — Moderate Risk — High Risk

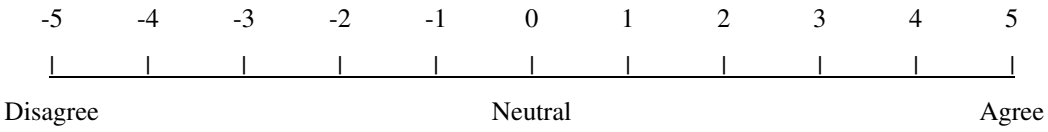
Once you have assessed all the risks, please proceed to page 7 to prepare a memo that provides the rationale for your risk assessments.

Please prepare a memo to the engagement partner that provides the rationale for your risk assessments.

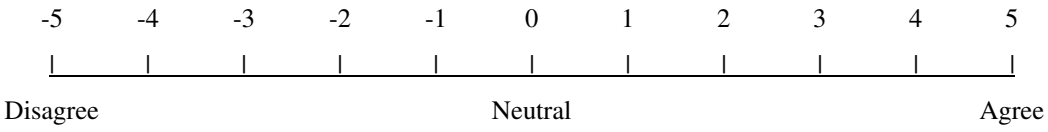
Before you answer the questions below, please write down the current time: _____

Please indicate your response to each of the following statements by placing a slash (/) at that point on the scale that best indicates your perception of the risk assessment exercise you just completed.

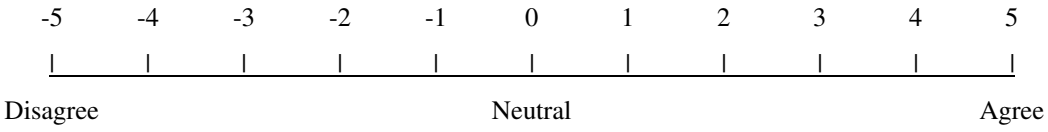
1. I found the pieces of information about XTC Inc. to be **realistic**.



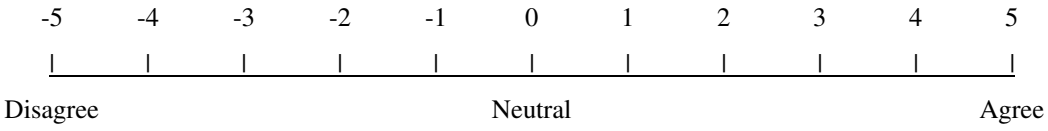
2. I found the pieces of information about XTC Inc. to be **useful in making risk assessments**.



3. The risk assessment exercise was **similar** to how I would perform it in practice.



4. On a typical engagement, my firm would **use decision aids** to assist with risk assessment.



5. I have seen these pieces of information about XTC Inc. on another occasion.

   No ☐ Yes ☐ If yes, please note where you have seen them

   _____

Please place this exercise in Envelope C and proceed with the next exercise, which is in the same envelope.

Exercise #5

Please answer the following demographic questions.

1. What is your educational background? (Check all that apply)

   a. ☐ Currently pursuing Bachelor's in _____ (please indicate discipline)

   b. ☐ Possess Bachelor's in _____ (please indicate discipline)

   c. ☐ Currently pursing Master's in _____ (please indicate discipline)

   d. ☐ Possess Master's in _____ (please indicate discipline)

   e. ☐ Other (specify) _____

2. What is your job title? (Check one item that best matches your title)

   a. ☐ No public accounting experience (Please go directly to Question 18 if this is the case)

   b. ☐ Staff (or Associate) auditor

   c. ☐ Senior (or In-Charge) auditor

   d. ☐ Manager

   e. ☐ Other (specify) _____

3. How many total months of experience do you have working for a public accounting firm?

   Please break your experience down by the firms you have worked for, beginning with your present firm.

   _____ months with _____ (present firm)

   _____ months with _____ (previous firm)

   _____ months with _____ (next previous)

4. Of the total months of experience in Question 3, how many of those months were spent working *solely on auditing/assurance engagements* (as opposed to tax, compilations, or other non-assurance engagements)?

