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Factors Influencing Auditors' Information Usage: Experience, Risk, Task Structure and Information Reliability

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Tiivistelmä

Tässä tutkimuksessa tarkastellaan tilintarkastajien informaation käyttöä ja tilintarkastuksen tehokkuutta. Tutkimuksen päätavoitteena on tutkia, kuinka yksilöön, ympäristöön, tehtäviin ja informaatiopalasiin liittyvät tekijät vaikuttavat tilintarkastajien informaation käyttöön yksittäisessä tilintarkastustehtävässä. Tutkimuksessa pyritään valottamaan tilintarkastajien päätöksentekoa pohjautuen näiden tekijöiden päivitettyyn ja laajennettuun luokitteluun.

Empiirisiä analyyseja varten toteutettiin kokeellinen tutkimus internetissä. Tutkimuksen otoksessa on mukana 271 havaintoa auktorisoiduilta ja auktorisoimattomilta tilintarkastajilta sekä tilintarkastuksen opiskelijoilta. Analyyseissa on mukana neljä tekijää: tilintarkastajan kokemus, riski, tehtävän rakenne ja informaation luotettavuus. Informaation käyttöä toimeksiannon jatkamis- ja hyväksymistehtävissä on mitattu tehtävään käytetyllä ajalla ja informaation määrällä.

Tutkimuksen päätulokset voidaan tiivistää seuraavasti: Ensiksikin kokeneet tilintarkastajat käyttävät kaiken kaikkiaan informaatiota tehokkaammin kuin vähemmän kokeneet koehenkilöt. Toiseksi tulokset osoittavat, että korkea riski lisää informaatiopalasten yhdistelyyn ja arviointiin käytettyä työmäärää. Kolmanneksi tarkastustehtävän rakenteen vaativuus lisää vähemmän kokeneiden koehenkilöiden käyttämää työmäärää informaatiopalasten yhdistelyssä ja arvioinnissa. Viimeiseksi kokeneiden tilintarkastajien tehokkuusedut informaation käytössä rajoittuvat vain olosuhteisiin, joissa informaatio on luotettavaa.

Kaiken kaikkiaan tutkimuksen tulokset tuovat uutta tietoa tilintarkastuksen tehokkuuteen vaikuttavista seikoista ja sitä voidaan käyttää myös käytäntöjen, kuten aikabudjetoinnin ja tilintarkastajien koulutuksen, kehittämiseen.

Asiasanat
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Abstract

This thesis investigates auditors' information usage and audit efficiency. In particular, the main objective of the thesis is to examine how individual, environmental, task-related and cue-related factors affect auditors' information usage in a single audit task. Based on a revised and expanded taxonomy of these factors, this study sheds further light on auditors' decision-making in this context.

For the empirical analysis, a web-based experiment was conducted. The sample consists of 271 observations from certified and non-certified auditors and auditing students. Four factors are included in the analysis: auditor experience, risk, task structure and information reliability. Information usage in client continuance and acceptance tasks is measured by the time spent on the task and number of used information cues.

The main results can be briefly summarized as follows. First, experienced auditors are, on the whole, more efficient in their information usage than less experienced subjects. Second, the results indicate that high risk increases the effort used in combining and evaluating the information cues. Third, the unstructuredness of a task increases less experienced subjects' effort in the combination and evaluation of the information cues. Finally, the efficiency advantage of the more experienced auditors in the information usage is limited to circumstances where information is reliable.

Overall, the findings of this thesis contribute to the audit literature by providing new evidence on audit efficiency. This information can be used to improve audit practices, such as time budgeting and auditor training.

Keywords
auditors' decision-making, information usage, experience, risk, task structure, information reliability

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List of abbreviations

ANOVA	Analysis of Variance
CPA	Certified Public Accountant
HTM	Certified auditor approved by the Auditing Committee of regional Chamber of Commerce (in Finnish: Hyväksytty tilimies)
JDM	Judgment and decision-making
JHTT	Certified auditor approved by the Finnish Board for Chartered Public Finance Auditors (in Finnish: Julkishallinnon ja -talouden tilin-tarkastaja)
KHT	Certified auditor approved by the Auditing Board of the Central Chamber of Commerce (in Finnish: Keskuskauppakamarin hyväksymä tilintarkastaja)
RMM	Risk of Material Misstatement

1 INTRODUCTION

Auditors are surrounded by an increasing amount of information in the current global environment. Modern audit approaches such as business risk auditing and strategic systems auditing emphasize the use of complex information from many different sources for holistic risk assessments (Bell, Peecher & Solomon 2005; Peecher, Schwartz & Solomon 2007). Numerous databases and complex business networks provide multiple information sources to acquire information for decision-making (Trotman 2005). At the same time, increased competition between audit firms (see Dunn, Kohlbeck & Mayhew 2011) and cost pressures induce auditors to emphasize efficiency in audit work. Consequently, information acquisition and usage in the decision-making should be performed in an efficient manner, that is, in a short time, yet without jeopardizing the audit effectiveness. At the core of this issue is an individual auditor who performs information acquisition and usage among various audit tasks as the audit process progresses towards an audit report.

The auditing standards (e.g. ISA 500) require an auditor to obtain sufficient amount of appropriate information (evidence) in order to draw reasonable conclusions on which to base the final audit opinion. Before an auditor is able to give such a written opinion to shareholders, he/she must conduct numerous audit phases and subphases, which include accomplishing a great number audit tasks. An auditor's decision-making process in accomplishing a single audit task includes three phases: information acquisition, information usage and judgment (Einhorn & Hogarth 1981). Before a task-specific judgment can be made, the information acquisition and usage phases consist of several elements that require professional judgment. For example, an auditor must consider which type of information to acquire as well as the amount of information and its cost. These judgments are presumably routine procedures if important information is defined clearly in audit manuals and the circumstances surrounding the judgment are normal. However, the opposite setting may threaten both audit effectiveness and efficiency.

When judgment is required for information acquisition and usage, audit effectiveness may be threatened if an auditor does not acquire sufficient appropriate information. Underacquiring information does not help a decision-maker make an accurate decision (Connolly & Thorn 1987). For example, if an auditor fails to gather all relevant information by overlooking important pieces during the acquisition phase, it may lead to a suboptimal judgment/decision (Abdel-Khalik & El-Sheshai 1980; Simnett & Trotman 1989). Ultimately, a failure in information acquisition and usage when making going-concern judgments may cause a wrong audit report to be issued (Bonner 2008).

Audit efficiency might also be decreased when an auditor overacquires information or uses an extensive amount of time for the acquisition or usage of information. Overacquiring may occur when a decision-maker gathers too much of the available information and therefore incurs additional costs in gathering information that adds little value to the final decision (Connolly & Thorn 1987). Thus, audit effectiveness might be decreased if, as a result of overacquiring, redundant and/or irrelevant information is used in the decision-making (see Joe 2003; Hackenbrack 1992). The use of an extensive amount of time can happen when an auditor does not believe that her/his client's internal information is sufficient or appropriate for making an accurate decision. The acquisition of elusive information from external sources may incur additional auditing costs.

Auditors' information usage is an important and timely topic. First, it is suggested that further research is warranted for investigating whether recent audit scandals are partly caused by auditors' poor information usage (El-Masry & Hansen 2008). Second, in high information environments and increasingly larger auditees, individual auditors' information acquisition and processing skills are important in detecting misstatements since it is not possible to review all available information (Hammersley 2006). Despite the topic's inherent importance, previous research has left many avenues unexplored. While previous studies (see El-Masry & Hansen 2008 for a review) have recognized several factors that affect auditors' information acquisition and usage, many factors have not been studied, especially at an audit task level.

For instance, previous studies (e.g. Anderson, Koonce & Marchant 1994; Goodwin 1999) have found that auditors adjust their task-specific judgments according to information reliability and make more conservative judgments when the available information is less reliable. However, they have not addressed whether information reliability affects the number of information gathered or the processing efficiency of information (e.g. time used) when auditors make judgments. Furthermore, it is not known whether some less studied factors interact with common factors (e.g. auditor experience), which have been previously found to be important determinants of information usage. Thus, there is a considerable research gap in this area, since these factors may have important implications on audit efficiency.

The present study investigates how different factors affect auditors' information usage behavior in a single audit task[1]. This study investigates previously recognized factors by applying empirically El-Masry and Hansen's (2008) taxonomy of different factors. The ultimate aim of the study is to add knowledge on auditors' information usage as well as help improve audit efficiency practices.

1.1 Research problem

The objective of the study is to examine how individual, environmental, task-related and cue-related factors affect auditors' information usage in a single audit task. In this study, information usage is measured by the time spent on the task and by the number of used cues in two different audit tasks, namely client continuance and acceptance. This study focuses on investigating information usage in single audit tasks as opposed to many previous studies that have examined auditors' information or evidence acquisition in audit planning.

The categorization of the factors is based on El-Masry and Hansen's (2008) literature review of the major factors that influence auditors' information acquisition and usage. In their study, they proposed a taxonomy that classifies factors into four categories according to their properties. As illustrated in Figure 1, these categories are *individual factors*, *environmental factors*, *task-related factors* and *cue-related factors*. The theoretical framework suggests that these factors have direct effects and/or interaction effects on auditors' information acquisition and usage.

In the present study, one factor from each category is selected to represent that category in the empirical analyses. While it would be possible to study any combination of the factors, this selection aims to capture the factors that have (i) gathered much less attention at an audit task level and/or (ii) important and previously identified factors in the auditing context that have meaningful theoretical interactions with the factors mentioned in section (i).

From the individual factors, the category *auditor experience* is chosen for the empirical analysis. Experience is the most studied factor in this category and it has been found to significantly affect information usage. A vast number of previ-

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[1] This study specifically focuses on examining auditors' information usage, namely the number of information or time that is used by subjects to read/assimilate and process the information. However, previous studies have also examined more directly the acquisition (selection, choice) of information, thus the term "information acquisition and usage" is used when referring to all previous studies in the research area.

ous studies (e.g. Biggs & Mock 1983; Bonner 1990; Bonner & Pennington 1991; Davis 1996; Moroney 2007) have indicated that experienced auditors' better knowledge and advanced acquisition strategies help them perform information usage more efficiently compared with less experienced auditors. Previous studies (e.g. Kennedy 1993; Shelton 1999; Cianci & Bierstaker 2009) have also shown that experience interacts with other factors and that these interactions reduce cognitive bias as well as improve judgment and decision-making (JDM) quality. Thus, these previous findings and the general cognitive differences between experienced and less experienced auditors suggest that it is important to study if the effects of experience affect other investigated factors.

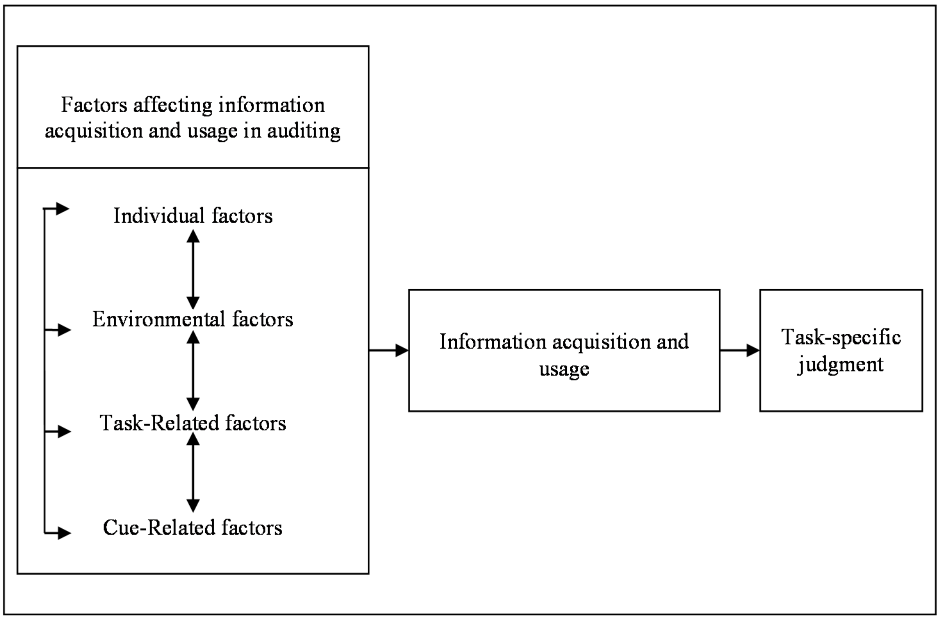

Figure 1. Individual, environmental, task-related and cue-related factors influence task-specific information acquisition and usage as well as task-specific judgment (adopted from El-Masry & Hansen 2008)

From the environmental factors, the category *risk of material misstatement (RMM)* is chosen. Previous research (e.g. Houston, Peters & Pratt 1999; Beaulieu 2001; Johnstone & Bedard 2001) indicates that auditors adjust their audits depending on the client's risks (e.g. planned amount of substantive tests), but there exists no evidence in the literature on how auditors adjust their information usage in a single audit task when risk varies. For instance, high risk may lead auditors to acquire a greater number of available information or process the information more carefully when performing an audit task.

Task structure is chosen from the task-related factors category. Task structure is a dimension of task complexity that has rarely been studied in auditing-related information acquisition and usage studies. Based on the definition of task structure (Bonner 1994), it is argued that when task structure is less structured (more structured), important task-specific information is less specified (more specified). This study investigates empirically whether auditors compensate for this increased uncertainty in less structured tasks by performing more extensive information usage compared with in more structured tasks.

Previous studies (e.g. Hirst 1994; Anderson, Koonce & Marchant 1994; Goodwin 1999; Glover, Jiambalvo & Kennedy 2000) have shown that auditors adjust their judgments depending on information reliability. However, they have not addressed whether information reliability affects auditors' information usage, i.e. the number of information used or the processing of information (e.g. used time) when auditors form these judgments. This study addresses this gap in the literature by examining whether *information reliability* from the category of cue-related factors influences auditors' information usage.

The main research question of the study is: How does (i) auditor experience, (ii) RMM, (iii) task structure and (iv) information reliability affect auditors' information usage in a single audit task? Furthermore, interactions are used to study if the effect of the factors depends on the levels of other factors.

Regarding the main research question, this study attempts to answer whether the studied factors separately affect auditors' information usage, and if they do, what is the magnitude and direction of this effect (direct effect). Furthermore, it is studied if the factors' potential effects are conditional on the levels of other factors and the direction of this effect (indirect effect).

Based on previous accounting and psychology studies, seven hypotheses are developed. To test these hypotheses, a web-based experiment is conducted. In the between-subjects experiment, two audit tasks are used: one semi-structured task and one unstructured task. Two of the studied factors, RMM and information reliability, are operationalized by phrase manipulations within the experiment. Auditors' experience is collected from the post-experimental questionnaire. The sample consists of Finnish CPAs, non-certified auditors and Master's level auditing students.

In the main empirical analyses, the analysis of variance (ANOVA) and ordered logistic regression methods are applied. Information usage is measured by multiple variables. One variable is used as a dependent variable at the time. There are two main variables and four alternative variables. The main dependent variables are total time per task and number of used cues. The alternative variables are total cue time, judgment time and number of important cues (self-estimated and carefully read). The independent and dependent variables of the study are summarized in Figure 2.

INDEPENDENT VARIABLES	**DEPENDENT VARIABLES**
- Individual factor: **Task-specific experience** - Environmental factor: **RMM** - Task-related factor: **Task structure** - Cue-related factor: **Information reliability**	- Total time per task (main) - Number of used cues (main) - Total cue time - Judgment time - Number of important (self-estimate) cues - Number of important (carefully read) cues

Figure 2. Independent and dependent variables of the study

1.2 Contribution of the study and main findings

The present study examines auditors' information usage and audit efficiency in a single audit task. The purpose of this study is to relax the assumption that individual, environmental, task-related and cue-related factors have only direct effects on information usage. More specifically, four factors are investigated to examine whether their potential effects are conditional on the levels of other factors. This approach makes it possible to consider how the information usage process affects these factors in a broad manner. Furthermore, this approach enables us to gain insights into how different factors interact with each other in a mundane decision-making environment, where auditors are constantly surrounded by a vast number of environmental, task-related and cue-related factors at the same time.

This study makes several contributions to the auditing literature. First, it revises the taxonomy of El-Masry and Hansen (2008) of individual, environmental, task-related and cue-related factors. More specifically, it contributes by expanding this original taxonomy with interaction effects between factors from the different categories.

Second, this study contributes empirically to the existing audit JDM literature by investigating the three factors from different categories (El-Masry & Hansen 2008) that have rarely been studied in an auditors' information usage context, namely RMM, task structure and information reliability. Previous studies have mainly investigated the effect of these factors on auditors' task-specific judgments (e.g. Simnett & Trotman 1989; Simnett 1996; Houston, Peters & Pratt 1999; Beaulieu 2001; Hirst 1994; Goodwin 1999), but not on auditors' information usage per se. This study contributes specifically by examining whether and how auditors adjust their information usage behavior in a single audit task when the levels of these factors change.

Third, this study also contributes empirically by examining how the factors from different categories (El-Masry & Hansen 2008) interact with each other. One factor from every category is brought into the simultaneous empirical investigation. The aim of this approach is to examine whether these factors' potential effects on information usage are conditional on the levels of other factors. Some of these interaction effects are suggested from the auditing and psychology literature, but have not yet been studied in the auditing context.

The main findings of the thesis can be summarized as follows. *First*, the audit expertise literature (e.g. Biggs & Mock 1983; Davis 1996; Moroney 2007) has found that experienced auditors generally use less information, apply directed information search strategies and are overall more efficient in their information usage than less experienced auditors. In this study, auditor experience is measured by an auditor's task-specific experience. This study extends the audit expertise literature by finding that task-specific experienced auditors also use less time for tasks than less experienced subjects. This study further finds that experienced auditors spend less time on cue screens as well as outside of cue screens while processing information. These findings suggest that experienced auditors may have better reading or assimilation techniques of cues that require less effort than the techniques used by less experienced subjects. However, robustness tests suggest that longer cue screen times are only realted to subjects having no or very little prior task-specific experience. The findings also suggest that experienced auditors are more efficient in evaluating and combining cues (i.e. processing) outside of cue screens than less experienced subjects. In summary, these results suggest that high task-specific experience leads to better overall efficiency in decision-making.

Second, previous studies investigating the effect of risk on auditors' decision-making (e.g. Mock & Wright 1993; Houston, Peters & Pratt 1999; Beaulieu 2001) have found that auditors adjust their information acquisition plans at an audit engagement level depending on client-related risks. This study extends this stream of research by finding that in a single audit task high RMM increases the total time for the task and the time used outside of cue screens, but not that used on cue screens. This finding suggests that auditors also seem to read and assimilate selected cues in the conventional way in a risky setting, but demonstrate greater effort in information processing outside of cue screens when making judgments.

Third, previous studies have rarely addressed how auditors' information acquisition and usage behavior varies depending on the complexity of an audit task (e.g. Simnett & Trotman 1989; Simnett 1996). This study contributes to the task complexity literature by finding that the unstructuredness of a task increases the time that is used outside of cue screens. This finding suggests that while the quantity of used information is not affected by task structure, acquired information is processed with a greater effort in unstructured than in semi-structured tasks. However, the results indicate significant interactions between task structure and auditor experience. These interactions show that only less experienced subjects are affected by task structure, while experienced auditors are not.

Fourth, previous studies investigating information reliability (e.g. Hirst 1994; Anderson, Koonce & Marchant; Goodwin 1999; Glover, Jiambalvo & Kennedy 2000) have particularly found that under less reliable information auditors tend to be more skeptical towards their clients and increase their information gathering in subsequent tasks. However, they have not examined whether auditors need more information to make judgments or use the same number of information but just process it more carefully when it is less reliable. This study extends this stream of research by finding evidence that less reliable information is processed for longer outside of cue screens, but not on cue screens. This finding suggests that the processing of less reliable information is more time-consuming, i.e. less efficient in auditors' decision-making processes, implying that information reliability affects audit judgment as well as the efficiency of the preceding decision-making process.

This study further contributes to this literature by finding interaction effects in information usage between auditor experience and information reliability. Specifically, it finds evidence that when information is less reliable, experienced auditors do not use less total time for a task or time outside of cue screens than less experienced subjects. This finding suggests that experienced auditors' more efficient cue processing exists only in conditions where information is reliable.

Therefore, with less reliable information even experienced auditors may need to engage in more effortful information processing similar to that used by less experienced subjects.

Finally, this study further contributes to the information usage literature by finding a significant three-way interaction between information reliability, task structure and RMM. The results indicate that used time outside of cue screens increases non-linearly as those factors with high values (=uncertainty factor[2]) increase. This shows that after the appearance of one uncertainty factor, used time does not increase significantly when the second uncertainty factor appears. However, the simultaneous appearance of three uncertainty factors increases used time significantly. This finding suggests that auditors do not increase linearly their efforts for information processing when the number of uncertainty factors increases. Thus, auditors may have only a few different information processing styles when there is an indication of a problem in an audit.

1.3 Structure of the study

The present chapter starts with the introduction of the research area and motivation behind the research. After this, the research problem is defined more specifically. The following section presents the contributions of the study to the existing literature and the main findings of the empirical analyses.

The second chapter presents an overview of auditors' information acquisition and usage processes and explains how they are related to the JDM process. This section also presents the two most common process tracing approaches used in this research area.

The third chapter reviews previous studies of auditors' information acquisition and usage. These studies are classified based on El-Masry and Hansen's (2008) taxonomy into four categories. The fifth section presents the interaction studies of the different categories. In each section, the factors are ordered by their commonness in the literature. The chapter concludes with a discussion of auditors' information acquisition and usage based on the results of previous studies.

The fourth chapter starts by presenting the factors included in the empirical analyses. These choices are built mainly on the gaps in the audit literature. The specif-

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[2] The term "uncertainty factor" is used to refer to any of the factors that have a "high value" (i.e. less experienced auditor/ high RMM/unstructured task/ less reliable information).

ic rationale behind the selection of each factor is explained. In the last section, the hypotheses of the study are developed.

The fifth chapter presents the experiment and the data of the study. In the first section, the studied tasks are outlined based on previous research. The second section presents the process used to form information cues for the experiment. The third section introduces the general advantages and disadvantages of web experiments, before the present experimental design, subjects and experimental procedures are introduced in detail. In the following section, the dependent and independent variables of the study are presented. After this, the sample is described as well as the rationale and criteria for excluding some observations from the data set. The chapter concludes by presenting extensive descriptive statistics of the data.

The sixth chapter presents the results of the study. This chapter also includes selected non-hypothesized tests that are aimed to further shed light on the role of information usage in auditors' JDM processes.

The final chapter summarizes the study and reviews the main results from a theoretical perspective. In this chapter, the practical implications of the results as well as suggestions for future research are discussed. The study concludes with a discussion of the limitations of the study.

2 AN AUDITOR'S DECISION-MAKING AND INFORMATION ACQUISITION AND USAGE

The purpose of this chapter is to review auditors' decision-making processes, particularly from the information acquisition and usage perspective, and to present the two most common research approaches used in previous audit studies investigating this research area.

While there is no unified theory of an individual's information acquisition and usage, in previous studies several decompositions of decision-making processes have highlighted the importance of the different phases of this process. The first section begins by presenting previous decompositions of decision-making processes. The activities related to auditors' information acquisition and usage are then sorted according to Moroney's (2007) decomposition model, as this is the most universal of the presented decompositions. Specifically, the role of problem representation and the procedures related to information acquisition are discussed in details. The first section concludes by presenting some common biases that may distort information acquisition and usage processes and thus cause suboptimal judgments or decisions.

The second section introduces the process tracing approach generally as well as the advantages and disadvantages of different process tracing approaches. Two common process tracing approaches, verbal protocol analysis and applied computer-based tracking techniques, are introduced in this chapter.

2.1 An auditor's information acquisition and usage in the decision-making process

Over the years, several theories have been developed to understand how individuals make decisions. Researchers have decomposed the decision-making process into different phases to understand better this sequential process and ultimately to find out the determinants of high JDM quality. Several decompositions (e.g. Einhorn & Hogarth 1981; Bonner & Pennington 1991; Koonce 1993) have recognized the importance of the information acquisition and usage phases in a decision-making process and their impact on overall JDM quality. These phases are especially suggested to require a considerable number of effort in decision-making. For instance, Biggs and Mock (1983) found that information usage-related activities formed a significant proportion (53.4%) of all decision-making activities in a complex audit task.

Pioneering work by Einhorn and Hogarth (1981) described that the decision-making process consists of three phases: information acquisition, information usage (evaluation) and judgment (action/choice). They especially stressed that information acquisition and evaluation (i.e. usage) are interdependent phases that should be examined together. Bonner and Pennington (1991) looked closely at auditors' decision-making processes. Their decomposition contains eight phases:

1. Retrieving knowledge from memory
2. External information search
3. Comprehension
4. Hypotheses generation
5. Evaluation of hypotheses
6. Design
7. Estimation
8. Choice

However, they noted that not all these phases are needed in every audit task, but rather in each audit phase (e.g. planning or completing the audit).

Koonce (1993) outlined the decision-making process of auditors' analytical reviews to be a diagnostic, sequential and iterative process. Diagnostic refers to the mental representation of the problem, hypothesis generation, information search and hypothesis evaluation. Sequential refers to the order of the process and iterative means that some of the components may be re-performed. Moroney (2007) proposed a similar model as Koonce (1993) but extended it to cover other audit tasks than analytical reviews. In her classification, the decision-making process consists of three phases: pre-information search, information acquisition and decision (Figure 3).

Pre-information search refers to the mental representation of the task, which defines how the rest of the task will be performed. Information acquisition encompasses many judgments that define the extent of information usage. For instance, an auditor needs to consider different information sources, type of acquired information, number of information and the order of search. Finally, when the auditor has gathered enough information, she/he is ready to make a decision. As the focus of the present study is on an auditor's information usage, the pre-information search and information acquisition phases are discussed in details in the following paragraphs.

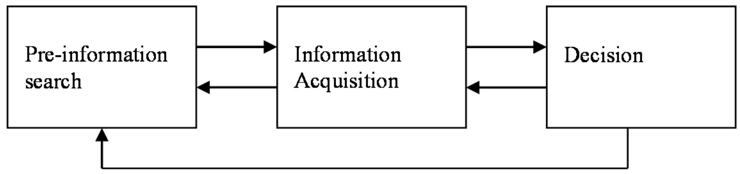

Figure 3. The diagnostic, sequential and iterative decision-making process (adopted from Moroney 2007)

The main purpose of information acquisition in the decision-making process is uncertainty reduction to an acceptable level (Koonce 1993). Before an auditor is able to begin information acquisition, the first step is to gain an understanding and interpretation of the problem at hand (Moroney 2007). This problem representation is based on an auditor's previous knowledge about the task and it guides what information will be searched in actual information acquisition (Christ 1993). Consequently, a lack of domain-specific knowledge in problem representation may constrain information acquisition (Bédard & Mock 1992). It is argued that initial problem representations are persistent and resist modification unless significant contradictory information emerges during information acquisition (Schultz, Bierstaker & O'Donnell 2010).

Depending on the audit environment and other circumstances, an auditor may choose different problem representations. For instance, auditors may choose between normal-audit and problem-audit representation, which may reflect on the subsequent information acquisition phase (Waller & Felix 1984). Further, it is suggested that switching to a problem-audit schema increases information acquisition (Asare & Knechel 1995).

In Bonner and Pennington's (1991) decomposition of a decision-making process, the first three phases particularly concern information acquisition and usage activities for the problem representation. First, an auditor may retrieve from memory information that concerns the task at hand. Second, many tasks require obtaining information from external sources. All sources other than an auditor's memory are considered to be external sources. Finally, the auditor comprehends information from both sources to form a mental representation of the problem (Bonner & Pennington 1991).

Highly developed domain-specific knowledge and the complete knowledge structure of the decision-maker are suggested to assist in making more efficient and effective problem representations (Koonce 1993; Biggs, Mock & Watkins 1988). Thus, advanced problem representation may sharpen finding and interpreting important information more efficiently in the information acquisition phase than undefined problem representation (Moroney 2007).

The information acquisition phase can be divided into two dimensions, depth of search and order of search. Depth of search refers to the total number of information searched, while order of search means the order in which information is acquired by the decision-maker (Ford et al. 1989). The order of search can be either directed or sequential. In a directed search, an auditor looks for specific information from the available information, but in a sequential search an auditor goes through information in the order in which it is presented (Bonner 2008). Previous research has widely documented that decision-makers' knowledge structures affect both these dimensions. Several audit studies (e.g. Simnett 1996; Bédard & Mock 1992; Davis 1996) suggest that experienced auditors use less information than less experienced auditors and that experienced auditors perform a goal-oriented, directed acquisition of audit evidence instead of a sequential search (Hoffman, Joe & Moser 2003).

An auditor must usually also choose which information to acquire and process, as it is not possible to examine all available information (Knechel & Messier 1991). As mentioned before, there are two main sources of information (Bonner & Pennington 1991). First, an auditor can use her/his internal memory to retrieve information about the client, client industry and earlier experiences that she/he thinks is relevant for the task. The second source of information is external sources, such as discussions with the client or with audit team members, work papers and industry databases. An auditor may also consider choosing between financial and non-financial information. In many tasks, financial information is easily available from the client or public sources, while the acquisition of complex nonfinancial information from external sources might be more time-consuming and incur additional costs.

Upon reaching a sufficient level of confidence for judgment or decision, the auditor will cease information acquisition. The information acquisition process can thus be described as a sequential process[3] where an auditor selects one piece of

[3] It is important to note that "sequential search" and "sequential processing" are different concepts that should not be mixed.

information, evaluates it and then decides whether to acquire additional information or stop the acquisition phase (Gibbins 1984). Sequential information processing assumes that an auditor evaluates each piece of information with respect to the earlier collected information (Knechel & Messier 1991). Auditors tend to initially search information that they deem the most diagnostic for the task (Knechel & Messier 1991). If the acquired information is sufficient to make a decision, the acquisition will be terminated, otherwise an auditor will continue acquisition until a decision can be made (Knechel & Messier 1991).

An auditor may use so-called stopping rules to determine when information acquisition should be terminated. Stopping rules can be simple, such as stopping after collecting a predetermined number of evidence items or the completion of a standard checklist. More complex stopping rules include mental models, where the current situation is compared with experiences and when there are no inconsistencies between the mental model and these experiences, information acquisition will be terminated (White & Harding 2011).

Research has shown that in some circumstances information acquisition might be biased. When auditors have directional goals, they might perform biased acquisitions and emphasize the importance of those cues that support their desired goals (Cianci & Bierstaker 2009). One form of this phenomenon is confirmation bias, where an auditor directs his/her information search towards information that confirms a favored hypothesis rather than that related to all generated hypotheses (Bonner 2008). For instance, susceptibility to confirmation bias can weaken independence from the client, because the favored hypothesis is often the same as the client-preferred position (Kadous, Magro & Spilker 2008).

Further, biased or unbalanced information acquisition may cause important information to be overlooked in the decision-making process. Some accounting studies (Andersson 2004; Thayer 2011) have shown that the judgments of the task outcome made in the initial decision-making phase are persistent and guide further information acquisition. These studies suggest that once a preliminary judgment has been formed, it is rarely challenged and information acquisition is directed to justify it. For instance, in analytical procedures once a hypothesis for the unexpected fluctuation has been explicitly or implicitly formulated, this reason will dominate subsequent information acquisition behavior (Libby 1985).

2.2 Process tracing approaches in previous studies

This study employs process tracing approaches to study auditors' information usage. Ford et al. (1989) states that process tracing approaches "*observe the pre-decisional behavior in analyzing a situation by tracing the steps leading to a decision*". Thus, one of their aims is to observe the "steps" in an individual's decision-making process to gain insights into how the process is evolving to the decision and find the underlying cognitive processes that drive information acquisition behavior. More specifically, process tracing studies trace the decision-maker's information acquisition and usage behavior in real-time when performing a task. Real-time tracing is particularly intended to prevent the subsequent rationalization of decision behavior (Andersson 2004). The general advantage of real-time tracing approaches is that they allow getting a rich data set of a decision-maker's behavior.

Previous process tracing studies (e.g. Biggs & Mock 1983; Bédard & Mock 1992; Moroney 2007) investigating auditors' information acquisition and usage have employed either verbal protocol analysis or computer-based tracking techniques. In verbal protocol analysis, a decision-maker thinks aloud in a supervised space when making a decision. By thinking aloud, she/he is presumed to express her/his thoughts and actions that reflect the cognitive processes used in the decision-making process (Ford et al. 1989; Andersson 2004). In particular, in information acquisition studies, a cue that is mentioned is considered to be used for the decision (Bédard & Mock 1992). For the analysis of research, obtained data from the research sessions are transcribed and coded.

The advantages of verbal protocol analysis studies are that studied tasks can be complex and realistic, as there are few instrumental restrictions other than the presence of the researcher. Verbal protocol analysis also allows for observing directly the decision-maker's behavior in a semi-natural environment. Thus, it is possible to incorporate a large number of information available for decision-making and present the information in its natural form (e.g. the format of audit work papers). A general disadvantage is that cues can be acquired without verbalizing acquisition. This threat is obvious when decision-makers are highly experienced subjects whose decision processes are automatic (Bédard & Mock 1992).

Other disadvantages are that a large amount of verbal protocol data is laborious and time-consuming to analyze, as the observations are usually coded by two independent coders to decrease subjective interpretations and to avoid coding errors (Andersson 2004; Biggs & Mock 1983; Wright & Bedard 2000). Furthermore, because of this tediousness, the data usually contain observations from only a few subjects that are not necessarily a representative sample of the whole subject population (Biggs, Mock & Watkins 1988).

Computer-based tracking techniques are based on software that accurately record information usage patterns when decision-makers are actively searching for information and making decisions in a computerized environment. This technique can handle large amounts of data in a reliable way, as recording happens automatically to the database (Andersson 2004). For instance, the number of used information, order of the search, time spent on the task, and each decision-making phase are followed effortlessly by this technique. The computer environment also minimizes researcher intrusion in the actual decision-making situation (Rosman & O'Neill 1993).

As a main limitation, the computer environment is usually much more simplified and artificial than a natural decision-making environment (Andersson 2004). For instance, tracking information usage accurately may require that information be separated into multiple cues or that cues be shortened. Information must also be located under menus or search engines, which can be considered to be artificial elements. Ultimately, in more complex tasks an information menu can even act as unwanted decision help that simplifies tasks compared with the natural environment (Boritz 1992).

In summary, both verbal protocol analysis and computer-based tracking techniques have advantages and disadvantages. In general, these approaches should be seen as complementary methods and the choice should be made based on the research problem of the study.

3 AUDITORS' INFORMATION USAGE FRAMEWORK

A large body of psychological research indicates that information acquisition and usage are highly dependent on the demands and characteristics of the task (Payne 1982; Ford et al. 1989). In other words, the nature of each task largely determines what information is needed to perform that task. Consequently, the determination of a client's going-concern status requires the acquisition and usage of vastly different information than the decision to accept or to reject a prospective client. However, audit tasks do not exist in a vacuum. Thus, performing a task is contingent upon the properties of the individual decision-maker and the context in which decision-making occurs (Andersson 2004). For example, individual auditor attributes affect an audit task, as auditors bring to bear these individual characteristics to the task (Nelson & Tan 2005).

As stated before, this study adopts El-Masry and Hansen's (2008) taxonomy, which classifies factors concerning auditors' information acquisition and usage into four categories. The aim of this chapter is to review audit studies that have investigated:

1. Individual factors
2. Environmental factors
3. Task-related factors
4. Cue-related factors (i.e. factors related to the nature of cues), and
5. Interactions between these factors

Compared with El-Masry and Hansen's (2008) study, the present study includes studies that have used external auditors or tax auditors[4] as subjects. Another prerequisite for including a particular study is that a study is suggested to have implications on auditors' information usage in a single audit task. Further, studies investigating interactions between the factors representing these four categories are central to this study and these studies are presented in a separate section. The chapter concludes with a discussion and conclusion of the results of the presented studies.

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[4] Those studies using tax auditors as subjects are also included as their information acquisition and usage process is expected to be similar to that of external auditors. Specifically, in most of these studies tax auditors were working in one of the Big-4/6 accounting firms, suggesting that their in-house training might also be similar to that of external auditors.

3.1 Individual factors

Individual factors are factors that relate to single auditor characteristics that vary between auditors (El-Masry & Hansen 2008). They also encompass the cognitive processes that an auditor uses while performing information acquisition and usage (Bonner 2008). The following factors have been studied previously in the auditing context: auditor experience, motivated reasoning and confirmation bias. From these three, auditor experience has received most attention in the previous studies.

3.1.1 Auditor experience

Almost all published audit studies have found that general audit experience (i.e. experience in years) decreases the acquisition of information for various audit tasks. In audit program planning, Biggs, Mock and Watkins (1988) found that audit seniors upon finding a problem in accounts receivables increased substantially their information acquisition compared with audit managers. Similarly, Davis (1996) found in control risk assessment that experienced auditors selected fewer cues and weighted cues' importance more unequally than less experienced auditors. In going-concern assessment, Simnett (1996) provided evidence that experienced auditors selected fewer ratios than less experienced auditors.

Contrary to the above studies, Moeckel (1991) in supervisory review task showed that experienced auditors used more information than less experienced auditors when information cues' forms deviated significantly from each other. The author concluded that experienced auditors were better able to utilize information than less experienced auditors, because they were better at making links between information cues when the information was not in "close proximity" or "semantically similar".

Research has also found that in less common audit tasks, i.e. tasks that are not prepared by every auditor on a regular basis, the amount of task-specific experience may have an important role in information acquisition and usage. Bédard and Mock (1992) found that computer audit specialist auditors utilize less information in internal control system evaluation task than non-specialists. Bonner (1990) specifically investigated the role of task-specific experience in two different audit tasks, namely analytical risk assessment and control risk assessment. It was hypothesized that a much larger experience-related effect would occur in analytical risk assessment than in control risk assessment, as the former requires knowledge that is acquired in the later years of an auditor's career. The results showed some support that task-specific experience helped auditors in analytical risk task recognize the relevant cues better and weight cues more accurately. As expected, the study did not find any significant experience-related effect in control risk task.

Some experimental studies have measured the time that auditors spend acquiring and processing information in a task. The amount of time spent in the task is usually defined as a proxy for audit efficiency in these studies. Thus, a shorter time for a task is deemed to signal more efficient information processing behavior. Davis (1996) found that in control risk assessment, experienced auditors used less total time than less experienced auditors, but the study did not conclude unambiguously whether this difference stemmed from the fact that experienced auditors acquired less information or processed the acquired information faster. Moroney (2007) showed that industry experience increased audit information acquisition efficiency in two industries when the auditor was an industry specialist. The result also held when the number of used information was controlled. Thus, the finding can be interpreted that industry-experienced auditors process single information cues more efficiently than non-industry-experienced auditors[5].

The literature has offered some explanations why experienced auditors acquire less information than less experienced auditors. The first explanation is that they have better knowledge of the relevant cues for specific tasks (Bonner 1990). The second explanation is that they are able to recognize better relevant information patterns by recalling similar situations that they have encountered earlier (Lehmann & Norman 2006). Thus, experienced auditors' more accurate problem representations help them better ignore irrelevant information in their information acquisition (Glover 1997; Shelton 1999). The third explanation is that experienced auditors already have more knowledge or information in their memories, which they rely on for their decision-making (Bonner 2008). For example, experienced auditors may have benchmark data or in-depth knowledge of accounting standards ready in their memories, which can be applied directly to the present task without external information acquisition.

The literature has developed theories to explain how experienced auditors' information acquisition behavior differs from that of less experienced auditors. Biggs and Mock (1983) recognized that auditors use either sequential or directed information acquisition strategies in internal control evaluation and audit scope decisions. In the sequential strategy, an auditor acquires extensively available infor-

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[5] Both Davis (1996) and Moroney (2007) also studied whether more efficient subjects are also more effective (i.e. accurate) in their judgments. The results did not support these expectations and showed even some support for opposite findings (i.e. taking more time leads to the better performance).

mation before making any subjudgment in a task. By contrast, in the directed strategy information on each subjudgment is collected separately. According to Bonner and Pennington (1991), experienced auditors apply directed strategies in information acquisition and use internal "checklists" as a guideline in acquisition processes. Hoffman, Joe and Moser (2003) described experienced auditors' information acquisition as a goal-oriented and directed process. Davis (1996) theorized that experienced auditors use a "top-down approach" in their information acquisition, i.e. they holistically recognize the general features of a given situation and use these features to select the relevant information for the task at hand. Less experienced auditors instead use a "bottom-up" approach, where they look for potential cues and then select these one after the other (Davis 1996). Knowledge of typical accounting and control systems guides experienced auditors in information acquisition compared with less experienced auditors, who usually acquire information in the order in which it is presented (Davis 1996). Experienced auditors are also suggested to use more rules of thumb, whereas less experienced auditors may only use simple sequential searches (Davis 1996).

While theories suggest that experienced auditors are more selective in their information acquisition, some studies have documented that experience increases balanced information usage. Specifically, these studies have found that because of experienced auditors' well-developed knowledge of tasks, they consider more effectively information that is inconsistent with their initial expectations or framing of the problem (Waller & Felix 1984; Choo & Trotman 1991). For instance, in a going-concern task experienced auditors are better at evaluating information that mitigated the threat to continued existence (Choo & Trotman 1991). Further, in an analytical procedures task experienced auditors recognize better whether the acquired information was sufficient for decision-making, while less experienced auditors were more likely to rely on weak information in their decision-making (Glover et al. 2005).

Vast experience may not always lead to better information usage because of overconfidence[6]. In a real estate valuation task, Earley (2002) expected the type of initially received information to influence how additional information was processed. It was hypothesized that whether client-provided data were consistent or inconsistent with industry average data impacted the usage of additional information. The results showed that experienced auditors performed generally better,

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6 Generally, overconfidence occurs when someone's average rated confidence is higher than average (Van Swol & Sniezek 2005). However, in this study the term is used in a more generic sense.

i.e. made more accurate judgments than less experienced auditors. However, when client-provided information was consistent with the industry data, there were no differences in the judgment performance between experience levels. This finding was explained by the fact that experienced auditors overlooked client-specific information of a sufficient depth and relied too much to their previous expectations, when the data were found to be consistent with industry data. Thus, when experienced auditors deem a task to be unchallenging they may not engage fully their cognitive processing activities that would need to consider both industry and client-specific information.

Another related finding shows that when experienced auditors are not allowed to process information in their natural ways, they will perform more like less experienced auditors (Hoffman, Joe & Moser 2003). In other words, when experienced auditors apply their usual information acquisition strategies, their judgments reflect their “expert processing” of the information. Hoffman, Joe and Moser (2003) showed that the possibility of performing unconstrained processing, compared with the fixed order of information processing, increased experienced auditors’ attention to mitigating information (i.e., the cues that decrease the threat of continued existence), which lead to more optimistic survival judgments of going-concern firms.

Taken together, the theories derived from the psychology literature as well as the empirical evidence from audit studies generally suggest that because of better developed knowledge content and structure and advanced cognitive processes, experienced auditors are more effective and efficient in their information acquisition and usage than less experienced auditors.

3.1.2 Motivated reasoning

Motivated reasoning theory posits that individuals with preferred conclusions use biased mechanisms to reach a desired goal (Kunda 1990). One of these mechanisms in the decision-making process is biased cue acquisition and usage (Cianci & Bierstaker 2009). If an auditor is susceptible to motivated reasoning, this may turn up in unbalanced information acquisition or the over-/underweighting of cues in information evaluation. Thus, an auditor who attempts to maximize audit efficiency or favor client-preferred judgments may do so by under-auditing or ignoring important information either in information acquisition or in processing (Cianci & Bierstaker 2009).

Motivated reasoning may also have positive effects on information acquisition and usage if it increases the motivation to provide objectivism and skepticism

(Cianci & Bierstaker 2009). Specifically, if auditors have these so-called accuracy goals in their decision-making, they may use more cognitive efforts, and therefore perform more comprehensive and balanced information acquisition and processing than would otherwise occur.

Blay (2005) investigated specifically how one reason for motivated reasoning, economic incentives, affected information evaluation in a going-concern reporting task. This experimental study manipulated the fear of losing the client (defined as independence threat) and litigation risk[7]. It was hypothesized that when the fear of losing the client is high, auditors evaluate acquired information consistently with a client-preferred conclusion. By contrast, high litigation risk was expected to result in the opposite direction of evidence evaluation. The results indicated that auditors with a high fear of losing the client evaluated those clients more likely to survive after the evaluation of information, whereas auditors who faced high litigation risk evaluated clients less likely to survive after information evaluation.

Kadous, Magro and Spilker (2008) examined how the level of practice risk effected the motivated reasoning of tax auditors. They theorized that when a practice risk of engagement is high, biased judgments are more likely to lead to negative consequences, such as monetary penalties or the loss of reputation, as these threats become more salient to the decision-maker. Therefore, auditors may want to protect themselves from such losses by emphasizing accuracy goals in those circumstances. As expected, the study found that when practice risk was high, auditors performed comprehensive and balanced information acquisition, while auditors with low risk clients mainly acquired information that was consistent with client preferences.

Closely related to motivated reasoning theory, auditors' attitudes towards the consequences of certain judgment outcomes may influence information usage. Guiral, Ruiz and Rodgers (2011) hypothesized that the fear of the self-fulfilling prophecy of issuing going-concern reports affects information evaluation. The study investigated how auditors' expectations of the existence of the self-fulfilling prophecy affected confirming (business termination) and disconfirming (business continuance) information evaluation. It was theorized that auditors who are afraid of the self-fulfilling prophecy are concerned that a going-concern opinion leads to

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[7] Independence threat and litigation risk can also be considered to be environmental factors. However, they are presented in this category because Blay (2005) theorized these factors convincingly as economic incentives that influence auditors' decision-making via motivated reasoning.

the loss of future economic rents, as the client relationship would terminate because of business failure. The results confirmed these expectations, namely auditors who had higher expectations of the self-fulfilling prophecy displayed greater sensitivity to disconfirming cues and simultaneously a lower tendency to confirming cues.

3.1.3 Confirmation bias

Confirmation bias is defined as a proneness to direct information acquisition to information that confirms the favored or initial hypothesis generated by an auditor[8] (Bonner 2008). An example of confirmation bias is a situation when an auditor finds a ratio that indicates unexpected fluctuation, assumes a reason (hypothesis) for the cause of fluctuation and searches only this hypothesis. Thus, an auditor's concentration on one hypothesis leads to biased information acquisition. Confirmation bias is also closely related to motivated reasoning in circumstances where an auditor favors one hypothesis over others.

Audit studies have found mixed evidence about the existence of confirmation bias. McMillan and White (1993) found that auditors who believed the error hypothesis when they encountered fluctuations in financial statement ratios used more confirming and disconfirming information than those who believed there was no error. Further, their results showed that all auditors, regardless of their initial hypothesis, were prone to using error-related evidence in the later stages of the task. This finding was interpreted to be consistent with Smith and Kida's (1991) view that auditors are educated to design information acquisition so that potential material errors are uncovered. However, a later study by Anderson and Maletta (1994) did not find evidence that initial beliefs affect auditors' attendance to positive or negative information.