   Please break your *assurance experience* down by the firms you have worked for, beginning with your present firm.

   _____ months with _____ (present firm)

   _____ months with _____ (previous firm)

   _____ months with _____ (next previous)

5. What proportion of your total assurance experience in Question 4 has been spent auditing the following types of clients (Please ensure the percentages add to 100%):

   Public companies _____%

   Private, for-profit companies _____%

   Not-for-profit organizations _____%

   Government agencies _____%

6. Please list the industries that you *specialize* in on your engagements (e.g., manufacturing, high-tech, financial institutions, health services, retail/wholesale, not-for-profit, etc.). If you do not specialize in any particular industry, please note this with "NA".

7. Does the *office* you work in (or have worked in) audit public company clients?

   Office of present firm ☐ Yes ☐ No

   Office of previous firm ☐ Yes ☐ No

   Office of next previous firm ☐ Yes ☐ No

8. On approximately how many audit engagements have you participated to this point in your career?

   _____ engagements

9. On approximately how many engagements did you participate in *gathering* information to be used to develop or update knowledge of a client's business?

   _____ engagements

10. On approximately how many engagements did you participate in *analyzing* information to be used to develop or update knowledge of a client's business?

    _____ engagements

11. On approximately how many engagements have you been responsible for *identifying risks*?

    _____ engagements

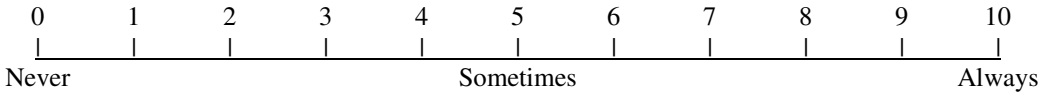
12. On approximately how many engagements relating to clients in the *high-tech industry* have you worked?

    _____ engagements

13. On approximately how many engagements that were your firm's first audit of a client (i.e., new engagements) have you worked?

    _____ engagements

14. On typical audit engagements, how frequently does your firm analyze the client's business strategy (i.e., the client's formal plans, commitments and actions designed to provide value to customers and gain a competitive advantage)? (Place a slash (/) at that point on the scale that best indicates how frequently your firm does this)



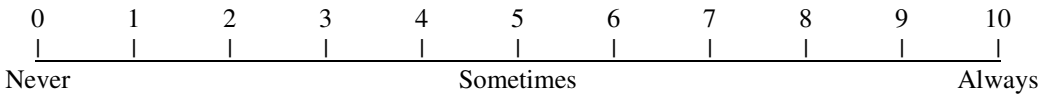
15. a. Has your firm provided you with any training in strategic analysis (i.e., techniques and tools useful in analyzing a client's strategic position; e.g., Porter's Five Forces, PEST, SWOT)?

☐ Yes ☐ No

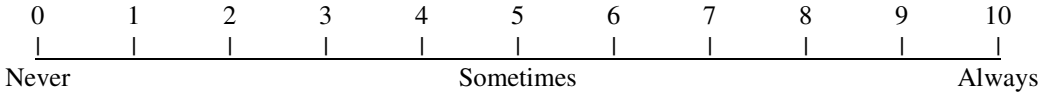
b. If yes, please note approximately how many hours of such training you have received and briefly describe the nature of this training?

_____ hours

16. On typical audit engagements, how frequently does your firm select and analyze the client's key business processes (i.e., processes that create value for, and/or sustain the value-creation potential of, the client)? (Place a slash (/) at that point on the scale that best indicates how frequently your firm does this)



17. On typical audit engagements, how frequently does your firm analyze the client's key performance indicators (i.e., financial or nonfinancial measures that provide diagnostic or predictive information regarding a process's critical success factors) as part of analyzing its business processes? (Place a slash (/) at that point on the scale that best indicates how frequently your firm does this)



18. Please comment on anything that you found unclear or confusing about any part of this study.

Please write down the current time: _____

Thank you very much for participating in this study. Your cooperation is greatly appreciated.

Please place Exercise #5 in Envelope C and seal it. Then place the elastic around all three envelopes and return them to the study coordinator.