Contrary to the findings of McMillan and White (1993), Bamber, Ramsay and Tubbs (1997) found that auditors are more sensitive to information that confirms their initial hypotheses in both fraud (material employee fraud in inventory) and non-fraud (collectability of a material accounts receivable) tasks. Brown, Peecher and Solomon (1999) found that whether auditors have a particular incentive to be efficient or effective in their decision-making influences their confirmation bias

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[8] This initial hypothesis may also stem from the task, namely depending on how the decision problem is described for the decision-maker. Studies investigating this effect (i.e. framing) are presented in Chapter 3.3.

proneness. Their results showed that unless auditors are encouraged to be effective in their hypothesis testing, they became confirmation bias prone.

3.1.4 Confirmation bias and auditor experience

Two studies have investigated whether increased experience mitigates proneness towards confirmation bias. Kaplan and Reckers (1989) found evidence that only less experienced auditors were confirmation bias prone in explaining ratio fluctuations. Thus, their initial hypothesis of the fluctuation cause correlated positively with the type of information they subsequently searched. By contrast, experienced auditors performed balanced information search strategies that did not correlate with their initial hypothesis.

While Bamber, Ramsay and Tubbs (1997) found that auditors are more sensitive to information that confirms their initial hypothesis, the low experience of a subject did not exacerbate confirmation bias proneness. However, the study provided evidence that less experienced auditors are more prone to rate more highly information that confirmed their initial hypothesis than experienced auditors, but this proneness did not have a significant effect on final judgment.

3.2 Environmental factors

Environmental factors are defined as factors that surround auditors while they perform audit tasks (El-Masry & Hansen 2008). They are not related to specific people or tasks, but to the particular environment in which the audit occurs (Bonner 2008). Several environmental factors have been found to affect auditors' information acquisition and usage. These factors are accountability, time pressure and client risk.

3.2.1 Accountability

Accountability means that there is pressure to justify one's actions or judgments to other people (Tetlock 1983). In auditing, the amount of accountability may vary from firm to firm depending on how much reviews, documentations and justifications are required by an audit firm. Generally, it is posited that accountability has positive effects on information acquisition and processing, as it motivates decision-makers to engage in effortful information processing (Lee et al. 1999). Thus, accountability information processing may become more complex, integrative and careful (Glover 1997; DeZoort, Harrison & Taylor 2006).

It must be noted that accountability may not always improve information acquisition and usage performance. Increased effort may increase the use of irrelevant information if an auditor lacks the necessary expertise to define task-relevant information (Bonner 2008). Thus, the additional effort might be used to process all available information without a consideration of its relevance.

Still, several studies have shown that accountability increases auditors' efforts in information acquisition and usage. Cloyd (1997) found that the existence of accountability increased tax auditors' efforts in information acquisition as evidenced by increased time spent on the task. Asare, Trompter and Wright (2000) found that auditors who were accountable when investigating the cause of unexpected fluctuations acquired more information on all the possible reasons for the fluctuations compared with auditors who were not held accountable. It was argued that auditors who worked under accountability did not want to eliminate any judgment options. Therefore, the overall acquiring of information usually increases as each judgment option needs its own information search. However, the study did not find that accountability influenced the depth of information search on auditors' primary hypothesis.

DeZoort, Harrison and Taylor (2006) found that depending on the amount of accountability pressure, auditors' usage of different information types varied in materiality judgment-related task. The amount of accountability pressure was manipulated via four forms of accountability pressure (none, review, justification and feedback). The results indicated that when pressure increased, auditors shifted to using more qualitative information than quantitative information in their explanations of the judgment. Further, the time spent on the task increased along with this, suggesting that accountability induced the more complex and careful analysis of available information.

Some studies have evidenced the negative effects of accountability, which have caused auditors to perform biased information processing. Specifically, when accountability is to a supervisor whose view of the matter is known before the decision-making process begins, there is a risk that information acquisition and usage is biased to support the desired conclusion if a decision-maker wants to please her/his supervisor (Bonner 2008). Thus, there is a risk that the decision-maker engages in motivated reasoning to reach the same conclusion as her/his supervisor.

Few studies have examined how the preferences of reviewers are affected when auditors are asked to justify[9] their decisions. Peecher (1996) found evidence that a supervisor's preference of the justification type (credence, objectivity or skepticism-inducing) in analytical procedures affects how extensively auditors search information for alternative explanations of fluctuations. Specifically, when the supervisor's preference was "client-provided information credence-inducing" and the client possessed high integrity, auditors terminated searching additional information earlier than auditors in other experimental conditions.

Turner (2001) asked auditors to justify their decisions in an accounts receivable collectability task. The study examined accountability's effect on audit efforts by measuring the number of information and the time that auditors spent reading each cue. Reviewer preference was manipulated in three levels: unknown preference, credence to client preference and skepticism preference. The study found that auditors with unknown reviewer preferences generally made similar information choices to auditors who had a reviewer with skepticism preference. The main finding was that auditors with credence preference acquired relatively more client-preferred information, but overall less information than auditors in other manipulation groups. However, the time spent reading each cue was not significantly different.

Wilks (2002) studied how the supervisor's view of the judgment affected auditors' information evaluation in a going-concern task. It was found that those auditors who knew their supervisors' views before information evaluation evaluated information more consistently with those compared with subjects who did not know their supervisors views beforehand. The former group also made more going-concern judgments that were consistent with the view of the supervisor than the latter group. However, the study emphasized that this so-called pre-decisional distortion of information seems to happen unknowingly and unintentionally by decision-makers.

3.2.2 Time pressure

Time pressure may affect auditors' information acquisition and usage in several ways. First, it is generally suggested that a low (but existent) level of time pressure accelerates the speed of information processing and thereby has a positive

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[9] Justification is the process of providing explanations to support one's beliefs (Bonner 2007). For example, staff auditors normally prepare a memo of audit procedures they have performed in certain audit task.

impact on audit efficiency. Hence, auditors tend to increase effort intensity and process information more efficiently in a given task. When the time pressure starts to increase from low to modest or high, it is suggested that auditors start to filter out information from their processing in order to perform a task in a given time. At the beginning, auditors might be able to filter out only information that they perceive less relevant but as the time pressure increases relevant information might also be ignored (Bonner 2008).

Second, time pressure may influence information processing strategies. It is suggested that increased time pressure might change processing strategy from compensatory to noncompensatory. In a compensatory strategy, different information cues can compensate each other, i.e. the low value of one cue versus another cue's high value. Noncompensatory strategies meanwhile do not permit such tradeoffs between the positive and negative features of the information. Compensatory strategies stress the comprehensive use of all available information, while noncompensatory strategies encourage using simplified rules and thus ignoring relevant information. As the time pressure increases to modest or high, auditors may believe that shifting to noncompensatory strategies (i.e. processing information more superficially) allows them to work more efficiently (Ford et al. 1989; Choo 1995; Bonner 2008).

The empirical results in the auditing domain have been consistent with the predictions from theory. McDaniel's (1990) results indicated that in an inventory audit task increased time pressure decreased the amount of collected information measured by the amount of sampling adequacy[10], whereas increased time pressure sped up subjects' information processing. Specifically, while the overall effectiveness decreased (total number of found errors) as time pressure increased to the high level it improved audit efficiency, as auditors in the most extreme time pressure group found seeded errors from the experimental material more efficiently (errors per used time) than those in other treatments.

Two studies (Braun 2000; Cianci & Bierstaker 2009) have indicated that increased time pressure leads auditors to consider the overall efficiency of the audit. Both have suggested that auditors favor cues that support "no-problem audit" under high time pressure[11]. Braun (2000) examined whether time pressure affect-

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[10] Sampling adequacy refers to the value that indicates whether the examined sample size by the subject was adequate compared with the desired level of certainty.

[11] Whether this happens because of motivated reasoning, is not obvious. Therefore, these studies are presented together with time pressure instead of motivated reasoning, as time pressure is the common denominator in these studies and is a common environmental factor in auditing.

ed subsidiary fraud detection when auditors' focus was directed to an inventory audit task. The results showed that auditors under low time pressure were able to process effectively a broader set of cues and recognize fraud signals more often than auditors under high time pressure. It was indicated that the low time pressure group recognized the fraud signals in the same period of time (i.e. during the first 45 minutes) as the high time pressure group. It was concluded that low time pressure, not the available time itself, helped an auditor be more attentive to all available cues.

Cianci and Bierstaker (2009) investigated how time (budget) pressure effects information evaluation in an internal control evaluation task. It was hypothesized that when time pressure increases, auditors may alter their information processing strategies to meet the efficiency demands of a task. Thus, in order to improve efficiency, auditors may discount the effect of negative information and emphasize the positive information of internal controls to progress towards an unqualified audit opinion. The empirical results strongly supported these expectations of biased information processing.

3.2.3 Client risk

The audit literature has mainly investigated indirectly how the perceived client risk affects auditors' information acquisition and usage. These studies have particularly examined how audit program plans and evidence collection plans are adjusted in the presence of different risk factors. The results of these studies generally suggest how auditors change their information acquisition behavior at an audit engagement level depending on client-related risks. However, they also provide suggestions on how information acquisition and usage adapts to the micro level of an audit, i.e. a single audit task.

Mock and Wright (1993) examined evidential planning decisions on actual audits with archival data. They found that account-specific risk factors, but not engagement-wide risks, particularly the number of previous errors, influenced the amount of evidence acquisition. Mock and Wright (1999) extended their earlier work by examining auditors' risk assessment and audit planning in accounts receivable tasks in two industries. They found that the type of the needed audit evidence was responsive to changes in a number of risk factors such as client's liquidity and profitability. Likewise, Pratt and Stice (1994) found that an audit client's poor financial condition, high value of receivables and inventory, high growth in sales and high market value of equity increased auditors' recommendations to obtain more audit evidence for the engagement.

Other indirect findings of the risk to information acquisition suggest that changes in client-related risks affect the extent of testing according to the number of staff level work hours. It is thus reasonable to assume that increased budgeted audit hours are also related to increased information acquisition, as audit staff are responsible for collecting audit evidence (Hackenbrack & Knechel 1997). Specifically, O'Keefe, Simunic and Stein (1994) found that the greater inherent risk of a client resulted in significantly greater audit hours of staff and senior auditors. Hackenbrack and Knechel (1997) measured client risk by type of firm (public vs. private) and found that this affected the number of auditors' labor hours. Bedard, Mock and Wright (1999) summarized the findings of previous audit planning studies and concluded that client-related nonfinancial risk factors and management explanations for unusual discrepancies are related to the extent of testing.

Several studies have investigated more directly how the riskiness of the client affects the amount of needed audit evidence. Houston, Peters and Pratt (1999) found that when client risk was manipulated by the discovery of accounting treatment that misspecified inventory, auditors increased the planned amount of audit evidence in order to complete the audit. Beaulieu (2001) found that a prospective client's management integrity was linked to auditors' recommendations of needed audit evidence. More specifically, when a CFO was characterized as possessing negative integrity, auditors planned to acquire additional evidence for the engagement. Johnstone and Bedard (2001) found that in audit engagement planning that the presence of risk factors affected subsequent audit evidence collection strategies.

3.3 Task-related factors

Task-related factors refer to the characteristics of different audit tasks, which vary from task to task (Bonner 2008). As it may be unreasonable to compare audit tasks with each other, because they have specific purposes in the audit process, task-related factors aim to recognize and classify the common denominators of different tasks to disentangle those effects on auditors' information acquisition and usage. However, task-related factors can also vary within tasks (Bonner 2008) – for example, the same going-concern task can be initially framed differently – which may affect subsequent information acquisition and usage. The task-related factors that have been studied previously are task complexity, task framing, task type and task response mode.

3.3.1 Task complexity

Bonner (1994) suggested that the definition of task complexity[12] encompasses task difficulty and task structure. The difficulty element of task complexity relates to the number of processing steps of the task, the number of information cues available, the number of possible hypotheses/decision alternatives and the correlation between information cues (Bonner 2008). Generally, an increase in the number of these factors increases task complexity. However, a strong correlation between cues might mitigate such an increase in task complexity, as the information load will not increase linearly with the number of information (Bonner 2008).

The task structure element refers to the clarity of cognitive processing in a task (Bonner 1994). This structure can vary depending on how well task-specific information is defined in terms of the degree of cue measurement, familiarity of the information form to the decision-maker and relations between information cues and task outcomes (Bonner 2008). When the clarity of task processing is not well-specified (e.g. information or its relation to the outcome), the task is classified as semi- or unstructured.

While task complexity is frequently studied in auditing (e.g. Tan & Kao 1999; Tan, Ng & Mak 2002), few studies have particularly studied task complexity's influence on information acquisition and usage. Simnett and Trotman (1989) studied the effect of information choice and information processing on auditors' judgments in business failure prediction task. They manipulated one element of task complexity, namely task structure, with two levels by giving one or two year before-the-event financial ratio information to auditors. Auditors then had to predict whether firms were going to go bankrupt within one or two years. Information choice, namely by selecting four ratios out of 10, was carried out by subjects or statistical models. Information processing was performed by an auditor or statistical model depending on the treatment.

The results indicated that information choice was a limiting factor in predictive accuracy, i.e. model-selected information outperformed human-selected information. By contrast, in the treatments where auditors selected information, there were no differences in judgment accuracy between subjects and model processing. In addition, while the results showed that predictive accuracy decreased steadily in all treatments when task structure shifted to less structured, the study

[12] There are numerous definitions of task complexity (see e.g. Wood 1986, Byström 2002) in the literature. For the sake of brevity, only Bonner's (1994) is discussed in this section.

did not find that task structure affected the types of ratios chosen by auditors. In other words, selected ratios were similar in both task structure levels.

Simnett (1996) examined another element of task complexity, namely task difficulty, in a corporate failure prediction task. Information load was manipulated using two levels (low/high) depending on the number of financial ratios given for the task. Similar to Simnett and Trotman (1989), information selection and processing varied so that phases were performed by auditors or statistical models (or a combination). Thus, there were 10 treatment groups. The results generally showed that auditors did not perform well in information acquisition and processing when task difficulty increased. Specifically, when information was selected by the model, it led to a better predictive accuracy of failure than when ratios were picked by an auditor. This finding was consistent with both low and high information load conditions. In addition, when information load was high, auditors' information processing performances were significantly lower compared with the statistical models. Thus, as in Simnett and Trotman (1989), information processing under high task complexity was deemed to be a limiting factor in judgment performance. Finally, the study found systematic differences between the types of selected ratios depending on information load. While these differences were not examined in detail, this result suggests that task difficulty influences the type of information that auditors select.

These two studies show that suboptimal information selection by auditors limits their judgment performances. They also indicate that deficiencies in auditors' information processing limit performance when the number of available information is high. Finally, these studies are inconclusive about whether task complexity affects the type of information that an auditor acquires for her/his decision-making.

3.3.2 Task framing

Framing refers to a change in a task that does not alter its true substance, but changes decision-makers' perceptions about it (Mueller & Anderson 2002). A framing effect is said to occur when a change in the description of the task (i.e. a frame) changes the decision that is made (Jamal, Johnson & Berryman 1995). In addition, task framing may also alter the decision-making process itself. Specifically, this happens when an auditor applies the initial frame as an anchor that directs the subsequent acquisition process. Thus, framing may activate confirmation bias if the auditor is not able to transform problems into a standard representation (Jamal, Johnson & Berryman 1995).

Overall, auditing studies have not found task framing to seriously direct auditors' information acquisition. Kida's (1984) experimental study divided subjects into two groups, namely failure and viability. In the failure (viability) group, subjects were asked to list information that they consider to be relevant to decide whether a firm would fail (remain viable) within two years. The study reported that the initial task framing influenced the information that auditors considered to be relevant. The results indicated that auditors in the viability group selected more viability cues than auditors in the failure group, but overall auditors in both groups listed more failures than viability cues.

Trotman and Sng (1989) extended Kida's (1984) research setting by taking into account that auditors may process information sequentially in their decision-making. The study found evidence that when an initial situation was set to positive (strong ratios) and the problem was framed to be positive (viability), auditors acquired more positive cues than when the initial situation was negative (weak ratios) and the problem was framed to be negative (failure). Consistent with the findings of Kida (1984), the study reported that regardless of problem framing, auditors overall acquired more negative than positive cues, meaning that there was no clear evidence of auditors' applying confirmation bias strategies depending on the initial problem frame.

In an analytical procedure task, Ayers and Kaplan (1993) found evidence that hypothesis framing affected auditors' information usage. It was hypothesized that problem framing influences subsequent information choice when either a misstatement or a non-misstatement frame is presented to auditors to explain unusual financial statement fluctuation. The results showed that a (non-)misstatement frame increased auditors' usage of (non-)misstatement cues. However, the study did not find any evidence that framing affected the actual judgments about the reason for the unusual fluctuation, i.e. only cue usage was affected.

3.3.3 Task type

While task type in information usage has only been examined in two audit studies, this factor might be an important determinant of how different cues are integrated into auditors' decision-making. Generally, tasks can be classified as either estimation or evaluation types (Hogarth & Einhorn 1992). A well-known belief adjustment model (Hogarth & Einhorn 1992) suggests that cues are integrated differently depending on task type. When an auditor estimates an amount of money, the task can be considered to be an estimation task (Kerr & Ward 1994), whereas when an auditor evaluates whether an account balance has been fairly stated, i.e. hypothesis testing, the task can be considered to be an evaluation task (Kerr & Ward 1994).

The belief adjustment model predicts that in estimation tasks every new piece of information is evaluated with respect to the current belief. Thus, this belief is adjusted through an averaging process of new pieces of information. By contrast, in evaluation tasks pieces of information are evaluated irrespective of the current belief by summing their values. Kerr and Ward's (1994) empirical results of audit planning (estimation type) and internal control evaluation (evaluation type) task support the above predictions, suggesting that task type may have implications on how the order of cues affects final judgments (El-Masry & Hansen 2008).

3.3.4 Task response mode

Turner (2001) investigated how different response modes in otherwise identical tasks affect information usage in an accounts receivable collectability task. In one set of treatments (belief), subjects were asked to assess the likelihood of each account balances' collectability. In the other set of treatments (action), subjects had to classify account balances according to whether they were collectible or uncollectible. It was expected that auditors in belief treatments would be judged (by their superiors) more by the quality of their decision-making processes compared with auditors in action treatments and thus the former use more effort for information usage. Consistently with this expectation, the study found that auditors in action treatments acquired less information cues and spent less time per information cue than auditors in belief treatments.

3.4 Cue-related factors

Several characteristics of cues *per se* may influence how they are acquired or processed in auditors' decision-making (El-Masry & Hansen 2008). For example, the (perceived) reliability of a cue may influence how much effort an auditor uses to process the cue to find out its information value. In this study, cue-related factors refer to the nature and characteristics of cues. In previous audit studies, cue-related factors[13] such as information order, information reliability, irrelevant information, presentation mode and information types have been studied.

[13] While some studies in this area have focused on cue effects only, others have investigated information effects in general. As there is no theoretical argument to distinguish between

3.4.1 Information order

Several studies have investigated how information order affects audit judgments, as depending on the presentation order of information in audit tasks different judgments or decisions will be made (Arnold et al. 2000). Ideally, judgments and decisions should only be influenced by the substance of information (Kennedy 1993). However, a significant amount of evidence (e.g. Knechel & Messier 1990; Messier 1992; Asare 1992; Messier & Tubbs 1994) suggests that auditors display information order effects known as recency. In recency effects, an auditor's beliefs are revised more negatively when negative information follows positive than if positive information follows negative (Anderson & Maletta 1999). In addition, few studies have investigated the opposite effect of recency, known as primacy. A primacy effect occurs when an auditor's belief is revised more negatively when negative information precedes positive information than if positive information precedes negative (Anderson & Maletta 1999).

Ashton and Ashton (1988) tested whether recency effects existed in an internal control task. They conducted two experiments, where some subject groups were given four pieces of positive or negative information (consistent information) and others were given mixed evidence, i.e. both positive and negative information. The results of these experiments were consistent with their predictions; no order effects were found for consistent information group, but recency effects were found in mixed evidence groups. Similarly, Butt and Campbell (1989) investigated the existence of recency effects in an internal control task. They observed recency effects only when subjects had negative beliefs about the internal control system. When subjects started with high positive beliefs about the internal control system, no recency effect was found. In a going-concern context, Asare (1992) found that auditors displayed recency effects in their probability estimates of the continued existence of a firm. Recency effects also affected their subsequent reporting behavior. Auditors who evaluated first negative (indicating failure) and then positive (indicating viability) information issued more unqualified audit reports than those who evaluated the same information but in the reverse order.

By contrast, some studies have evidenced that auditors are not always susceptible to the order effect. In an inherent risk assessment task, Monroe and Ng (2000) found that auditors always focused on factors that indicated high inherent risk regardless of the order in which they were presented. They explained this con-

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these two terms in this context, all cue-related factors in this study are named "information" instead of "cue".

servative behavior by stating that the existence of high inherent risk factors dominates the order effect. Further, Favere-Marchesi (2006) documented that an awareness of the temporal order of information decreases the recency effect in a going-concern judgment. He argued that the temporal order of information dominates presentation order, because the chronological order of information emphasizes cause-and-effect relationships and attaches greater weight to more recent information.

3.4.2 Information reliability

Information reliability is suggested to be an important factor in auditors' JDM, as less reliable information is expected to be weighted less in the decision-making process compared with more reliable information (Kizirian, Mayhew & Sneathen 2005). Information reliability is often estimated as the credibility of its source (Hirst 1994; Goodwin 1999). Thus, information that comes from a more credible source is considered to be more reliable than information from a less credible source.

In previous audit studies, source credibility has been suggested to consist of several components: independence, competence and integrity (Rebele, Heintz & Briden 1988; Hirst 1994; Goodwin 1999). For example, an auditor may evaluate differently information provided by an internal auditing function depending on its competency and position in the organizational hierarchy. However, even if the source is competent, it is not necessarily objective if it has an incentive not to be truthful. Thus, as the source's incentive not to be truthful increases, its credibility decreases. Thus, a biased source can be considered to be less credible and less persuasive than an unbiased one (Robertson 2010).

The seminal work by Joyce and Biddle (1981) investigated how source independence affected auditors' judgments. They experimentally manipulated a source in which the description of the client's financial difficulties had been obtained. Their presumption was that when the description was from an independent third party, the information should be considered to be more reliable compared with the same description obtained from the client's credit manager, as the latter has more incentive to give a biased description. Their empirical results did not support the premise that auditors were sensitive to source independence when carrying out a task. However, in a another experiment that employed a within-subjects design, i.e. where auditors were performing two tasks successively with different levels of source reliability, auditors were sensitive to source reliability as hypothesized.

Subsequent studies have found more support for auditors' sensitivity to source credibility. Rebele, Heintz and Briden (1988) found that when estimating the amount of uncollectible accounts, auditors placed significantly more reliance on information received from a more competent source than on information received from a less competent source. Further, Hirst's (1994) results in an inventory misstatement task evidenced that both source competence (specialist/non-specialist) and independence (other auditor/CFO) influenced auditors' misstatement estimates. Similarly, Goodwin and Trotman (1996) found in an asset revaluation task that when information came from a less competent source, auditors planned to use more audit hours for audit evidence gathering than if the source was perceived as more competent.

Anderson, Koonce and Marchant (1994) investigated whether the competence of management (low or high) influenced auditors' judgments about the reliability of management explanations of unexpected fluctuations. It was also studied if the timing of competence information (before or after the explanation) affected judgments. Their results indicated that auditors were sensitive to the competence of information but that the timing of the information did not affect judgments. Interestingly, the answer of the control group (i.e. those who did not receive information about the competence of management) was significantly different from that of the low competence group, but not significantly different from that of the high competence group. This finding suggests that auditors may generally deem management as competent if there are no opposite indicators of this.

An auditor's assessment of the integrity of the information source may particularly affect how information is processed. Goodwin (1999) studied whether audit evidence was evaluated differently if the source was internal (management) or external. The consistency of other information with the integrity of the information source was also studied simultaneously. In two tasks (probability of lawsuit and overstatement of inventory), the integrity of the information source was manipulated by two levels (low or high). The results indicated that auditors were sensitive to the integrity of the information source regardless of whether it was internal or external. The study also provided evidence that auditors were even more concerned about source integrity when the other information was inconsistent with the information from the actual source.

Further, Krhisnamoorthy, Mock and Washington (1999) used four belief revision models to show that auditors were sensitive in their judgments to differences in the reliability of internal control system. Glover, Jiambalvo and Kennedy (2000) found that when management did not justify extensively unexpected fluctuation and had an explicit incentive to misstate the reason of the fluctuation, the majority of auditors planned to acquire additional information compared with the other three experimental conditions where the level of justification and presence of incentive varied.

In addition to the independence, competence and integrity of the source, the degree of personal involvement in the information processing stage might also affect how the credibility of the information source is perceived. Reimers and Fennema (1999) expected that less involved auditors (reviewers of work papers) pay less attention to the details of information compared with more involved auditors (preparers of work papers), but that reviewers are more sensitive to general persuasiveness, i.e. the credibility of the information source. Their experimental results in an accounts receivable task supported the expectation that reviewers were more sensitive to the credibility of the information source.

3.4.3 Presentation mode

Presentation mode refers to the form in which the information is presented to the decision-maker (Bonner 2008). For example, in many cases the piece of information can be presented in either a graphical or a tabular format. Research has investigated whether presenting the same piece of information in different formats affects how information is acquired or how task-specific judgments are made.

Presenting data graphically instead of in a tabular format may result in better judgments in tasks that require information to be compared for two reasons. First, it may help information acquisition by reducing cognitive efforts when information is presented more concisely and in meaningful patterns. Thus, information can be more easily and quickly interpreted, which enables an auditor to direct more cognitive resources towards advanced information processing. Second, graphical data may thus reduce the cognitive efforts needed to correctly weight and combine information into a judgment (Wright 1995).

Few studies have investigated how information presentation affects auditors' JDM. While no studies have investigated how presentation mode affects auditors' information acquisition, some have examined how different information formats affect task-specific judgments. Thus, these results give suggestions for how presentation mode affects information usage.

Studies examining presentation mode have found generally mixed results, although they have evidenced some benefits of a graphical over a tabular format. An early study by Ricchiute (1984) evidenced that auditors are most likely to adjust audits when information is presented in a written format instead of discussed orally. Kaplan (1988) examined whether the presentation mode of the previous year's accounts affected auditors when they were asked to estimate the same account's next year's value. Presentation mode was either graphical or tabular. The results showed no evidence that presentation format significantly affected subjects' expected value judgments.

Anderson and Reckers (1992) extended Kaplan's (1988) study by creating a more realistic estimation task. In their study, expected sales value was evaluated with ratio analysis instead of simple trend analysis. To make a ratio analysis, subjects had first to establish a historical relationship of sales with five other variables, i.e. find the best variable that correlates with sales. The results showed that the graphical display of data led to better judgment performance and confidence compared with tabular data.

Schulz and Booth (1995) provided more variables and a longer data period for a similar estimation task. Their results provided evidence that graphically presented data leads to the more accurate prediction of sales accounts than tabularly presented data. Inconsistent with the findings of Anderson and Reckers (1992), they found that auditors with graphically presented data were no more confident about their predictions compared with subjects in the tabular group. However, graphically presented data led to greater information processing efficiency, as the time spent on the task decreased.

In an inherent risk assessment task, Dilla and Stone (1997) showed that representing cues in quantitative (financial) instead of qualitative (nonfinancial) form increased consensus in auditors' information processing and decreased the time to process cues. In an internal control evaluation task, Bierstaker and Brody (2001) found that additional flowcharts over the narrative description of internal controls did not increase judgment accuracy, i.e. presentation format had no effect on auditors' judgments.

3.4.4 Irrelevant information

The audit environment usually contains a lot of information, and some information is relevant for a specific task, whereas other information is not. One stream of research has examined how the presence of irrelevant and relevant information affects auditors' judgments and their decision-making processes. Specifically, these studies have examined whether auditors are susceptible to the so-called dilution effect. The dilution effect occurs when the presence of irrelevant information leads to less extreme decisions when presented together with relevant information (Hackenbrack 1992). The theory behind the dilution effect assumes that the presence of irrelevant information cues (with relevant information cues) diminishes the similarity of the situation compared with decision-makers' mental models of a problem (Bonner 2008). Thus, increased dissimilarity dilutes the judgment, as the current situation is not identical to the mental image of a typical situation.

The pioneering study by Hackenbrack (1992) was the first to assess the dilution effect in auditing. In this study, auditors were given two fraud-risk assessment tasks; the first task included both relevant and irrelevant information and the second included only relevant information. The results indicated strong support for the dilution effect, as auditors' fraud-risk assessments became less extreme when irrelevant information was present. By contrast, irrelevant information has mainly been studied with other variables, i.e. interaction effects. These studies are presented in the next chapter.

A closely related factor to irrelevant information is redundant information. For example, an information cue might be repeated several times because of media coverage (Joe 2003). Thus, the repetition of information can be seen as irrelevant information, as it is has no informative value to the decision-maker after it has been presented once (Bonner 2008). Typically, an auditor may be exposed to information redundancy when there are multiple information sources that the auditor considers to be relevant. Joe (2003) investigated how the press coverage of client debt default was associated with the increased likelihood of modified audit opinions, even though this information was already known by the auditor. The study had two competing hypothesis for the reason for this. The first explanation was that auditors might react to this overlapping information to mitigate their perceived litigation risk (strategic hypothesis). The alternative explanation was the cognitive reason that the high salience of debt default leads auditors to conclude that the firm has a higher probability of failure (cognitive hypothesis). The experimental results showed that auditors modified their audit opinions because of the cognitive hypothesis, meaning that they were prone to redundant information because of biased information processing.

3.4.5 Information types

Some studies have considered how information types affect information acquisition and processing. Information types have been categorized in these studies into two classes: financial and nonfinancial information. Financial information refers to quantitative information such as financial statements, cash flow charts and ratios. This information is usually readily available for an auditor as it is produced in a client firm. Nonfinancial information refers to qualitative information outside financial statements and footnotes (Cohen, Krishnamoorthy & Wright 2000; Brazel, Jones & Zimbelman 2009).

It has been suggested that financial information acts as a primary information source in many audit tasks, e.g. materiality judgments, risk assessments, analytical procedures and going-concern decisions (Krogstad, Ettenson & Shanteau 1984; Mutchler 1986; Rosman, Seol & Biggs 1999; Cohen, Krishnamoorthy & Wright 2000). This is expected to arise because auditors' education and training places emphasize financial information (Cohen, Krishnamoorthy & Wright 2000). However, some studies have found that nonfinancial information is also important in certain audit tasks.

First, nonfinancial information has been suggested to act as corroborating evidence for financial information in some audit tasks. Cohen, Krishnamoorthy and Wright (2000) investigated how financial and nonfinancial information are used in two analytical review tasks: establishing the level of audit scope and generating hypotheses for unusual fluctuation. In the former task, their results indicated that auditors place more reliance on financial trends than on nonfinancial trends. The study found that auditors mainly use nonfinancial information as corroborating evidence in this task. Thus, by using nonfinancial information, an auditor can be more convinced about the financial information's accuracy and consistency. However, in the hypotheses generation task, auditors generated an equal number of hypotheses when either financial or nonfinancial information indicated a decline. This finding suggests that auditors value both information types equally important in this task.

Second, nonfinancial information can also supplement financial information. In going-concern tasks, forward-looking nonfinancial information can be used to predict future financial information (Arnold & Edwards 1993; Behn & Riley 1999). For example, a general prediction of poor economic conditions is visible much later in the firm's financial statements than in the surrounding environment, where an auditor can acquire this cue first.

Changes in a task's problem representation may lead to different acquisitions of financial and nonfinancial information. Rosman, Seol and Biggs (1999) hypothesized that different task settings, stages of organizational development (start-up or mature) and financial health (bankrupt or non-bankrupt) affect auditors' information acquisition and judgment in going-concern tasks. The results indicated that information acquisition was sensitive to different task settings. Specifically, in start-up (mature) company treatments, auditors acquired more nonfinancial (financial) cues when they needed additional information for the judgment. However, in both organizational development levels, auditors acquired more mitigating (i.e., cues that decrease the threat of continued existence) financial cues than mitigating nonfinancial cues. Thus, financial information dominated nonfinancial information in this part of the task.

3.5 Interactions

Considerable studies of auditors' information acquisition and usage have investigated interactions between factors from the four categories discussed above. In general, the majority of these studies has examined whether the presence of mitigating factors (e.g. auditor experience, accountability) decreases information acquisition and usage-related judgmental biases that are caused by the presence of a known negative phenomenon (e.g. recency, high time pressure). From these mitigating factors, auditor experience has received most attention in the previous literature. Consequently, in the section 3.5.1 all interaction studies with individual factors except one study have examined whether the effects of other factors are conditional on auditor experience. In the section 3.5.2, interactions with environmental factors are presented. Those studies have mainly investigated the effect of accountability in mitigating or exacerbating cognitive biases related to information acquisition and usage. Rest of the studies in this section have examined time pressure and client risk with cue-related factors. Finally, section 3.5.3 presents a miscellaneous interaction between cue-related and task-related factors.

3.5.1 Interactions and individual factors

Studies of auditor experience have the general premise that experienced auditors are less susceptible to different biases in their information acquisition and usage, because they have superior domain- or task-specific knowledge and better problem-solving schemas than less experienced auditors. In many studies, these properties are expected to lead to better information acquisition and processing, and this is expected to be one of the determinants that explain the better overall JDM quality of the experienced auditors. However, not all studies have found these hypothesized interactions.

Time pressure (environmental factor) and auditor experience

The studies of time pressure and auditor experience have expected that experienced auditors suffer less from moderate or high time pressure than less experienced auditors. Cianci and Bierstaker (2009) expected that less experienced auditors are more susceptible to time (budget) pressure than experienced ones. It was reasoned that experienced auditors have greater cognitive resources, better mental representations of the task and more sensitivity to the legal environment, which helps them mitigate time pressure effects. The results brought some evidence supporting this expectation, as negative internal control information was evaluated differently by less experienced auditors under high time pressure. However, the evaluation of positive internal control information and final judgments were not affected by experience.

Two studies where tax auditors were the subjects have suggested that when auditors are experienced the presence of time pressure increases the usage of more important[14] information. In both these studies, it was expected that experienced tax auditors' advanced knowledge structures allow them to selectively attend to more important information under high time pressure. By contrast, because less experienced tax auditors lack this proper knowledge, they were expected to be less able to change their search behavior under high time pressure.

Spilker (1995) measured how tax professionals' type of knowledge (declarative/procedural) and time pressure affected information acquisition. Declarative knowledge was defined as knowledge of facts and concepts and procedural knowledge[15] as knowledge about how to perform a task. The results indicated that when subjects had significant procedural knowledge they acquired more crucial information than subjects who had only declarative knowledge. Similarly, subjects with declarative knowledge acquired more crucial information than subjects who had little or none of either type of knowledge. When examined jointly with time pressure, the procedural knowledge group acquired more crucial information than the declarative knowledge group under moderate time pressure than under low time pressure. By contrast, subjects who had little or no declarative or procedural knowledge acquired less crucial information under moderate time pressure than under low time pressure.

Spilker and Prawitt (1997) extended Spilker's (1995) study by measuring the time utilization of tax auditors under time pressure. They hypothesized that experienced tax auditors adapt better to time pressure than less experienced ones. Specifically, it was expected that experienced tax auditors use less time in each phase of the task, i.e. problem representation, re-reviewing initial problem and information search than less experienced tax auditors. However, the empirical results

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[14] Spilker (1995) used the term "relevant" for this information in his study, but he did not implicitly state that the rest of the information was totally irrelevant.

[15] It is reasonable to assume that procedural knowledge is acquired through task-specific experience.

indicated that experienced subjects spent less time only information searching, as they focused on more important information under high time pressure.

Information order (cue-related factor) and auditor experience

The findings of several auditing studies have indicated that experience may mitigate the recency effect. These studies have assumed that experienced subjects are generally more familiar with various tasks, and therefore their increased confidence of the initial impression of a problem makes them react less strongly to the contrasting cues they encounter (Messier & Tubbs 1994; Trotman & Wright 1996). Less experienced auditors' cognitive strain may also mean that they cannot process large amounts of information simultaneously, which leads them to employ information processing strategies that cause more easily recency bias (Kennedy 1993; Trotman & Wright 1996).

In a going-concern task, Kennedy (1993) did not find the recency effect for audit managers, whereas students displayed it strongly. Thus, students who received information in a positive/negative order judged the likelihood of failure to be greater than subjects who received information in the opposite order. In an accounts receivable task, Messier and Tubbs (1994) used audit seniors and managers as subjects and found that managers were less exposed to the recency effect.

By contrast, Krull, Reckers and Wong-On-Wing (1993) found that when subjects faced fraud signals in the writedown of an inventory task, increased experience raised exposure to the recency effect. Their experiment provided very little background information to subjects and expected experienced auditors to better recognize the inadequacy of the initial information and therefore emphasize subsequent information compared with less experienced auditors. Thus, the increased usage of subsequent information may have caused greater order effects. The second explanation for the results was that between-treatment subjects varied only slightly in their experience (managers vs. senior managers).

Information order, task complexity (task-related factors) and auditor experience

One study has examined the three-way interaction between information order, task complexity and auditor experience. The belief adjustment model (Hogarth & Einhorn 1992) predicts that the recency effect continues to bias experienced auditors' decisions, as experience only mitigates the degree to which experience reduces task complexity (Arnold et al. 2000). Trotman and Wright (1996) studied this issue in two tasks, namely internal control evaluation and going-concern tasks, which were defined as less and more complex tasks, respectively. Their subjects consisted of students, audit seniors and audit managers. The results indicated that students displayed a significant recency effect in both tasks, while seniors displayed the recency effect only in the going-concern task. However, contrary to the predictions of the belief adjustment model, managers did not display the recency effect in either task.

Irrelevant information (cue-related factor) and auditor experience

Experienced auditors may also be able to better ignore irrelevant information than less experienced auditors. As suggested in the experience literature generally (see e.g. Choo 1989), experienced auditors employ directed information acquisition strategies and have advanced knowledge structures, which may help them ignore irrelevant information in the audit environment. Shelton (1999) specifically hypothesized that the better knowledge of task-specific relevant cues may help prevent the influence of irrelevant cues in decision-making. In her study, experienced subjects were audit partners or managers and less experienced subjects were audit seniors. The results indicated that less experienced subjects' going-concern judgments were significantly influenced by irrelevant information, while experienced subjects' judgments were unaffected by the presence of irrelevant information.

Presentation mode (cue-related factor) and auditor experience

Compared with the above studies examining experience's interaction effects, studies of presentation mode have not focused on any specific judgmental bias. Instead, they have investigated whether presenting information in one particular format diminishes judgment quality-related differences between more and less experienced auditors. However, there exists little empirical evidence showing that presentation mode and experience interact in auditors' information processing. In Bierstaker and Brody (2001), subjects needed to evaluate the quality of the internal control system, where one group had a narrative description of internal controls and the other group was given an additional flowchart of these controls. While the flowchart was considered to be overlapping information with the narrative description, it was expected to interact with experience (no direction was hypothesized). The study failed to find any interaction effect. However, experienced auditors outperformed less experienced auditors regardless of the used documentation format.

Anderson and Mueller (2005) examined the interaction between experience and presentation mode in two analytical review tasks. Subjects were audit seniors and accounting students. The presentation mode of given information varied between tabular and graphical formats. In the first task, subjects were asked to predict correlations between income statement accounts and related factors that were correlated with the accounts. The results indicated that students benefited more when information was presented in a graphical format instead of in a tabular format. While both subject groups were more accurate with graphical data, auditors outperformed students only in the tabular information group. The finding was explained by the argument that auditors had more previous experience with tables only, but not with graphs.

In a second task, subjects were asked to predict the future value of a sales account. The results showed again that both subject groups were more accurate with graphical data, but that experience had no effect on performance. It was concluded that the second task was less complex than the first task and that it did not require the deep information processing of tabular information as the previous task.

Information types (cue-related factor) and auditor experience

Krogstad, Ettenson and Shanteau (1984) investigated how auditors and students utilized financial and nonfinancial information in materiality judgments. The results indicated that auditors consistently focused on the effect on net income (one of the financial cues), but also used various nonfinancial information to fine-tune their judgments. By contrast, students did not concentrate on any single cue and they used considerably more nonfinancial cues than financial cues. However, the overall mean number of cues did not vary between auditors and students, indicating that less experience does not always increase the number of used cues.

Presentation mode (cue-related factor) and confirmation bias

A recent study by Ricchiute (2010) argued that whether auditors search confirming or disconfirming information is conditional on the details of the information. The results from financial restatement-related tasks suggested that when information is presented in a detailed format instead of in a summary format (as used in many previous studies), auditors tend to start their information searches by looking for disconfirming information (i.e. information that contradicts the accounting in previous financial statements) from the given material.

3.5.2 Interactions and environmental factors

In this section, the interactions related to environmental factors that have no individual factors are presented. The second most common factor in interaction studies, albeit much less studied than auditor experience, is accountability. These studies have hypothesized that accountability either mitigates or exacerbates judgmental bias, depending on the interacting factor. However, the empirical results have mainly evidenced only the positive effects of accountability as an interacting variable. Another factor that has been studied more than in one interaction study is time pressure. Specifically, these studies have evidenced that the existence of time pressure has positive effects in decreasing irrelevant information.

Information order (cue-related factor) and accountability

Two studies have found strong evidence that the presence of accountability acts as a debiasing mechanism for the recency effect. Kennedy (1993) hypothesized that those decision-makers who are accountable for their judgments exert more effortful information processing that may overcome the recency effect. The study had three experimental groups: pre-accountability, post-accountability and no-accountability. Subjects in the pre-accountability group knew before information evaluation that their judgments would be reviewed, while subjects in post-accountability were told this after information evaluation, but before the likelihood judgment of firm failure. The results indicated that the judgments of subjects in the pre-accountability group showed no exposure to the recency effect, while the other groups were affected. However, the difference in the magnitude of the recency effect between the post-accountability and no-accountability groups was only marginal.

Cushing and Ahlawat (1996) examined how the documentation requirement affected the recency effect in a going-concern judgment. The documentation requirement was expected to increase overall effort in decision-making, especially increasing attention, comprehension and the recall of important information. In the experiment, some subjects had to write a memorandum to the senior partner to provide reasons to support their report choices. The results showed that subjects who had a documentation requirement did not display the recency effect at all, while the no-documentation requirement subjects were susceptible to recency bias.

Irrelevant information (cue-related factor) and accountability

Few studies have suggested that additional effort caused by the presence of accountability increases proneness to process all available information without considering its relevance. Hoffman and Patton (1997) hypothesized that accountability exacerbates the dilution effect in fraud-risk assessments. Their empirical results did not confirm the expected exacerbation effect but evidenced that auditors were susceptible to the dilution effect regardless of the presence of accountability. Likewise, Glover (1997) hypothesized that increased effort and attention encourage auditors to employ more integrative and complex thinking in information processing that would cause a greater dilution effect. However, the study did not find that accountability increased the use of irrelevant information in RMM assessment tasks. By contrast, Cloyd (1997) found that accountability improved tax auditors' abilities to filter out irrelevant information. However, the positive effect was only limited to subjects who possessed high knowledge of the relevant tax rules.

Irrelevant information (cue-related factor) and time pressure

Few studies have suggested that moderate time pressure has positive effects on audit efficiency and judgment quality. Glover (1997) found in an RMM assessment task that when time pressure increased from a low to a moderate level, auditors' utilization of irrelevant audit information decreased. This finding suggests that moderate time pressure sharpens auditors' focus on a smaller set of information that reduces the acquisition of irrelevant information. However, Choo's (1995) results in an audit confirmation-related task evidenced that when time pressure shifted to a high level, the usage of relevant cues also decreased along with irrelevant cues.

Information reliability (cue-related factor) and client risk

Alexander (2003) found that the perceived risk of engagement could interact with source credibility in certain circumstances. In this study, the perceived risk of the engagement variable was included as a control variable. It used a tax consulting domain to investigate simultaneously how the competence of the information source and the source's incentives to be honest affect tax auditors' information acquisition. The results showed that tax auditors responded to a more competent source by performing less detailed information acquisition, but this tendency decreased when the source had incentives to be less honest. However, the perceived risk of engagement was found to be an intervening variable in the experiment.

When engagement risk was considered to be low by a subject, auditors relied on more competent sources. When the risk was perceived to be high, less competent sources were trusted more. This mixed finding was explained by the fact that the incentives of the information source dominated the competence of the source.

3.5.3 Interactions and task-related and cue-related factors

Task complexity (task-related factor) and presentation mode (cue-related factor)

Wright (1995) suggested that how information presentation affects judgment accuracy depends on task complexity. It was hypothesized that an additional graphical summarization of the information leads to more accurate judgments than bare tabular information. However, graphical data were expected to improve performance only when the task was highly complex. This is because highly complex tasks requiring additional effort and graphical data help free up cognitive efforts for information acquisition and processing. The experiment consisted of three loan collectability-related judgments. Each judgment was from a different task complexity level. The results confirmed the expectations that additional graphical information was beneficial only in the most complex task by allowing for unbiased estimates to be made.

3.6 Conclusions about the studies

The studies presented in the above sections show that many factors affect both consciously and unconsciously auditors' information acquisition and usage in varying audit tasks. The results of these studies suggest at least the following four conclusions.

First, some studies of environmental and cue-related factors suggest that the amount and direction of auditors' cognitive efforts in single audit tasks depend on whether particular factors are present in a decision-making situation. For instance, studies (e.g. McDaniel 1990; Asare, Trompeter & Wright 2000) have shown that a moderate time pressure or the presence of accountability leads auditors to perform more efficient or effective information acquisition and usage than would occur otherwise. Furthermore, studies of the effect of presentation mode (e.g. Anderson & Reckers 1992; Schulz & Booth 1995) suggest that graphical data allow users to direct cognitive efforts from more simple information processing activities to more critical task activities.

Second, several results of the studies of individual and cue-related factors indicate that auditors' cognitive limitations affect information processing. For instance, studies of confirmation bias (e.g. McMillan & White 1993) and the order of information (e.g. Asare 1992) show that auditors are susceptible to judgmental bias. Furthermore, studies of task complexity (Simnett & Trotman 1989; Simnett 1996) show that the information processing limitations of an auditor constrain performance in complex audit tasks. Overall, these studies have found various factors that intervene negatively in auditors' information processing, indicating that the substance of information is not the only determinant of auditors' JDM. Those factors are also likely to decrease JDM quality (e.g. Earley 2002).

Third, studies of individual and environmental factors indicate that auditors' information acquisition and usage are responsive to different directional goals in the audit environment. For instance, the studies by Blay (2005) and Guiral, Ruiz and Rodgers (2011) indicated that auditors' information acquisition and processing is adjusted according to the pressure to favor client preferences or maximize future audit rents. In addition, while individual factors, like motivated reasoning and confirmation bias, decrease audit effectiveness (i.e. decision accuracy), they can also increase audit efficiency if biased information acquisition leads to the decreased usage of available information. Furthermore, increased time pressure may lead to the client-preferred evaluation of the information, enhancing audit efficiency, but at the same time, it may compromise audit effectiveness in some degree (Braun 2000; Cianci & Bierstaker 2009). In addition, studies have shown that the presence of accountability leads to less objective information evaluation when the reviewer's preference is known before the judgment, as subordinates seem to adjust their judgments towards this preference (Peecher 1996; Turner 2001). Thus, the results of these studies suggest that various directional goals and surrounding preferences play an important role, not only in making final decisions but also in the preceding information acquisition and usage process. However, biased information processing, similar to motivated reasoning, can happen unconsciously by the auditor (Wilks 2002).

Finally, the results of interaction studies indicate that a relatively large number of factors from different categories interact with each other. In particular, these studies have produced a considerable amount of evidence that auditor experience and the presence of accountability mitigate or even reduce judgmental biases related to information acquisition and usage. For instance, these results suggest that the influence of irrelevant information (Shelton 1999) and the recency effect (Kennedy 1993) on audit judgment is eliminated when a task is performed by an experienced auditor or accountability is present, respectively.

Furthermore, interaction studies have documented that initially unseemingly related factors interact with each other in information acquisition and usage. For instance, studies have found evidence that the impact of irrelevant information on audit judgments is revoked under moderate time pressure (Glover 1997) and that the graphical format of information is beneficial only in complex audit tasks (Wright 1995). Overall, the results of interaction studies give valuable insights when estimating whether and to what extent judgmental bias is likely to exist in a mundane audit environment.

4 FACTORS AND HYPOTHESES DEVELOPMENT

As concluded in Chapter 3, previous research has recognized a considerable number of factors that affect auditors' information acquisition and usage. More importantly, these studies have shown that different types (i.e. factors from different categories) of factors interact with each other and that the observed interactions have explained auditors' information acquisition and usage behavior in the decision-making process (see Chapter 3.6). Despite the evident importance of the topic, several factors and their interactions have been studied only unilaterally in an audit context. Many previous studies have only focused on examining whether the existence of a particular factor changes the processing of information and consequently task-specific judgments. For instance, previous studies (e.g. Anderson, Koonce & Marchant 1994; Goodwin 1999) have shown that auditors adjust their task-specific judgments depending on the reliability of client-related information. Anyhow, these studies have not examined whether an auditor needs more information to make a judgment or process it in a more effortful way when it is less reliable. Thus, the notion that many factors influence auditors' information usage in a single audit task has been insufficiently addressed in previous studies.

4.1 Factors for the empirical analysis

As noted before, this study aims to shed light on the gaps in the auditors' information usage literature. To select relevant factors they were first classified into four categories in previous chapters. This categorization makes it possible to consider the decision-making process-affecting factors in a broad manner i.e. so that all the significant aspects of these factors are included into one analysis. This is done by selecting one factor from each category to represent the category in question. This approach enables us to gain insights into how different types of factors interact with each other in a mundane decision-making environment, where auditors are constantly and simultaneously surrounded by a vast number of environmental, task-related and cue-related factors. To further analyze information usage in auditors' decision-making processes the main interactions between the selected factors are also included in the analysis. In the following paragraphs, the selected factors and rationale for their selection are presented.

Individual factor: *Auditor experience*

Auditor experience is clearly the most studied single individual factor (see Chapter 3.1). A vast amount of auditing literature indicates that experienced auditors' information acquisition and usage differs from less experienced auditors in several ways. For example, previous studies have suggested that experienced auditors acquire less information and process information more efficiently (e.g. Davis 1996; Moroney 2007) than less experienced auditors. These observed differences have been suggested to stem from experienced auditors' advanced information acquisition strategies (Biggs & Mock 1983) and well-developed knowledge of tasks (Waller & Felix 1984; Choo & Trotman 1991). Furthermore, as concluded in Chapter 3.6, the effect of many previously investigated factors on information usage is conditional on the level of auditor experience. Thus, owing to the strong theories from the psychology literature and previous empirical findings, auditor experience has been selected to represent individual factors in the empirical analysis.

Environmental factor: *Client risk*

Professional auditing standards e.g. ISA 330 (IFAC 2009a) emphasize that auditors should carry out procedures designed to reduce client risk to an acceptably low level. According to theoretical predictions, as client risk increases, the level of audit effort should also increase (Sharma, Boo & Sharma 2008). Previous studies (e.g. Mock & Wright 1993; Houston, Peters & Pratt 1999; Beaulieu 2001) have generally found that auditors adjust their information acquisition plans at an audit engagement level depending on client-related risks and have found that the presence of risk factors increases demand for additional audit evidence. Despite the importance of risk in the auditing context, previous research has rarely addressed the influence of risk on auditors' information usage behavior in a single audit task. In this study, risk has been selected to represent environmental factors in the empirical analysis. The present study employs one measure of client risk, namely RMM, which is an integrated measure of the different types of audit client risks. It can be formed based on source-based risk factors, i.e. inherent and control risks, or type-based risk factors, i.e. error and fraud risks (Popova 2008). Thus, RMM is a combined risk measure that should affect how auditors plan their audit procedures, e.g. the nature, timing and extent of audit evidence acquisition (Messier 2003). When RMM increases, auditors are expected to adjust these procedures, especially increasing their evidence acquisition. However, it is unknown how auditors adjust their information usage behavior in a single audit task when RMM is high. For example, auditors can acquire additional information, use more effort to find information or do both to mitigate increased uncertainty.

Task-related factor: *Task structure*

In this study, task structure has been selected to represent task-related factors in the empirical analysis. According to Bonner (1994) task structure is the other dimension of task complexity, while the task difficulty is the other one. While the task complexity overall has been recognized in many studies as an important factor that affects auditors' JDM quality (Abdolmohammadi & Wright 1987; Simnett & Trotman 1989; Simnett 1996; Tan & Kao 1999; Tan, Ng & Mak 2002), apart from the studies by Simnett and Trotman (1989) and Simnett (1996), the effect of different task complexity dimensions (i.e. structure or difficulty) on information acquisition and usage has been exiguously studied. This study focuses on a task complexity dimension, namely task structure, while trying to keep the task difficulty dimension constant between the studied tasks. It is important to distinct these dimensions of task complexity from each other as changes in them might have opposite consequences to the information usage[16].

Task structure is an important task dimension, as less structured tasks are more demanding for a decision-maker than more structured tasks and because the level of structure is likely to affect audit judgment quality (Abdolmohammadi 1999). By definition, when a task structure changes from more structured to less structured, important task-specific information becomes less specified or less clear (Abdolmohammadi & Wright 1987). Consequently, a decision-maker may compensate for increased information uncertainty in less structured tasks through more extensive information usage than in more structured tasks. This study addresses empirically this issue in the auditing context.

Cue-related factor: *Information reliability*

An auditor must take into account the various properties of information when acquiring it. For instance, auditors must consider information cost, relevance and reliability. In this study, information reliability has been selected to represent cue-related factors in the empirical analysis.

Previous studies (e.g. Hirst 1994; Anderson, Koonce & Marchant 1994; Goodwin 1999; Glover, Jiambalvo & Kennedy 2000) have widely demonstrated that audi-

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[16] For example, Ford et al. (1989) suggests that increase in *task difficulty* increases the use of simplifying information search strategies to make tasks more manageable, i.e. decreases information usage, while the present study argues that increase in a *task structure* has opposite effect. See also Wood (1986) for other definitions of the task complexity.

tors adjust their task-specific judgments depending on information reliability. Some (Goodwin & Trotman 1996; Glover, Jiambalvo & Kennedy 2000) have found that when management-provided information is less reliable, auditors tend to be more skeptical towards their clients and plan to increase their information gathering in subsequent tasks. However, these studies have not examined whether an auditor needs more information for making judgments or whether they process information in a more effortful way when it is less reliable.

In summary, three factors – RMM, task structure and information reliability – have been chosen for this study's empirical investigation, as how they affect auditors' information usage behavior in a single audit task has been virtually unstudied. In addition, it is important to study their effects on information usage as they are common factors in a mundane audit environment and their levels are likely to vary between audit engagements. Auditor experience has also been chosen as it has been found to be an influential factor alone and an interacting factor in previous studies (see e.g. Chapters 3.1 and 3.6).

4.2 Hypotheses development

In this section, the hypotheses of the study are developed. All selected factors are expected to affect auditors' information usage. Thus, the first four hypotheses of the study concern these main effects. As discussed in previous sections, it is suggested that many influencing factors on information usage might be conditional on the level of auditor experience. Therefore, this study builds three interaction hypotheses where the effects of auditor experience on the factors' main effects are examined.

4.2.1 Hypothesis 1 – Auditor experience

The majority of previous audit studies have found that experienced auditors use less information than less experienced auditors. Bédard and Mock (1992) found that experts utilized less information in control evaluations than novice auditors. Simnett (1996) found that experienced auditors selected fewer ratios in going-concern assessment than less experienced auditors. Similarly, Davis (1996) found that experienced auditors based on their previous knowledge of decision-making situations weighted cues more unequally and selected fewer information cues than less experienced auditors.

These observed differences may occur for several reasons. First, the more accurate problem representations of experienced auditors may sharpen finding and interpreting important information more efficiently than the undefined problem representations of less experienced auditors (Moroney 2007).

Second, the research has demonstrated that experienced auditors are able to ignore irrelevant information better than less experienced auditors (Glover 1997; Shelton 1999). Experienced auditors may also focus on one type of information that decreases overall information usage. Krogstad, Ettenson and Shanteau (1984) found that students used more nonfinancial information than auditors.

Third, experienced auditors may already have more knowledge in their memories, which they can rely on (Bonner 2008). Thus, they are exempted from external information acquisition. Further, experienced auditors may have useful benchmark data in their memories for interpreting the problem at hand. For example, Butt (1988) showed that experienced auditors had better frequency information about the existence of errors in financial statements than less experienced ones.

Fourth, experienced auditors' knowledge of correlations between information cues in a task may also decrease information usage. If information cues are *ex-ante* known to be highly correlated, then additional information may not be used, because it is presumed not to have a positive effect on judgment quality (Bonner 2008). By contrast, when an auditor lacks knowledge on important task-specific information, then the correlations might not be properly recognized before conducting the task and all available information will thus be acquired.

Finally, general information acquisition and usage strategies may vary by experience level. Experienced auditors are suggested to apply a goal-oriented, directed evaluation of audit evidence in their information search processes (Hoffman, Joe & Moser 2003). They also use more rules of thumb and structured checklists in information search processes, whereas less experienced auditors use only simple sequential searches (Davis 1996). Experienced auditors may even have an internal "checklist" as a guideline for the search process (Bonner & Pennington 1991). Further, it is suggested that highly experienced professionals are able to recognize relevant information patterns by recalling similar situations encountered earlier (Lehmann & Norman 2006). Knowledge of typical accounting and control systems drives experienced auditors in information search, instead of less experienced auditors who usually acquire information in the order in which it is presented (Davis 1996).

Thus, it is expected that in experimental decision-making task less experienced subjects use more extensively information[17] than experienced auditors. The above discussion leads to the first empirically testable hypothesis:

> H1: Less experienced auditors use the available information in decision-making more extensively than experienced auditors.

4.2.2 Hypothesis 2 – RMM

Generally, an auditor has several options when encountering an audit client with high RMM. The auditor may try to get rid of this client, compensate for it by carrying out additional audit procedures or bill fee premiums to cover the possible consequences of loss of reputation or litigation (Johnstone 2000). If the auditor decides to retain the high risk client, performing additional audit procedures is usually necessary.

Previous research has investigated how auditors conduct audits depending on client risk factors. One stream of research has investigated how audit resources are allocated when there exist risk factors or the assessment of overall risk has changed. The focus of these studies has been on how the perceived level of inherent and/or control risk affects subsequent audit planning decisions.

Some archival studies (Mock & Wright 1993; 1999) have found that changes in client risk factors have only a minor impact on general audit planning decisions. Other such studies (O'Keefe, Simunic & Stein 1994; Hackenbrack & Knechel 1997) have found that the level of inherent risk (but not control risk) affects staff work hours. Audit staff work usually includes collecting audit evidence (Hackenbrack & Knechel 1997). Johnstone and Bedard (2001) found that in the initial engagement planning stage, clients with error risk factors were more likely to be tested more intensively than other clients. In behavioral studies, the strong link between an auditor's risk judgments and audit planning has been demonstrated. Gaumnitz et al. (1982) provided evidence that auditors' evaluations of internal control riskiness influenced their judgments of the audit hours used to accomplish the task. Kaplan (1985) reported that high inherent risk and high control risk jointly (i.e. RMM) increased significantly the number of planned audit hours compared with when both risks were low.

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[17] In the present study term ”the more extensive use of information” refers to spending more time for reading, combining and evaluating of cues and/or acquiring greater number of information cues

Another stream of research (Houston, Peters & Pratt 1999; Beaulieu 2001) has investigated specifically how client riskiness affects audit evidence. Houston, Peters and Pratt (1999) found that when there was unintentional, inconsistent accounting treatment, auditors planned to acquire more audit evidence. Beaulieu (2001) found that auditors' judgments of a prospective client's CFO integrity were linked to the recommendations of audit evidence amount. The results specifically indicated that when the CFO was perceived as dishonest, auditors planned to collect more audit evidence and vice versa (i.e. evidence collection judgments were adjusted in response to client integrity). Blay, Sneathen and Kizirian (2007) used archival data from audit engagements to show that auditors' assessments of RMM were associated with their evidence searches.

There are at least four arguments for high risk increasing information usage in a single audit task. First, high RMM may prompt auditors to act more conservatively[18] in a decision-making process, which ultimately aims to minimize economic losses (Smith & Kida 1991; Mueller & Anderson 2002). Alternatively, high RMM may cause auditors to demonstrate greater professional skepticism than they do usually (Shaub & Lawrence 1996; Quadackers, Groot & Wright 2009). Consequently, auditors who show increased professional skepticism have been shown to acquire more information (Hurtt, Eining & Plumlee 2008). Increased conservatism and/or professional skepticism can also trigger auditors to increase effort for the task, particularly leading to more extensive information processing in order to find errors or inconsistencies between different cues.

Second, high RMM may change auditors' problem representations of a task. It has been found that different problem representations affect subsequent information usage within the same audit task (Rosman, Seol & Biggs 1999). Specifically, because of high RMM auditors may switch to a problem audit representation from a normal audit representation, leading to increased information usage (Waller & Felix 1984; Asare & Knechel 1995).

Third, initially encountered negative characteristics (i.e. high RMM in this case) in audit tasks may cause auditors to display confirmation bias more easily than when neutral/positive characteristics are encountered (Trotman & Sng 1989). If an auditor is susceptible to confirmation bias, she/he may perform extensive information acquisition to find any negative information to support this initial view (assuming that negative information is not instantly found) (McMillan & White

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[18] An auditor's conservatism is defined by Smith and Kida (1991) as follows: *"A tendency to give more attention to, and to be more influenced by, negative information or outcomes"*.

1993). Furthermore, there is also contrary evidence that high client risk may mitigate proneness towards confirmation bias if the risk of litigation is more salient (Kadous, Magro & Spilker 2008). This has also been shown to lead to effortful and balanced information usage (Kadous, Magro & Spilker 2008). Finally, the presence of high RMM may increase the uncertainty of the task outcome and consequently lead to more extensive information usage to reduce this increased uncertainty (Blay, Kadous & Sawers 2012).

To summarize, at the audit planning level earlier research indicates that auditors adjust their audits and plans to increase audit effort depending on client risk (including RMM). In addition, in single audit tasks auditors' cognitive processes related to conservatism, professional skepticism, problem representation, confirmation bias and increased uncertainty suggest that auditors use available information more extensively when client-related risks are high. The above discussion leads to the second empirically testable hypothesis:

> H2: Information is used more extensively in decision-making when RMM is high compared with when RMM is low.

4.2.3 Hypothesis 3 – Task structure

Task structure is a dimension of task complexity that defines how well a task is specified a priori for a decision-maker (Bonner 1994). Performing a task usually consists of three phases of general information processing: input, processing and output. In this connection, task structure specifically refers to a task's different elements in each of these information processing phases, i.e. defines the task's overall structure. These elements are related to information clarity, e.g. cue/procedure/goal specification, cue measurement, magnitude of input/output relations and cue consistency (Bonner 1994).

Previous research in this area has been scarce. Simnett and Trotman (1989) manipulated task structure by giving one- or two-year before-the-event financial ratio information to auditors. They found no evidence that task structure affected the types of ratios chosen by auditors in failure prediction task. However, it is not clear if the finding is related only to that particular task, as the environmental predictability manipulation (i.e. will failure occur in one or two years) of bankruptcy is task-specific.

Following the model of audit task complexity by Bonner (1994), when task structure shifts from structured to unstructured and as the cue, procedure or goal specification becomes less clear, a decision-maker may choose more information to alleviate the uncertainty of less structured tasks. Similarly, when the magnitude of the input/output relations of information is not clear for the decision-maker, she/he may feel that more information is needed to make a judgment.

Abdolmohammadi and Wright (1987) suggested three types of task structures: structured, semi-structured and unstructured. Specifically, in structured and semi-structured tasks there is less uncertainty about important information than in unstructured tasks (Abdolmohammadi & Wright 1987). In addition, the lack of specified procedures in unstructured tasks might cause information usage to be exaggerated if a decision-maker perceives that additional procedures can compensate for this uncertainty. Taken together, when an auditor is performing unstructured tasks, she/he is expected to use information more extensively than in more structured tasks in order to alleviate the anxiety that stems from the increased uncertainty of the important information and the less specified procedures of a task. The above discussion leads to the third empirically testable hypothesis:

> H3: Information is used more extensively in decision-making when a task is less structured compared with when a task is more structured.

4.2.4 Hypothesis 4 – Information reliability

When information is acquired or processed, it is necessary to consider information reliability, as this affects information persuasiveness (Pornpitakpan 2004). In audit research, information reliability has been estimated by source credibility (see Chapter 3.4.2). This is based on the assumption that a highly credible source is more persuasive in decision-making (Pornpitakpan 2004). Thus, it is assumed that information from a more credible source is more reliable than information from a less credible source.

Several studies have examined the effects of source credibility components on auditors' judgments. First, studies of source competence have found that auditors place more weight in their decision-making on information received from more competent information sources compared with when the same information is received from less competent information sources (Bamber 1983; Rebele, Heintz & Briden 1988; Anderson, Koonce & Marchant 1994). In addition, Goodwin and Trotman (1996) found that when information was obtained from the less competent source, auditors planned to use more audit hours for subsequent audit evidence gathering.

Second, the studies of the independence component of source credibility have documented mixed results. Joyce and Biddle (1981) found that auditors were not always sensitive to the information source in an accounts receivable task, while Hirst (1994) found that both source competence and source objectivity influenced auditors' misstatement estimates. Finally, studies (Goodwin 1999; Glover, Jiambalvo & Kennedy 2000) of the integrity component of source credibility have found that auditors are sensitive to the perceived integrity of management. Goodwin (1999) indicated in two separate audit tasks that auditors are always sensitive to the integrity of the information source regardless of whether it from inside or outside of the client. Glover, Jiambalvo and Kennedy (2000) found that when management had an incentive to misstate the reason for an unexpected fluctuation, auditors planned to acquire more additional information than when an incentive was not present.

To summarize, the results of these studies indicate that auditors adjust their judgments depending on information reliability, which stems from varying components of source credibility. From this study's standpoint, the results of Goodwin and Trotman (1996) and Glover, Jiambalvo and Kennedy (2000) are especially important, as they indicate that information from a less competent or low integrity source causes auditors to deem that information to be less reliable and consequently increase plans for additional information acquisition.

From a single audit task perspective, it is suggested that less reliable information is weighted less than more reliable information in decision-making (Kizirian, Mayhew & Sneathen 2005). Specifically, less reliable information has a smaller correspondence between information signal and the resulting outcome compared with more reliable information (Knechel & Messier 1991). Therefore, auditors might compensate for the smaller persuasiveness of less reliable information by acquiring more information (i.e. increasing the depth of search) or processing it in a more effortful way to assess its usefulness (i.e. finding out its information value).

Furthermore, it is important to note that the whole information acquisition and usage process aims at reducing uncertainty in decision-making (Koonce 1993). Thus, if an auditor perceives information as less reliable, she/he may need to perform more extensive information usage to reach a sufficiency threshold in uncertainty reduction than when information is more reliable. The above discussion leads to the fourth empirically testable hypothesis:

> H4: Information is used more extensively in decision-making when information is less reliable compared with when it is more reliable.

4.2.5 Hypothesis 5 – RMM and auditor experience

Auditor experience is expected to interact with RMM for three reasons. First, previous audit studies (Choo & Trotman 1991; Moeckel 1990) have hinted that professional skepticism about the existence of errors decreases when experience increases. This may stem from the fact that experienced auditors possess more accurate knowledge of the errors in financial statements than less experienced ones (Nelson 2009). Experienced auditors are also suggested to be able to explain non-errors in their audit findings more easily than they can errors (Nelson 2009). Thus, even under high RMM, experienced auditors may perceive many unusual audit findings as non-errors and are less likely to alter their usual information usage. By contrast, high RMM may exaggerate less experienced auditors' reactions to deem any unusual finding as an indication of an error and consequently cause more extensive information acquisition.

Although experienced auditors react to high RMM by increasing their information usage, they may not engage in extensive information search if their expectations of the error are not supported by the first pieces of acquired information (Earley 2002).

Second, degree of auditor conservatism might be reflected in the extent of information usage. Previous research has suggested that less experienced auditors are generally more conservative and less optimistic than experienced ones (Libby 1995). For example, Libby (1995) summarized that experienced auditors have been found to give more positive estimates of probabilities of continuation as a going-concern than less experienced ones. Similarly, Abdolmohammadi and Wright (1987) found that less experienced auditors were more likely to make audit adjustments than experienced ones. These findings imply that the conservative judgments of less experienced auditors may also affect information usage. They might especially use more effort to find negative information or even errors from the available information when RMM is high. Consequently, this could lead less experienced auditors to perform extensive information usage.

Finally, less experienced auditors may also be more susceptible to confirmation bias than experienced auditors. Kaplan and Reckers (1989) found that in explaining ratio fluctuations only less experienced auditors were sensitive to confirmation bias. When RMM is high, less experienced auditors might be more willing to find confirming information of initially negative indicators than experienced ones. This may lead to more extensive information usage than under circumstances in which disconfirming information is considered to be diagnostic information. The above discussion leads to the fifth hypothesis:

H5: In the context of high RMM, a less experienced auditor uses information more extensively than an experienced one.

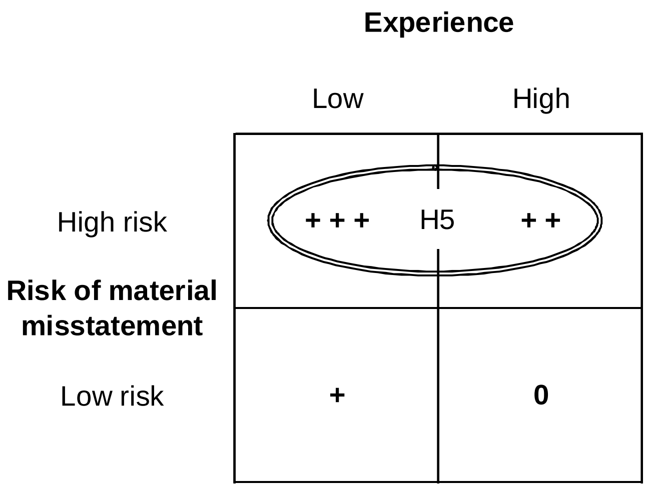

Figure 4. Graphical illustration of hypothesis 5 (“+” indicates increase in information usage, “0” is a baseline)

4.2.6 Hypothesis 6 – Task structure and auditor experience

Differences between experienced and less experienced auditors in information usage behavior might exist only when a task is unstructured (Bonner 1990). In particular, when a task structure changes from structured to unstructured and when the clarity of important information becomes more unspecified, the better knowledge of experienced auditors may help them perform their usual information usage process.

Different task structures demand different cognitive processes from an auditor. These cognitive processes are construction and reduction processes. Construction processes are demanding functions usually needed only in unstructured tasks, while reduction processes are required in all structure levels. When a task requires construction processes, e.g. information comprehension, hypothesis generation and hypothesis design, the benefits of experience may have positive impacts for decision-making. If a task requires only reduction processes, e.g. hypothesis evaluation, estimation and choice, knowledge differences may have only a small or no influence at all on decision-making (Bonner & Pennington 1991).

Further, despite a task being an unstructured one, experienced auditors may still be able to apply their usual directed information acquisition approach if they possess the necessary knowledge of the task. Experienced auditors may have a better developed understanding of task-specific diagnostic information and an ability to recognize information input/output relations better than less experienced ones.

In summary, experienced auditors' better cognitive processes and highly developed knowledge of unstructured tasks may compensate for a task's complexity and help perform information usage in a similar way compared with more structured tasks. The above discussion leads to the sixth hypothesis:

> H6: The level of task structure does not affect the information usage of experienced auditors.

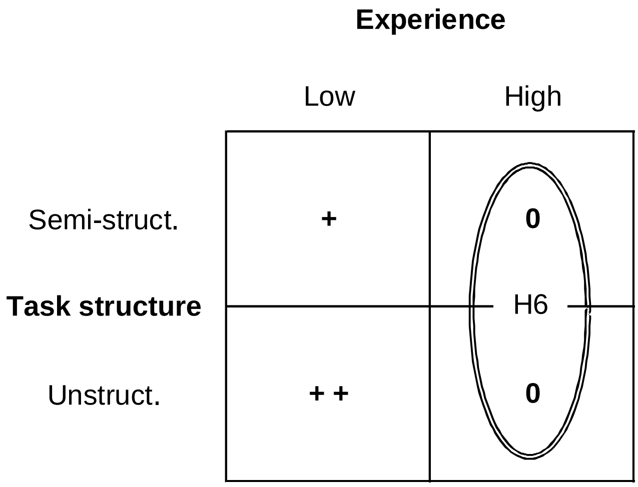

Figure 5. Graphical illustration of hypothesis 6 ("+" indicates increase in information usage, "0" is a baseline)

4.2.7 *Hypothesis 7 – Information reliability and auditor experience*

Information reliability is expected to interact with auditor experience. A general theory from psychology suggests that a decision-maker who trusts an information source and perceives that information to be highly reliable may only focus on the content of information instead of questioning its relevance and pertinence (Sacchi & Burigo 2008). Thus, when experienced decision-makers rely on the reliability of the information source, they tend to use less cognitive efforts and apply sequential information search strategies that are similar to those usually used by less experienced decision-makers (Sacchi & Burigo 2008).

The above theory suggests that experienced and less experienced auditors may acquire information in the order of its presentation when they trust that information is from a competent source. Thus, experienced auditors may reject their typical goal-directed information usage strategies (Hoffman, Joe & Moser 2003), which they normally apply in the search of diagnostic information, and use more information in their decision-making. Therefore, the degree of the sequential information usage of experienced auditors is expected to increase when information is more reliable. By contrast, when information is less reliable, differences in information usage strategies across different experience levels are expected to emerge. The above discussion leads to the seventh and final hypothesis of the thesis:

> H7: In the context of less reliable information, a less experienced auditor uses information more extensively than an experienced one.

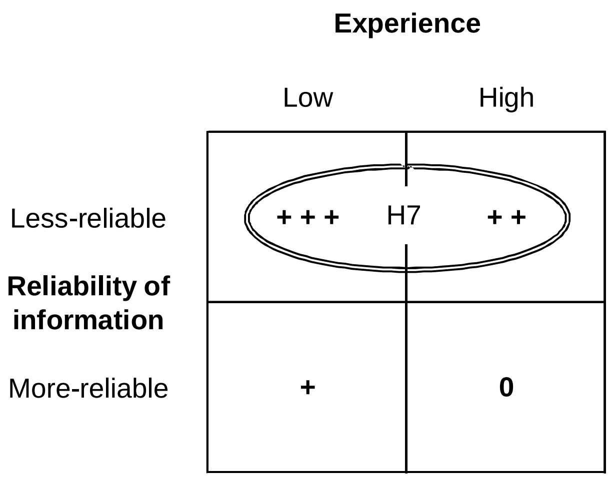

Figure 6. Graphical illustration of hypothesis 7 ("+" indicates increase in information usage, "0" is a baseline)

5 EXPERIMENT AND DATA

This chapter presents the experiment and data of this study. First, the two tasks that are applied in this study's experiment, client acceptance and client continuance, are introduced by presenting previous research on them. Next, based on previous studies in the client acceptance literature, four information classes are formed that are used for the experiment. This is followed by the presentation of 12 cues in the experiment's information menu.

In the next section, the general properties of web experiments are briefly discussed. Then, the experimental design, subjects and procedures for this study are introduced. The next two sections define the dependent and independent variables of the study, respectively. Then, the handling of the data is described as well as the rationale to exclude observations from the data set. Finally, the descriptive statistics of subjects' demographic information and cue usage are presented.

5.1 Client acceptance and continuance tasks

Client acceptance and continuance tasks are chosen for this study because although they have many similarities, their task structure level varies. As argued in the following paragraphs, client acceptance can be classified as an unstructured task and client continuance as a semi-structured task, while both consist of many similar judgmental elements. Furthermore, because of their high similarities, the available information for a decision-maker can be presented in almost identical form in both tasks, which allows for the direct comparison of information usage between them.

Before an auditor can accept a prospective client, s/he must usually become familiar with its background and business environment. Thus, the auditor needs to exercise a considerable amount of consideration and effort for information acquisition and usage. This can be especially emphasized in the audit environment where an auditor is worried about a prospective client's high risk indicators or other unusual circumstances, and therefore wants to find confirming or disconfirming information to justify the rejection or acceptance of a client.

In contrast to client acceptance decisions, client continuance decisions are usually less demanding, as the suitability of a client has already been assessed in the initial acceptance decision. In continuance decisions, auditor may only focus on monitoring the material changes in factors and conditions that have happened recently to the client (IFAC 2010). Thus, in a client continuance task less effort from the auditor is expected (Waller & Felix 1984). Specifically, it is proposed in this study that when a new auditor represents the same audit firm, s/he is mainly interested in the success of the previous audit and the most important material changes that have occurred recently in the client entity and/or business environment. Therefore, it is argued that a new auditor is generally able to make a continuance decision with the smaller usage of available information than a new auditor in an initial acceptance decision.

In addition, following the argumentation of Bonner's (1994) framework of task structure, it is posited that client continuance tasks are more structured than client acceptance tasks. In particular, information clarity may be greater in client continuance tasks than in new client acceptance tasks because the input/output relation of the information is better specified, i.e. the firm has been already accepted by the auditor to be the client. In other words, the client's input information has led to a certain output (acceptance). Thus, continuing with the existing client can be considered to be the default option for the decision. The procedures are better specified, because an auditor can focus on the major changes that have occurred in the client entity and environment recently. By contrast, in acceptance tasks an auditor is required to perform an in-depth analysis of the potential client's background and environment and use more overall consideration, as there are no previous judgments on which to rely.

The other reason for choosing client acceptance and continuance tasks for this study is that pre-engagement decisions for evaluating risky clients are highly important in audit firms' overall risk management strategies (Huss & Jacobs 1991). However, little is known about how auditors acquire and use information in client acceptance and continuance judgments. Asare and Knechel (1995) investigated how the information type (positive/negative) of a prospective client affected the number of acquired information. Positive information favored acceptance, while negative information recommended rejection. They found that on average auditors terminated information acquisition after receiving seven negative information cues and then made the rejection decision. When subjects received only positive cues, they tended to acquire all available information and then accept the client. The findings confirmed their expectations that auditors focus only on finding negative information that would indicate that the rejection of a prospective client is necessary.

However, the study by Asare and Knechel (1995) has some limitations that should be taken into account when generalizing the results. First, subjects received all cues in a predetermined order and they could not re-read previously seen information. In addition, subjects did not know the information pool that was available to them before they acquired the maximum number of information. Second, the study was conducted in the US where exposure to legal liability is much higher than in Scandinavia (La Porta, Lopez-de-Silanes & Shieifer 1998). Thus, the generalizability of the findings in Asare and Knechel (1995) to other environments is potentially hindered by the environment that emphasizes the total avoidance of risky clients. Therefore, it is proposed that in less litigious environments auditors may perform more balanced information acquisition, where neutral or positive information is also considered to be diagnostic.

Client acceptance is described as a multidimensional decision that consists of two phases (Johnstone 2000). The first phase includes the evaluation of relevant risks. Engagement risk is the overall risk associated with accepting a new client and it comprises three components: 1) client's business risk, 2) audit risk and 3) auditor's business risk. A client's business risk consists of factors that affect the profitability and continued existence of the client. Audit risk is defined as the risk that the auditor fails to modify his/her audit opinion when financial statements are materially misstated. An auditor's business risk concerns the possibility that an auditor is sued or that s/he receives adverse publicity because of being connected to a particular client (Johnstone 2000).

The second phase is a risk-adaption phase where an auditor considers ways to respond to evaluated risks. These screening strategies are based on clients' risk levels, the interaction of risks (considering the mediation effect) and proactive measures for controlling risks (Johnstone 2000). First, an auditor may make a screening decision only based on levels of risk, i.e. by rejecting clients that have a high level of audit risk or client business risk. Second, some audit firms may consider the mediating effect of auditor business risk on high audit risk or client business risk. For example, an auditor can decrease the loss on engagement risk by using highly experienced or industry-specialist auditors in a risky audit. Third, an auditor may use proactive steps to adjust heightened audit risk or client business risk by increasing the audit fee or acquiring more information during the acceptance process for the decision (Johnstone 2000).

In an experimental study, Johnstone (2000) reported evidence that auditors preferred to avoid risky clients rather than proactively adapt to the increased risk. Similarly, other studies (e.g. Cohen & Hanno 2000; Asare, Cohen & Trompeter 2005) have shown that clients with low integrity managers are more likely to be rejected. However, some studies have found evidence that when audit firms accept high risk clients they tend to increase the level of substantive tests, bill higher rates or assign more experienced auditors to the engagement (Beaulieu 2001; Johnstone & Bedard 2003; Ethridge, Marsh & Revelt 2007). In summary, these results stress the importance of risk evaluations in client acceptance decisions.

A survey conducted by Johnstone (2001) plotted the importance of various engagement risk factors. She also studied whether there were differences in the perceptions between less and more experienced audit partners. The results showed that less experienced partners had more variability in their answers than experienced ones. Both respondent groups agreed that the category containing audit risk-related factors was the most important in decision-making. Within that category, "management attitude towards internal controls" was ranked the most important factor by experienced partners. Less experienced partners ranked the "nature of the relationship between client and their previous auditor" as the most significant factor. Both groups valued other factors equally, such as the "subjective valuation of the client's assets", "industry growth patterns" and "existence of an internal audit department". In a client's business risk category, "financial trends" were ranked as the most important factor followed by "industry comparisons", "long-term planning" and "industry competition information". In an auditor's business risk category, the rank order of factors was "Expertise in the potential client's industry", "IPO information", "spin-off work likelihood", "timing of the engagement" and "pricing strategies of competing firms". Respondents were also asked to name additional unlisted factors. "Information about management" and "discussions with management" were the most common answers. "Discussions with the previous auditor, client's bankers or lawyers" were also frequently cited factors.

Bell et al. (2002) developed a decision aid to make client acceptance risk assessments. Based on the overall risk assessment, the appropriate level of client review can be determined. The authors considered a comprehensive set of risk factors based on numerous real cases and related interviews. Risk factors were divided into seven categories depending on their natures and the risk types they affected.

The first category included client entity characteristics that affect an auditor's business risk. The second category focused on engagement information mainly from an independence and a client relationship perspective. These factors may affect an auditor's business risk. The third category included information about the quality of the relationship with the client, which may affect audit risk and an auditor's business risk. These factors were mainly derived from the client's third parties such as previous auditors, bankers and lawyers.

The fourth and fifth categories included quantitative and qualitative factors concerning the client's business environment, industry trends, level of competition and legal environment. These factors affect a client's business risk, but may also influence audit risk. The sixth category included risk factors that concern the quality of a client's control environment and the characteristics of management and board that directly impact on audit risk. Finally, the seventh category's factors included the quality of accounting and the results of previous audits affect audit risk.

In a recent survey, Ethridge, Marsh and Canfield (2007) found that audit partners ranked management integrity as the most important risk factor. They concluded that management is responsible for the entity's control environment and thus that management's attitude towards internal controls is a key factor in mitigating risks.

Finally, some studies have compared client acceptance decision-making between auditors and audit firms. It is generally recognized that audit firms usually have written client acceptance policies that aim to standardize procedures (Huss & Jacobs 1991; Gendron 2001). Huss and Jacobs's (1991) interviews among Big-6 audit firms showed significant differences between audit firms in specifying important information and sources. Gendron's (2001) field study showed that even when decision-making procedures are established and mechanic decision aids are available, auditors are still most likely to make the most demanding client acceptance decisions using a considerable amount of personal judgment, i.e. not using decision aids extensively.

In summary, previous client acceptance studies have demonstrated that auditors focus on negative information from their prospective clients. This also implies that their information usage does not equally consider negative and positive information. Based on these findings, it can be inferred that auditors accept a prospective client if they are not able to find information that would suggest doing otherwise. However, it is not obvious whether these results can be generalized directly to this study's settings, as all those studies were conducted in environments where the risk of litigation is substantially higher than that in this study. Thus, a degree of negative/positive information usage might be conditional on the environment's legal liability.

5.2 Information cues

Information cues for the experiment are selected based on earlier client acceptance studies (Asare & Knechel 1995; Johnstone 2000; Johnstone 2001; Bell et al. 2002; Ethridge, Marsh & Canfield 2007), the IFAC's guidance of "Client Acceptance and Continuance" and the research problem of the present study.

The most highlighted factor found in previous studies (Asare & Knechel 1995; Johnstone 2001; Ethridge, Marsh & Canfield 2007), namely the characterization and integrity of management, is included in RMM manipulation. The main criteria for cue selection are their popularity or commonness in previous experimental studies of client acceptance decisions. The IFAC's guidance is mainly used to form information categories.

Based on these studies, information cues are divided into four classes (Figure 7): financial, industry and competition, previous audit and third parties, and organization and internal controls information. The information set for the experiment aims for a systematic mix of financial and nonfinancial information on the (prospective) audit client and its business environment. Financial information consists of publicly available cues that provide an overview of the client's financial status. Nonfinancial information contains both internal and external information on the client. Internal information includes, for example, information on the effectiveness of internal controls, while external information includes cues about industry outlook and the competitive environment.

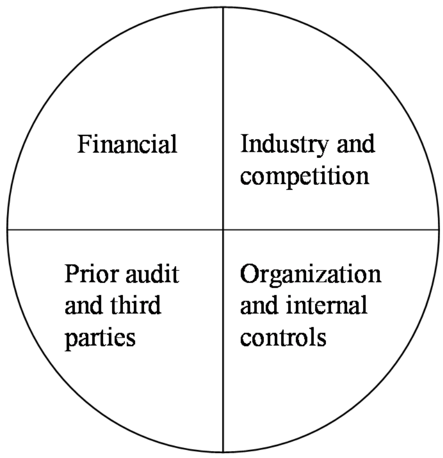

Figure 7. Information classes of client continuance and acceptance tasks

In the experiment, each of these four information classes is operationalized by three separate information cues. In the information menu, cues are presented in alphabetical order. Information cues contain neutral or slightly positive information about the firm or its business environment. Thus, the aim is to present cues that make the firm look like an average small firm without strong positive or negative information. The cues were pilot-tested in several rounds with experienced auditors as well as other accounting professionals to ensure that there was sufficient appropriate information available for the given tasks.

Table 1 presents the 12 cues used in this study. Financial trends have been found to be the most important factor when evaluating a client's business risk (Johnstone 2001). Financial information contains three cues to represent a client's financial position and trends. The income statement and balance sheet are presented in their regular forms to show the steady trends consistent with the industry's average profitability, liquidity and solvency. Key ratios includes a summary of nine financial ratios covering growth, profitability, liquidity and solvency trends. All information is from the past three years in order to present the financial trends of the firm (Johnstone 2000; Johnstone 2001).

Industry comparison and competition information have also been recognized to be important factors in client acceptance decisions (Johnstone 2000; Johnstone 2001; Bell et al. 2002). The cues in this class aim to provide information about a client's business risks. All presented cues were ranked next important after financial trends (Johnstone 2001). The industry comparison cue compares the key ratios of the client to other firms in the same industry. The industry status and outlook cue describes how the whole industry has been developed compared with the previous year and the general expectations for future sales and estimated trends. The competitive environment cue describes the qualitative analysis of the business environment and the client's long-term strategy to manage competitive pressure.

Organizational and internal controls information contains cues about the client's organizational structure and accounting and internal controls (Johnstone 2000; Bell et al. 2002; IFAC 2010). These cues aim to provide information on audit risk factors, i.e. factors that should be taken into account when conducting the audit (Johnstone 2001). The structure of organization cue presents an overview of the number of personnel at each organizational level, while the internal controls cue assesses the client's risk factors and related controls. This cue also includes the previous overall assessment of the internal control system. The accounting and bookkeeping (financial administration) cue describes how bookkeeping and financial planning are organized. This cue also describes the accounting system that is currently used in the client firm.

Previous audit and third party information contains information on the results of previous audits and on the client's relationships with external parties. Information on previous audit reports and the client's relationship with a previous auditor are recognized to be important factors when making client acceptance decisions (Johnstone 2000; Johnstone 2001; Bell et al. 2002; IFAC 2010). Thus, the previous audit cue in this experiment covers information on previous audit reports and the reasons for changing auditor. Cues about third parties include relationship with the main creditor and lawyer. These cues are also perceived to be important by auditors (Johnstone 2001). The relationship with the main creditor cue shows that the client has the usual relationship with the bank and has repaid loans in time. This cue also indicates that clients have had no defaults in recent years. The relationship with the lawyer cue states the client's lawyer confirmation that there are no signs of any juridical matters in the past or present.

Table 1. Cues of the information menu

Class	Cue
FINANCIAL	Income Statements
FINANCIAL	Balance Sheets
FINANCIAL	Key Ratios
INDUSTRY AND COMPETITION	Industry Comparison
INDUSTRY AND COMPETITION	Industry Status and Outlook
INDUSTRY AND COMPETITION	Competitive Environment
ORGANISATION AND INT. CTRLS	Structure of Organization
ORGANISATION AND INT. CTRLS	Internal Controls
ORGANISATION AND INT. CTRLS	Accounting and Bookkeep. (financial admin.)
PREVIOUS AUDIT AND THIRD PARTIES	Predecessor Audit information/Prior Audit
PREVIOUS AUDIT AND THIRD PARTIES	Relationship with the main Creditor
PREVIOUS AUDIT AND THIRD PARTIES	Relationship with the Lawyer

5.3 Web-based experiment

The data in this study are acquired through an experiment that uses a computer-based tracking technique. This type of experiment allows for advanced possibilities to trace each subject's information usage, which is not possible with traditional paper-and-pencil experiments (Bryant, Hunton & Stone 2004; Andersson 2004). Alternatively, the current research problem could be studied by using verbal protocol analysis (see Chapter 2.2). This method would also have generated a rich set of insights into the decision-making process. However, the main disadvantage of verbal protocol analysis is that investigating four independent variables would have required several laborious experimental sessions. These time-consuming sessions would have been restricted to a small number of auditors, which might not have sampled the population representatively (Andersson 2004).

The advantage of web-experiments is the availability of large sample sizes. Thus, greater statistical power can be expected. The chances of human data entry and transcription errors in the analysis phase are also minimized. Furthermore, the risk of the experimenter's unnecessary influence on subjects is reduced, because face-to-face contact is not necessary (Bryant, Hunton & Stone 2004).

It was decided to conduct the experiment online instead of through series of supervised experiments in computer rooms. In particular, a large number of treatment groups would require a considerable sample of subjects for reliable statistical analyses. Thus, it would have been difficult to arrange sessions comprising subjects with different experience levels. These sessions would have also required more time from the experimenter and subjects, which would have incurred significantly more research costs in terms of travelling expense and the renting of computer space (Bryant, Hunton & Stone 2004).

5.4 Experimental design

The experiment in this study consists of two between-subjects audit tasks. In the client continuance task, subjects are asked to evaluate their willingness to continue a relationship with an existing client where they would act as an (new) incumbent auditor. A client acceptance task is otherwise identical but now the client is new to the audit firm.

There are two manipulated factors in the experiment, level of RMM and information reliability, which are manipulated at two levels. Subjects' task-specific experience is collected using the post-experimental questionnaire. Subjects are then classified as less experienced and experienced subjects according to their task-specific experience. Thus, there are eight treatment groups as presented in Figure 8. Subjects are randomly assigned to one of these groups.

Both tasks are based on almost identical information. The background text and information cues between the tasks are only slightly modified to reflect either the client continuance or the client acceptance situation. The firm presented in the experiment is a small-sized firm operating in the boat manufacturing industry. Financial information on the firm is based on a real firm selected from the Voitto+ database, which is a large Finnish company information database. Financial information is modified to make the firm unidentifiable.

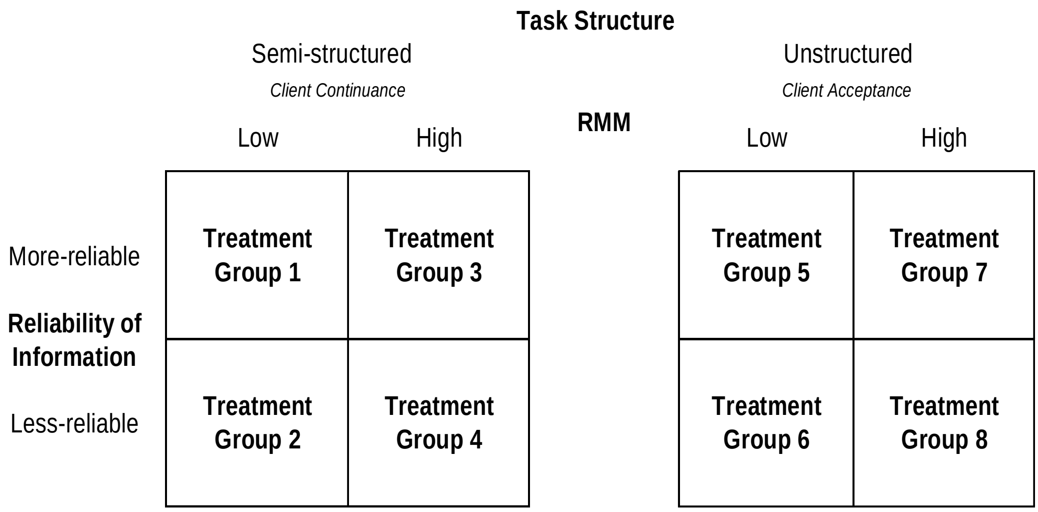

Figure 8. Treatment groups of the study

Client continuance task

The semi-structured task is a client continuance task. In this task, a subject is asked to evaluate if her/his audit firm can continue with the existing client, where she/he would be a new auditor. In the background information, it is stated that the relationship with the current audit firm was established five years ago and that the client firm's board of directors wants to continue the relationship. Furthermore, the Auditing standards, such as the ISQC 1 paragraph 26 a-b (IFAC 2009b), require audit firms to consider its competency (e.g. audit resources) as well as compliance with ethical requirements (e.g. objectivity) in client continuance/acceptance decisions, these concerns are relaxed by stating that the subject may assume that there are no conflicting issues with these requirements.

The background information contains a short description of a (prospective) client's business, history, industry and management/ownership. The risk and information reliability manipulations are also included. The risk manipulation aims to affect one part of the engagement risk, namely audit risk. Audit risk consists of RMM and detection risk (Messier 2003). Level of RMM is manipulated at the beginning of the background information. The subject's estimation of detection risk is indirectly examined after the judgment by asking him/her to estimate planned audit hours for the engagement. The information reliability manipulation manipulates the information reliability presented in the information menu. Appendix 1 presents all RMM and information reliability manipulations used in this study.

Risk

In the low RMM manipulation, the subjects were told that the owners are happy with the management. It is stated that a new auditor's preliminary discussions with the management indicate that it is competent, possesses high integrity and emphasizes high ethical values in its course of business. By contrast, in the high RMM manipulation, it is told that the owners are not satisfied with management performance and are planning to alter management compensation so that a major part is determined by previously reported earnings. It is also stated that "preliminary discussions with management indicate that you are not fully convinced about the management's integrity and motivation to work under new terms".

Information reliability

The information is said to have been collected by the previous auditor. In the more reliable information manipulation, it is stated that the previous auditor has one of the highest reputations in your audit firm and that s/he is known for the conscientiousness and preciseness of her/his work. In the less reliable reliability manipulation, it is stated that the previous auditor has been given several remarks in the audit firm's internal quality inspections and that s/he has been blamed for superficial and poor documentation in her/his previous audits.

Information usage

Subjects can freely choose any information necessary for the decision-making from the menu and terminate information usage at any point. As observed by Hoffman, Joe and Moser (2003) a pre-established order of information may result in less effective information processing and, therefore, the unconstrained selection of information is highlighted in the instruction text. Subjects also have the option to go back and see the background information again. After the completion of the information usage stage, subjects are asked to give a probability on an 11-point scale of recommending the continuance of the engagement. Other questions concern confidence with the main judgment and the estimates of audit hours and fees. Specifically, subjects are asked how they would adjust budgeted audit hours and fees compared with the previous audit. To make all these judgments, subjects can return to the cues and background information.

Manipulation check questions and realism of the task

Two manipulation questions about perceived RMM and information reliability were presented. The third question concerned the perceived realism of the task. Before the demographic information, the importance of the utilized information was requested. Subjects were asked to evaluate on an 11-point scale all those cues that they opened from the information menu. If the subject was not sure about or did not remember what particular information cue contained, she/he could review it again in a pop-up window. The research instrument is illustrated in Figure 9.

Client acceptance task

The unstructured task is a new client acceptance task that is similar to the client continuance task. A subject was now asked to evaluate if a totally new client can be accepted as a new client to the audit firm where she/he would be an incumbent auditor.

Risk

The auditing standards (e.g. IFAC 2009b) emphasize that the integrity of the prospective client should be considered before every acceptance decision. Thus, auditors should in particular assess whether the client related risks are heightened due to a dishonest management or principal owners. The RMM manipulation was similar to before (see Appendix 1).

Information reliability

Information reliability was manipulated via an audit assistant and a previous auditor who was responsible for collecting information on decision-making. In the more reliable information manipulation, the assistant is characterized as being an accurate and thorough worker with a good reputation. The previous auditor is characterized as having a high reputation and being a conscientious auditor. In the less reliable information manipulation, it was stated that after information collection the assistant had pointed out to be an incompetent and negligent in her/his work. In addition, it was stated that the previous auditor had recently been suspended by her/his audit firm because of several remarks at the audit firm's internal quality inspections.

Post-experimental questionnaire

After subjects had completed one of the tasks, an identical post-experimental questionnaire was used for follow-up questions. First, questions on the task-specific experience of both client continuance and client acceptance were asked followed by auditor-specific questions, such as career length as an auditor, specific training for these tasks (number of hours), level of auditor certification, Big-4/non-Big-4 firm, rank, time in current rank, gender and age. Subjects were also asked about the purpose of the task and given the option to provide feedback. After submitting the form, subjects had the chance to take part in a raffle by providing their contact information. To assure anonymity and confidentiality, contact information was collected in a separate form.

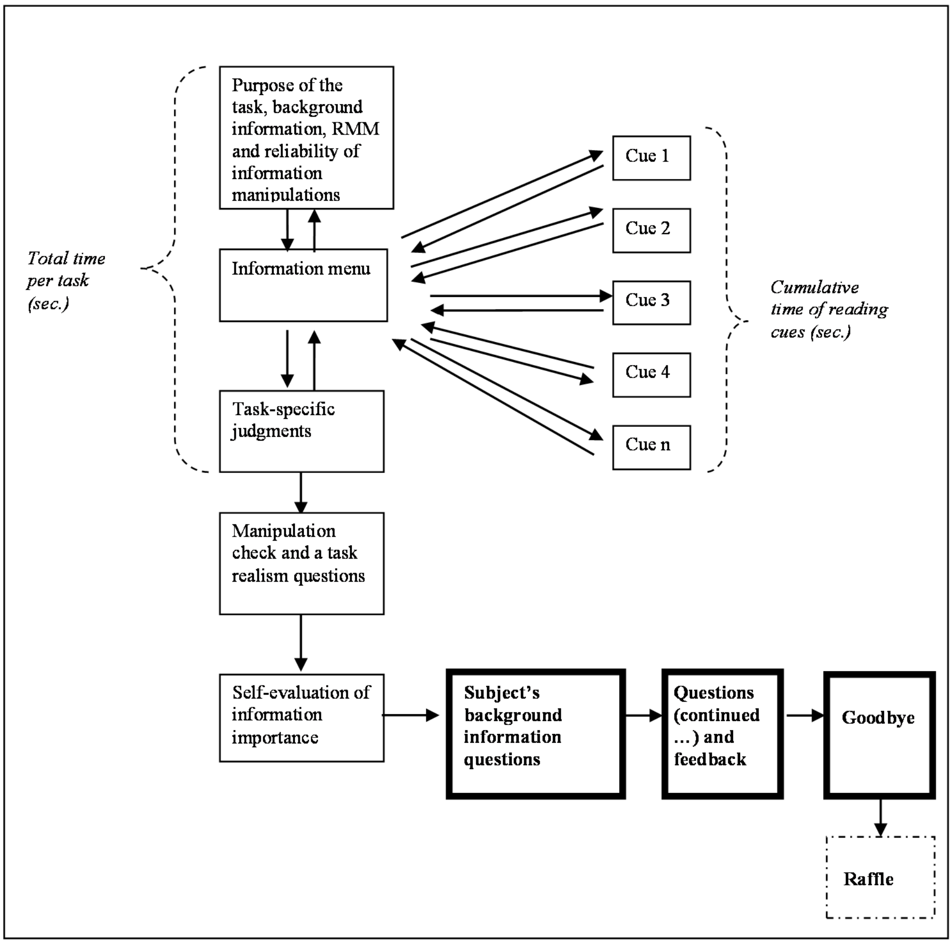

Figure 9. Overview of the research instrument

Technical execution

The experiment was technically carried out using the server-side scripting, PHP and MySQL language. This technique allowed us to record automatically information usage variables such as the number of used information, the length of time used for reading a single information cue (cumulative time), order of information acquisition and the total length of time spent during the experiment. A list of all variables that were automatically generated by the software is in Appendix 2. The software also incorporated some internal controls on the most critical screens to ensure completeness on one screen before moving to the next screen.

5.5 Subjects and experimental procedures

This study's subjects consisted of Finnish CPAs, non-certified auditors and students. Two groups of certified accountants, KHT and HTM auditors, comprised the majority of subjects. To ensure sufficient responses for the statistical analyses, the subject population included all these certified accountants. As the names of certified auditors and their respective audit firms are available on the (Central) Chamber of Commerce's webpages, this information was used to obtain the e-mail addresses of each auditor. The e-mail addresses of non-certified auditors were collected from one of the Big-4 webpages, which list people whose work is audit-related. The student population consisted of Master's level students who had participated in at least one of the two advanced auditing and accounting courses in the previous semester.

Using students as subjects is consistent with previous experimental studies of auditors' information acquisition and usage (e.g. Krogstad, Ettenson & Shanteau 1984; Kennedy 1993; Trotman & Wright 1996; Anderson & Mueller 2005). Students were used in this study in order to have enough subjects in the less experienced subjects group[19]. It was assumed that Master's level students who have basic auditing knowledge are able to perform these tasks as well as can other less experienced auditors, as the studied tasks do not require complex problem representation (i.e. both tasks have a basic information menu and the purposes of the tasks are explained unambiguously) before information usage.

[19] Including less experienced subjects in the sample is otherwise difficult, as the contact information of novice auditors is not publicly available.

Including all these subjects resulted in a total population of 1352 subjects; 1277 certified auditors (94.5%), 36 non-certified auditors (2.7%) and 39 students (2.9%). To enhance the response rate, the chance to win travel gift vouchers and book prizes was provided in return for participation. Before the experiment was carried out, it was extensively pre-tested. Pre-testers included auditors and other accounting professionals with various experience levels. The aim of pre-tests was to ensure sufficient task realism as well as that the experiment's user interface was easy-to-use and that the required time to complete the experiment was reasonably short.

All population subjects were randomly divided into the two groups (client continuance and client acceptance) before an introductory e-mail was sent (see Appendix 3). This e-mail contained general information about the purpose of the study, overview of the task, URL to the task and chance to participate in a raffle. When a subject clicked on the URL, the research instrument started automatically in a new window. The software randomly assigned each subject to one of the treatment groups at the beginning of the experiment.

Subjects were asked to participate in the experiment within 10 days. After 10 days, the first follow-up email (see Appendix 4) was sent to those subjects who had not given their contact information for the raffle. They were again asked kindly to participate in the experiment, but the response time was reduced to seven days. After this time had expired, two similar follow-up rounds were performed at intervals of one week.

5.6 Dependent variables

A rich set of dependent variables is used to measure information usage. First, based on variables used in previous studies of information usage (e.g. Davis 1996; Zimbelman 1997; Turner 2001; Andersson 2004; Moroney 2007; Thayer 2011), these variables aim to capture the two basic dimensions of information usage: total time spent on the task and the number of used information. For instance, time-based measures have been suggested to proxy for used effort[20] in previous information usage studies (Cloyd 1997; Zimbelman 1997). Second, alternative variables are used in order to overcome shortages in the traditional measures above and to give more insights into auditors' information usage.

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[20] Used time is limited to measure only one dimension of effort, namely effort duration, but not effort intensity, i.e. working harder per time unit (Cloyd 1997).

The main dependent variables are *total time per task* (TOT_TIME), which is defined as time from the beginning of the task to the submission of task-specific judgments (see Figure 6) and *number of used cues* (NUMBER_INF), which is the total number of cue openings in the information menu.

The other four variables are alternative measurements for the above measures. These variables aim to capture the nuances in information usage caused by independent variable manipulations. Alternative time measures divide total task time into the following two subcomponents.

Total cue time (TOT_CUE_TIME) is the total time spent at cue screens (see Figure 6). This variable aims to measure whether the manipulations of independent variables affect a subject's time to utilize cues from cue screens. It is expected that total cue time depends on the number of used cues. The variable also measures the amount of effort a subject uses when reading and assimilating cues as well as his/her knowledge (Zimbelman 1997).

Judgment time (JUDG_TIME) is the time spent outside of cue screens in the task. It is defined as TOT_TIME minus TOT_CUE_TIME. This variable measures the effort used to evaluate and combine (i.e. process) acquired cues and make task-specific judgments. Thus, it is also expected that used judgment time depends on the number of used cues.

Alternative count measures of used cues include very short cue visits and subjective estimates of less important cues. These measures are based on the assumption that plain cue visits alone do not mean a cue is fully used in a decision-making process. For instance, very short cue time may indicate that cue is not read to the end.

Number of important cues (NUMBER_IMP_CUE) is an adjusted number of used cues, where the cues whose importance is self-estimated to be less than five are extracted from the number of used cues. This variable aims to capture cues perceived to be important after reading/processing all cues and making task-specific judgments.

The *number of information 9 seconds* (NUMBER_INF_9) has the same purpose as the previous variable. For this variable, cues read in less than nine seconds are extracted from the number of used cues. A short cue time may indicate that a cue is read only partly or superficially and deemed to be less important by a subject.

5.7 Independent variables

Three independent variables of the study are manipulated variables: *Risk*, *Structure* and *Reliability* are factor (univariate) or categorical/dummy (multivariate) variables in the analyses. The observations from treatments 3, 4, 7 and 8 are classified as high RMM observations and those from treatments 1, 2, 5 and 6 as low RMM observations. Treatments 1–4 are classified as semi-structured and 5–8 as unstructured tasks. The observations from treatments 2, 4, 6 and 8 are classified as less reliable information observations and those from treatments 1, 3, 5 and 7 as more reliable information observations.

Subjects are classified into less experienced subject and experienced auditor groups based on their task-specific experience. This classification is consistent with previous studies in the expertise literature (e.g. Bonner & Pennington 1991; Bonner 1990; Earley 2002), when it is desired to examine whether there exists differences in judgments and information usage between “novices” and “experts”.

Task-specific experience is chosen over general audit experience (i.e. years of audit experience), as neither task is conducted by all auditors on a regular basis. Therefore, using general experience as a proxy for knowledge of client continuance and acceptance tasks would entail much noise (Tan 2001). In addition, previous studies suggest that audit partners are responsible for actual client acceptance judgments, because they have been used as subjects in these studies (e.g. Johnstone 2000; Wittek, van der Zee & Muhlau 2008). Thus, even a long tenure as an auditor may not be a suitable proxy for knowledge of these tasks if the auditor has not worked at the partner-level in an audit firm. However, it is expected that many auditors may have assisted in these tasks, for example by gathering information for partners’ decision-making[21] or have other second-hand experience (training) of tasks.

Auditors' task-specific experiences are measured separately from client continuance and acceptance tasks from all the subjects. Both measures uses the identical 0-4 scale, where 0 refers to zero experience and 4 refers to 30+ times of task-specific experiences (see Table 2 notes for full definition of the scale). It was decided to combine task-specific experiences from both tasks to one variable as the purpose was to measure subjects' knowledge of these tasks broadly. Specifically

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21 For the sake of clarity, in the post-experimental questionnaire all “assisting experience” was also counted. Owing to this broad definition of task-specific experience where “pure” and “assisting” experience are not separated, the cut-off point for experienced was set to relatively high.

in this study, it is suggested that experience from one task might also increase relevant knowledge regarding the other task due to their many similarities, in other words, knowledge could be transferred across these tasks[22].

Subjects are classified as less experienced if the sum of their self-reported task-specific experiences is less[23] than 5 on a scale of 0–8. All other subjects are considered to be experienced auditors. Thus, subjects without task-specific encounters had a value of 0 and the most experienced auditor had a value of 8 on the scale. Hence, the most experienced auditors have performed both tasks at least 30 times, totaling over 60 times. On this 0-8 scale, the mean statistics (not tabulated) indicate that the less experienced group's mean task-specific experience is 3.1, while that of experienced auditors is 5.8.

5.8 Data and exclusion of outliers

After the final follow-up round, 339 (25.1%) observations were gathered[24]. First, 32 incomplete and duplicate observations[25] were deleted from the sample. Second, data were analyzed to find significant outliers from non-diligent subjects, as these observations can significantly increase noise and reduce the power of an experiment (Oppenheimer, Meyvis & Davidenko 2009). Further, all observations may not represent the behavior of motivated individuals. If the motivation of the subject is not in line with the expectations of the experimenter, a lack of effort in the experiment may cause its pre-planned goals to be unmet (Kersten, Wu & Oertel 2011). In particular, time-based variables are generally considered to be noisy measures of subjects' efforts in task making, and a distracting environment in web-based experimental settings may further magnify such noise (Cloyd 1997; Bryant, Hunton & Stone 2004).

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[22] For instance, it is suggested that an auditor who has only task-specific experience from a client continuance task has more relevant knowledge for a client acceptance task than an auditor without any experience in these tasks.

[23] Further, as seen from Table 2, subjects in this sample are generally highly experienced auditors. Thus, in order to have enough observations of both experience levels for the statistical analyses, the cut-off point was set higher than in previous studies (e.g. Earley 2002). In theory, one would expect even more experience effects between less experienced and experienced auditors if this limit had been set to a lower level (e.g. "0–10" vs. "11-" encounter times as in Earley's (2002) real-estate valuation task).

[24] E-mail addresses were manually collected from the (Central) Chamber of Commerce's webpage. Because manually collecting e-mail addresses was laborious, a two-year-old collection of emails was used. This database was then updated with the auditors certified after this date. However, a significant number of addresses (169; 13.5%) were outdated (mainly because of retirements and job changes), which were returned to the sender.

[25] Duplicate observations were traced using IP address and time stamp match.

Appendix 5 reports the descriptive statistics of dependent variables (n=307). These statistics show a considerable range of time-based dependent variables. For instance, TOT_TIME ranges from 76 to 4947 seconds and TOT_CUE_TIME from 0 to 4340 seconds, while the mean (SD) times of these variables are 666.3 (589.5) and 332.9 (349.1) seconds, respectively. This mean total time (about 11 min.) is line with the time mentioned to the participants to allocate for the experiment in the introductory letter. However, very short and long times indicate strongly that subjects were either uninterested in the actual task[26] or were interrupted during it.

To control for the influence of extreme observations on the results, particular observations are removed from the sample as follows[27]. First, all observations where subjects used three minutes or less total time are removed. This exclusion is based on the extensive pre-testing of the tasks, which showed that it takes at least three minutes to read the background information of the task and to answer properly all four task-specific judgments. Several observations from pre-testing indicated that three minutes was required even for the easiest condition, i.e. when the auditor was experienced, RMM was low, task unstructured and information reliable. Using this exclusion removed 16 observations from the sample.

Second, all observations taking more than 20 minutes are removed. This limit is defined by multiplying by two the time (10 minutes) that was mentioned to subjects in the introductory letter to allocate for task making. Further, the results from pre-testing indicated that none of the 18 pre-testers used more than 17 minutes for task making. However, it is acknowledged that some individuals may use more time as they are unfamiliar with making audit judgments on computer screens compared with the pre-testers. For example, older auditors may have used more time for this reason (see Nearon 1999). Thus, it seems reasonable to increase this limit slightly as the mean age of subjects is high (48.8. years; see Table 2). The exclusion of these observations decreased the sample by an additional 20 observations[28].

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[26] For example, the chance to win a prize in the raffle may have encouraged participation without any true intention to act professionally in the actual decision-making part of the experiment (O’Neil & Penrod 2001).

[27] These two elimination steps are similar to those used by Bailey, Daily and Philips (2006), who measured the time spent on an audit task in a web experiment.

[28] To analyze whether experience level or background (see Table 2 for variables) of excluded subjects (n=36) systematically differ from included subjects, several univariate tests were carried out. These results show no significant differences between these subject groups (p-values = > 0.400).

Thus, the final sample size is 271 observations. All descriptive statistics and statistical analyses are carried out with the same data set to keep results comparable. As shown in Figure 10, observations are distributed evenly between the eight treatment groups, ranging from 28 to 41 observations per treatment.

	Task Structure					
	Semi-structured			Unstructured		
	Low	High	**RMM**	Low	High	
More-reliable	**28 (10.3 %)** TREATMENT 1	**31 (11,4 %)** TREATMENT 3	**59 (21.8 %)**	**5** **31 (11,4 %)** TREATMENT 5	**7** **41 (15.1 %)** TREATMENT 7	**72 (26.6 %)**
Reliability of Information						
Less-reliable	**41 (15.1 %)** TREATMENT 2	**32 (11.8 %)** TREATMENT 4	**73 (26.9 %)**	**6** **37 (13.7 %)** TREATMENT 6	**8** **30 (11.1 %)** TREATMENT 8	**67 (24.7 %)**
	69 (25.5 %)	**63 (23.2 %)**	**132 (48.7 %)**	**68 (25.1 %)**	**71 (26.2 %)**	**139 (51.3 %)**

Figure 10. Distribution of observations between treatment groups (percentages in parentheses)

5.8.1 Descriptive statistics of subjects

The total sample of 271 subjects consists of 219 certified auditors, 32 non-certified auditors[29] and 20 students. In a post-experimental questionnaire, information was collected about subjects' audit experience and backgrounds. These descriptive statistics are summarized in Table 2. In this study, the mean age of subjects is considerably high (48.8 years) and 84.9% of them have completed at least one auditor certification (JHTT/HTM/KHT). Slightly less than one third (31.0%) of subjects are female. On the task-specific experience scale of 0-4 (see Table 2 notes for definitions of scale), subjects indicated mean (standard deviation; SD) experience levels of 2.3 (1.5) for client continuance experience and 2.7

[29] A closer examination of the data showed that besides "not yet certified" auditors, some retired auditors who previously held an auditor certification belonged to this group.

(1.6) for client acceptance experience[30]. There is an almost equal number of subjects working in Big-4 audit firms (30.8%) as in non-Big-4 firms (28.4%). The major proportion of subjects (40.8%) work outside of audit firms or are students. In summary, these descriptive statistics indicate that on average subjects have a lot of experience of both tasks.

Table 2. Descriptive statistics of subjects

Descriptive Statistics of Subjects												
	Age[a]		Gender[b]	Auditor Certification	Audit firm[c]			Continuance task-specific experience[d]		Acceptance task-specific experience[d]	
Treatment	Mean	SD	Female %	Yes %	Big-4 %	Non-Big-4 %	None %	Mean	SD	Mean	SD
1(n=28)	53.4	10.5	32.1	89.3	30.8	11.5	57.7	2.3	1.6	3.0	1.6
2(n=41)	45.1	13.6	31.7	82.9	30.8	30.8	38.5	2.3	1.6	2.7	1.5
3 (n=31)	48.5	12.9	35.5	90.3	30.0	43.3	26.7	2.7	1.5	2.7	1.5
4 (n=32)	51.6	11.3	40.6	81.3	14.3	32.1	53.6	1.7	1.3	2.7	1.6
5 (n=31)	46.4	12.3	32.3	83.9	31.0	31.0	37.9	2.5	1.5	3.0	1.4
6 (n=41)	50.5	14.2	26.8	82.9	28.9	23.7	47.4	2.2	1.6	2.4	1.6
7 (n=37)	48.2	16.4	13.5	83.8	41.2	23.5	35.3	2.2	1.6	2.7	1.6
8 (n=30)	47.5	14.4	40.0	86.7	38.5	30.8	30.8	2.3	1.6	2.7	1.6
∑ (n=271)	48.8	13.5	31.0	84.9	30.8	28.4	40.8	2.3	1.5	2.7	1.6

Notes:
a 10 missing observations
b Two missing observations
c 21 missing observations
d Variable is defined as follows: 0 = No experience, 1 = 1–9 times, 2 = 10–19 times, 3 = 20–29 times, 4 = 30+ times

In the post-experimental questionnaire, the realism of the experiment was evaluated on an 11-point scale (0 = very unrealistic; 10 = very realistic). Subjects evaluated the realism of both the client continuance (mean 7.64, SD 1.92) and the client acceptance (mean 7.06, SD 2.15) tasks fairly over mean of the response

[30] This confounding finding that subjects had more experience with the acceptance than with the continuance task may be because the latter is a routine task that is passed quickly without the significant consideration of performing that task (especially when there has been no controversy with the client).

scale (5.0). Thus, it can be assumed that the majority of subjects perceived these tasks to be relatively realistic for the given judgments.

5.8.2 Descriptive statistics of the dependent variables

Table 3 presents the descriptive statistics of the dependent variables (Appendix 6 reports the means and SDs for each treatment and experience). It can be seen from Panel A that on average a subject used about 11 minutes for the task. This time is distributed evenly between the cue and the judgment time, indicating that both "phases" were time consuming on average.

Table 3. Descriptive statistics of the dependent variables

Panel A: Descriptive statistics of the continuous variables (All units in seconds)							
Variable	Mean	Std Dev	Minimum	Q1	Median	Q3	Max.
TOT_TIME	569.6	243.9	185.0	364.0	535.0	747.0	1191.0
TOT_CUE_TIME	298.3	164.9	27.0	163.0	275.0	409.0	926.0
JUDG_TIME	271.3	134.5	45.0	185.0	247.0	313.0	961.0
Panel B: Descriptive statistics of the count variables (All units in counts)							
NUMBER_INF	10.9	3.5	2.0	10.0	12.0	12.0	25.0
NUMBER_INF_9	9.7	3.3	0.0	7.0	10.0	12.0	25.0
NUMBER_IMP_CUE	10.5	3.3	0.0	9.0	11.0	13.0	23.0

Panel C: Pearson's correlation coefficients of the dependent variables					
	TOT_CUE _TIME	JUDG _TIME	NUMBER _INF	NUMBER _INF_9	NUMBER _IMP_CUE
TOT_TIME	0.852***	0.768***	0.447 ***	0.625 ***	0.382 ***
TOT_CUE_TIME		0.320***	0.487 ***	0.688 ***	0.423 ***
JUDG_TIME			0.213 ***	0.289 ***	0.174 **
NUMBER_INF				0.830 ***	0.753 ***
NUMBER_INF_9					0.651 ***

Notes:
Statistical significance based on two-tailed tests at the 1%, 5% and 10% levels are denoted by ***, ** and *, respectively.
The variables are defined as follows:
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time spent reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance was self-evaluated to be more than 4, including multiple reads

As shown in Panel B of Table 3, there is only a slight variance in the count variables between subjects. Over one third (37%) of subjects read all available cues once, 22% of subjects read at least one cue more than once and four subjects used no cue at all (not tabulated). Additional measures, such as the *number of important cues* and *number of information 9 seconds,* show only a slightly diminished average number of used cues. Overall, Panel B suggests that cues' names and contents attracted the majority of subjects to read them carefully.

Finally, Panel C of Table 3 reports a correlation matrix of the dependent variables. As noted, the correlations among the continuous and count variables are considerably high within the same types of variables, but not between types. Thus, it can be inferred that different types of variables measure – at least partly – different dimensions of information usage.

5.8.3 Descriptive statistics of cue usage

Next, the descriptive statistics of cue usage are presented to assess whether some cues were perceived to be more important than others for decision-making. Table 4 reports the pooled cue usage of all subjects, while in Tables 5–8 cue usage is examined by the level of each independent variable.

Table 4 shows that all available cues were perceived to be relatively important for decision-making. All self-evaluated average importance values were above the mean (5.0) of the scale, the lowest average being 5.95 and the highest being 7.94. Similarly, the total cue visit percentage ranged from 65.7% to 97.8%, which indicates that no cues were deemed to be particularly uninteresting in the menu view.

Further, in Table 4 several variables indicate that *Previous Audit* was perceived to be the most important cue. Over 97 percent of subjects used this cue and only four subjects read it for less than 10 seconds[31]. In addition, when *Previous Audit's* reading time is scaled by cue length, the used median time was the highest (0.43 seconds/word) of all cues. The next important cues were *Balance Sheet*, *Internal Controls* and *Accounting and Bookkeeping*. All those cues were used by more than 90 percent of participants and less than five percent of them read them for less than 10 seconds. Consistent with that, subjects also self-evaluated these four cues' average importance in the top five in the post-experimental questionnaire.

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[31] While *Previous Audit* was the first cue in the Finnish information menu (alphabetic order), the order of the cues did not seem to fully explain their popularity, as the second most popular cue, *Balance Sheet*, was only the seventh item in the menu.

Consequently, the results from these different measures are fairly consistent with each other.

As shown in Table 4, the three least important cues were all from the industry and competition information category. *Industry Comparison*, *Industry Status and Outlook* and *Competitive Environment* were consistently self-evaluated as being the least important and also read relatively superficially by subjects (i.e. over 45 percent of subjects who opened these cues read them for less than 10 seconds). While the long length of these cues may have caused fatigue in processing them carefully, it must be noted that before their length was exposed to a subject, they also received smaller attention in the information menu compared with other cues (total visits varied between 65.7% and 76.0%).

Table 4. Descriptive statistics of cue usage

Descriptive Statistics of Cue Usage													
Variable	IS	BS	KR	IC	ISO	CE	SO	CO	AB	PA	RC	RL	**AVG.**
Self-evaluated importance:[a]													
Mean	7.78	7.78	7.14	5.95	6.11	5.60	6.72	7.48	7.94	7.63	6.82	6.41	**6.95**
Median	8.00	8.00	7.00	6.00	7.00	5.00	7.00	8.00	8.00	8.00	7.00	7.00	**7.17**
Total visits:													
% of subjects	87.82	95.20	82.66	65.68	75.28	76.01	87.45	93.73	93.36	97.79	86.72	93.73	**86.29**
Total visits (> 9 sec on cue.):													
% of subjects	74.54	93.36	68.63	54.61	59.04	60.15	72.32	89.30	88.93	96.31	72.69	77.49	**75.62**
Used cue time:													
Mean time	33.61	47.03	21.39	20.52	33.57	24.32	20.40	34.06	31.45	37.21	18.48	18.69	**28.39**
Median time	20.0	38.0	18.0	19.0	25.0	21.0	18.0	30.0	28.0	32.0	16.0	16.0	**23.42**
Sec. per word (mean)	0.27	0.28	0.35	0.28	0.17	0.24	0.35	0.34	0.34	0.50	0.33	0.26	**0.31**
Sec. per word (median)	0.16	0.22	0.30	0.26	0.13	0.21	0.31	0.30	0.30	0.43	0.29	0.23	**0.26**

Notes:
[a] Measured on an 11-point Likert-type scale
Information cues are defined as follows: IS = Income Statements, BS = Balance Sheet, KR = Key Ratios, IC = Industry Comparison, ISO = Industry Status and Outlook, CE = Competitive Environment, SO = Structure of Organization, CO = Internal Controls, AB = Accounting and Bookkeeping, PA = Previous audit, RC = Relationship with the main Creditor, RL = Relationship with the Lawyer

Tables 5–8 report the cue statistics where subjects' cue usage is classified by experience, risk, task structure and information reliability. Table 5 shows the clear differences in information usage between less experienced and experienced auditors. The statistics clearly show that less experienced subjects used more cues and more average reading time per cue than experienced auditors. By contrast, the average self-evaluated importance evaluations of the cues do not seem to be dependent on auditor experience, which is consistent with the findings of Johnstone (2001). However, less experienced subjects have slightly smaller standard deviations in their importance evaluations between the cues than experienced auditors (0.6 vs. 0.85, not tabulated).

Table 5. Descriptive statistics of cue usage – auditor experience

Descriptive Statistics of Cue Usage - AUDITOR EXPERIENCE													
Variable	IS	BS	KR	IC	ISO	CE	SO	CO	AB	PA	RC	RL	**AVG.**
Self-evaluated importance:[a]													
Mean (LESS)	7.95	7.84	7.23	6.16	6.40	5.91	6.62	7.35	7.89	7.52	6.61	6.36	**6.99**
Mean (MORE)	7.69	7.76	7.09	5.85	5.95	5.44	6.77	7.54	7.96	7.68	6.87	6.43	**6.92**
Total visits:													
% of subjects (LESS)	89.53	94.19	90.70	72.09	86.05	83.72	89.53	97.67	93.02	98.84	89.53	96.51	**90.12**
% of subjects (MORE)	87.03	95.68	78.92	62.70	70.27	72.43	86.49	91.89	93.51	97.30	85.41	92.43	**84.50**
Total visits(> 9 sec on cue.):													
% of subjects (LESS)	80.2	93.0	80.2	66.3	74.4	70.9	76.7	93.0	93.0	95.3	82.6	84.9	**82.56**
% of subjects (MORE)	71.9	93.5	63.2	49.2	51.9	55.1	70.3	87.6	87.0	96.8	68.1	74.1	**72.39**
Used cue time:													
Median time (LESS)	24.0	48.0	19.0	20.5	39.0	28.0	20.0	32.5	31.0	36.0	19.0	18.0	**27.92**
Median time (MORE)	18.0	35.0	17.0	18.5	21.5	18.0	16.0	26.5	26.0	30.0	15.0	15.0	**21.38**
Sec. /word median (LESS)	0.19	0.28	0.31	0.28	0.20	0.28	0.34	0.33	0.33	0.49	0.34	0.25	**0.30**
Sec. /word median (MORE)	0.14	0.20	0.28	0.25	0.11	0.18	0.28	0.27	0.28	0.41	0.27	0.21	**0.24**

Notes:

[a] Measured on an 11-point Likert-type scale

Information cues are defined as follows: IS = Income Statements, BS = Balance Sheet, KR = Key Ratios, IC = Industry Comparison, ISO = Industry Status and Outlook, CE = Competitive Environment, SO = Structure of Organization, CO = Internal Controls, AB = Accounting and Bookkeeping, PA = Previous audit, RC = Relationship with the main Creditor, RL = Relationship with the Lawyer

Table 6 reports the cue statistics where subjects' cue usage is classified according to RMM level. Unexpectedly, these results show that more information is used when RMM is low, as *Total visits%* is higher (87.8% vs. 84.6%), while cues are slightly less carefully read (22.7 vs. 24.2 seconds) in the decision-making process. This same effect is also shown by the greater drop between *Total visits%* and *Total visits (> 9 sec. on cue)%* in low RMM treatments (12.9 %) than in high RMM treatments (9.4%).

Table 6. Descriptive statistics of cue usage – RMM

Descriptive Statistics of Cue Usage - RMM													
Variable	IS	BS	KR	IC	ISO	CE	SO	CO	AB	PA	RC	RL	**AVG.**
Self-evaluated importance:[a]													
Mean (LOW)	7.69	7.86	7.16	6.01	6.10	5.62	6.65	7.47	7.97	7.56	6.78	6.52	**6.95**
Mean (HIGH)	7.87	7.70	7.12	5.88	6.12	5.58	6.80	7.50	7.91	7.70	6.79	6.28	**6.94**
Total visits:													
% of subjects (LOW)	87.94	95.04	85.82	70.92	78.01	80.14	88.65	93.62	95.04	97.16	87.94	94.33	**87.88**
% of subjects (HIGH)	87.69	95.38	79.23	60.00	72.31	71.54	86.15	93.85	91.54	98.46	85.38	93.08	**84.55**
Total visits (> 9 sec on cue.):													
% of subjects (LOW)	71.63	92.20	70.21	60.28	60.28	63.12	68.79	86.52	90.07	95.04	76.60	77.30	**76.00**
% of subjects (HIGH)	77.69	94.62	66.92	48.46	57.69	56.92	76.15	92.31	87.69	97.69	68.46	77.69	**75.19**
Used cue time:													
Median time (LOW)	21.0	37.5	17.0	18.5	24.5	20.0	17.0	27.0	27.0	31.0	15.5	16.0	**22.67**
Median time (HIGH)	19.0	38.5	19.0	20.0	27.5	21.0	19.0	31.0	30.0	32.0	16.0	17.0	**24.17**
Sec. /word median (LOW)	0.17	0.22	0.28	0.25	0.13	0.20	0.29	0.27	0.29	0.42	0.28	0.23	**0.25**
Sec. /word median (HIGH)	0.15	0.23	0.31	0.27	0.14	0.21	0.33	0.31	0.32	0.43	0.29	0.24	**0.27**

Notes:
[a] Measured on an 11-point Likert-type scale
Information cues are defined as follows: IS = Income Statements, BS = Balance Sheet, KR = Key Ratios, IC = Industry Comparison, ISO = Industry Status and Outlook, CE = Competitive Environment, SO = Structure of Organization, CO = Internal Controls, AB = Accounting and Bookkeeping, PA = Previous audit, RC = Relationship with the main Creditor, RL = Relationship with the Lawyer

Table 7 reports the cue statistics where subjects' cue usage is classified according to task structure level. The only visible difference in cue usage between semi-structured and unstructured tasks is that in the latter task more cues are initially used. However, the Total visits (> 9 sec. on cue) percentage is virtually the same for both structure levels, suggesting that cues are used more superficially in unstructured tasks.

Table 7. Descriptive statistics of cue usage – task structure

Descriptive Statistics of Cue Usage - TASK STRUCTURE													
Variable	IS	BS	KR	IC	ISO	CE	SO	CO	AB	PA	RC	RL	**AVG.**
Self-evaluated importance:[a]													
Mean (SEMI)	7.53	7.60	7.00	5.44	5.66	5.24	6.62	7.52	7.92	7.86	6.71	6.21	**6.78**
Mean (UNSTR)	8.00	7.95	7.27	6.43	6.54	5.94	6.82	7.44	7.96	7.41	6.92	6.60	**7.11**
Total visits:													
% of subjects (SEMI)	84.85	94.70	79.55	63.64	72.73	75.00	86.36	94.70	92.42	96.21	84.09	93.18	**84.79**
% of subjects (UNSTR)	90.65	95.68	85.61	67.63	77.70	76.98	88.49	92.81	94.24	99.28	89.21	94.24	**87.71**
Total visits (> 9 sec on cue.):													
% of subjects (SEMI)	75.00	93.18	68.18	56.06	57.58	61.36	73.48	90.91	90.91	94.70	72.73	76.52	**75.88**
% of subjects (UNSTR)	74.10	93.53	69.06	53.24	60.43	58.99	71.22	87.77	87.05	97.84	72.66	78.42	**75.36**
Used cue time:													
Median time (SEMI)	19.0	35.0	17.0	19.0	20.0	21.0	19.0	31.0	29.0	32.0	16.0	16.0	**22.83**
Median time (UNSTR)	22.5	43.0	19.0	19.0	28.5	19.0	18.0	27.0	28.0	31.0	15.0	16.0	**23.83**
Sec. /word median (SEMI)	0.15	0.20	0.28	0.26	0.10	0.21	0.33	0.28	0.31	0.43	0.29	0.23	**0.26**
Sec. /word median (UNSTR)	0.18	0.25	0.31	0.26	0.15	0.19	0.31	0.29	0.30	0.42	0.27	0.23	**0.26**

Notes:
[a] Measured on an 11-point Likert-type scale
Information cues are defined as follows: IS = Income Statements, BS = Balance Sheet, KR = Key Ratios, IC = Industry Comparison, ISO = Industry Status and Outlook, CE = Competitive Environment, SO = Structure of Organization, CO = Internal Controls, AB = Accounting and Bookkeeping, PA = Previous audit, RC = Relationship with the main Creditor, RL = Relationship with the Lawyer

Table 8 reports the cue statistics where subjects' cue usage is classified according to information reliability level. All total visit and cue time variables are indicating that less reliable information is selected more and read longer time compared with more reliable information. This is consistent with the expectations that more less reliable information is needed to reach a sufficiency threshold in uncertainty reduction than when information is more reliable. Subjects in the more reliable information treatments evaluated cues as being only slightly more important than those who had less reliable information, as indicated by *self-evaluated importance* (7.06 vs. 6.85, respectively).

Table 8. Descriptive statistics of cue usage – information reliability

Descriptive Statistics of Cue Usage - INFORMATION RELIABILITY													
Variable	IS	BS	KR	IC	ISO	CE	SO	CO	AB	PA	RC	RL	**AVG.**
Self-evaluated importance:[a]													
Mean (LESS)	7.75	7.81	7.15	5.81	6.10	5.47	6.59	7.26	7.85	7.21	6.83	6.38	**6.85**
Mean (MORE)	7.81	7.75	7.14	6.13	6.12	5.78	6.89	7.74	8.06	8.10	6.74	6.44	**7.06**
Total visits:													
% of subjects (LESS)	88.19	96.53	86.81	66.67	76.39	81.25	89.58	94.44	95.83	97.22	86.11	96.53	**87.96**
% of subjects (MORE)	87.40	93.70	77.95	64.57	74.02	70.08	85.04	92.91	90.55	98.43	87.40	90.55	**84.38**
Total visits (> 9 sec on cue.):													
% of subjects (LESS)	75.00	95.83	73.61	60.42	65.97	65.97	75.00	88.19	91.67	95.14	76.39	81.25	**78.70**
% of subjects (MORE)	74.02	90.55	62.99	48.03	51.18	53.54	69.29	90.55	85.83	97.64	68.50	73.23	**72.11**
Used cue time:													
Median time (LESS)	20.0	39.0	18.0	20.0	30.5	23.0	19.0	31.0	29.0	33.0	16.0	17.0	**24.63**
Median time (MORE)	20.0	36.0	17.0	18.5	19.0	19.0	17.0	27.0	28.0	29.0	15.0	14.0	**21.63**
Sec. /word median (LESS)	0.16	0.23	0.30	0.27	0.16	0.23	0.33	0.31	0.31	0.45	0.29	0.24	**0.27**
Sec. /word median (MORE)	0.16	0.21	0.28	0.25	0.10	0.19	0.29	0.27	0.30	0.39	0.27	0.20	**0.24**

Notes:
[a] Measured on an 11-point Likert-type scale
Information cues are defined as follows: IS = Income Statements, BS = Balance Sheet, KR = Key Ratios, IC = Industry Comparison, ISO = Industry Status and Outlook, CE = Competitive Environment, SO = Structure of Organization, CO = Internal Controls, AB = Accounting and Bookkeeping, PA = Previous audit, RC = Relationship with the main Creditor, RL = Relationship with the Lawyer

In parallel with the descriptive statistics of the dependent variables, these statistics suggest that the majority of subjects perceived all available cues to be important and used information extensively in their decision-making. Finally, it must be noted that the same cues are the generally most (e.g. financial information) and the least (e.g. industry information) used and ranked in Tables 5–8. This suggests that the "relative importance order" of information is not dependent on any particular independent variable or its level. In other words, the manipulations of the variables or the level of experience had no unwanted influence on the demand of any individual cue.

6 METHODOLOGY AND RESULTS

This chapter presents the methodology used in the data analysis as well as the results from the empirical tests. The tests start with the univariate analyses to examine how each independent variable affects the dependent variables. In the following section, multivariate analyses are applied to test the hypotheses. The supplementary and robustness tests are presented in their own sections, as are the analyses of how independent variables affect task-specific judgments. The final section discusses the main empirical findings of the study.

6.1 Manipulation check

Before the univariate and multivariate analyses are carried out, I test if subjects' evaluations of RMM and information reliability are consistent with the intended manipulations. The first manipulation check confirms that subjects generally perceived risk to be higher (mean 5.05) when the high RMM manipulation was present than when the low RMM manipulation (mean 4.13) was present (Mann–Whitney U = 6700.0, p =< 0.001 two-tailed)[32]. The second manipulation check confirms that subjects generally perceived information in the information menu to be more reliable (mean 6.65) when the more reliable information manipulation was present than when the less reliable information manipulation (mean 5.93) was present (Mann–Whitney U = 6769.50, p =< 0.001 two-tailed). These results indicate that both manipulation checks are supported by the data and that the hypotheses of the study can be tested.

6.2 Univariate analyses

The analyses start with the univariate tests, which can give insights into how the experience, risk, task structure, information reliability and hypothesized interaction effects influence the dependent variables. Tables 9–15 present the results of the univariate tests for hypotheses 1–7. Because the dependent variables are not normally distributed, non-parametric tests are used instead of t-tests.

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32 Further results indicate that experienced auditors' estimates of perceived RMM were significantly lower than those of less experienced auditors (U = 8950.50 p =0.021 two-tailed). This finding is not consistent with that of Colbert (1988), who found that level of experience had no effect on auditors' RMM assessments.

The first hypothesis of this study predicts that information is used more extensively in decision-making when the subject is less experienced. A vast amount of literature has shown that experienced auditors' information usage is different from less experienced auditors. For example, experienced auditors' directed information acquisition strategies, knowledge and better recognition of relevant cues are expected to decrease the number of used information and time spent on cue screens.

Table 9. Univariate tests of hypothesis 1

Hypothesis 1 – Auditor (subject) experience						
Variable	EXPERIENCE	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	Less exper.	86	160.6			
	Experienced	185	124.6	13318.5	3.53	0.000
TOT_CUE_TIME	Less exper.	86	160.0			
	Experienced	185	125.3	13672.5	3.30	0.001
JUDG_TIME	Less exper.	86	155.7			
	Experienced	185	126.9	13386.5	2.81	0.005
NUMBER_INF	Less exper.	86	155.5			
	Experienced	185	127.0	133371.0	2.89	0.004
NUMBER_INF_9	Less exper.	86	161.4			
	Experienced	185	124.2	13883.5	3.68	0.000
NUMBER_IMP_CUE	Less exper.	86	145.3			
	Experienced	185	131.7	12497.0	1.34	0.180

Notes:
The variables are defined as follows:
EXPERIENCE = Level of experience (Less experienced/Experienced)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

As shown in Table 9, five measures out of six indicate at the 1% significance level that experienced auditors use less time and cues in their decision-making than less experienced subjects[33]. Only NUMBER_IMP_CUE (p = 0.180) is statistical-

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33 To further analyze whether students' (n=20) information usage differs from other less experienced subjects (n=66), similar univariate tests within this group were carried out. These re-

ly non-significant, which suggests that experience level has no effect on the self-evaluation of cue importance. This is consistent with the findings of Johnstone (2001) who found that less and more experienced auditors' evaluations of the most important cues in an client acceptance task did not differ from each other. Overall, these results are consistent with hypothesis 1.

The second hypothesis of the study predicts that information is used more extensively in subjects' decision-making when RMM is high than when RMM is low. Previous research indicates that auditors increase their audit efforts as client-related risk increases. Specifically in a single audit task, increased risk may heighten conservatism, increase professional skepticism and increase exposure to confirmation bias, which subsequently causes available information to be used more extensively than otherwise.

As shown in Table 10, all time variables show an increase in used time when RMM increases to a high level. Two of these variables are significant at conventional levels, TOT_TIME ($p = 0.068$) and JUDG_TIME ($p = 0.029$). The other dependent variables that measure used information indicate that less information is used when RMM is high, but all these variables are statistically non-significant.

These results imply that the type of information becomes more important when RMM increases. To examine this issue more carefully, total time is divided by the number of used information to test if the means between the low and high risk groups differ. This expectation is supported by the data (Wilcoxon = 19363.0, $p = 0.001$; not tabulated). This result suggests that subjects focused on fewer cues in high risk treatments, but evaluated and combined those cues in a more effortful way than subjects in low risk treatments. In summary, the results show some support for hypothesis 2.

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sults show that only TOT_CUE_TIME is statistically significant ($p=0.035$), indicating that students spent longer on cue screens than other subjects.

Table 10. Univariate tests of hypothesis 2

Hypothesis 2 - RMM						
Variable	RISK	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	Low	141	127.6			
	High	130	145.1	18863.0	1.84	0.068
TOT_CUE_TIME	Low	141	131.8			
	High	130	140.5	18270.5	0.92	0.361
JUDG_TIME	Low	141	126.0			
	High	130	146.9	19097.5	2.20	0.029
NUMBER_INF	Low	141	141.8			
	High	130	129.7	16859.0	-1.32	0.189
NUMBER_INF_9	Low	141	136.6			
	High	130	135.3	17590.5	-0.14	0.889
NUMBER_IMP_CUE	Low	141	141.4			
	High	130	130.1	16913.0	-1.20	0.232

Notes:
The variables are defined as follows:
RISK = Level of RMM (Low/High)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

The third hypothesis of the study predicts that information is used more extensively in subjects' decision-making when the task is unstructured than when it is semi-structured. Arguments from the task structure literature (Bonner 1994) indicate that the lack of specified procedures in unstructured tasks might lead to extensive information usage if it is used as a way to reduce uncertainty in decision-making.

The univariate results for hypothesis 3 are reported in Table 11. Only one mean rank out of the six dependent variables indicates that more cues are used in unstructured than in semi-structured tasks. The variable NUMBER_IMP_CUE is significant at the 5% level ($p = 0.039$). Otherwise, these results are not consistent with hypothesis 3.

The fourth hypothesis of the study predicts that information is used more extensively in subjects' decision-making when information is less reliable than when it is more reliable. Previous studies suggest that less reliable information is weighted less than more reliable information. As auditors' information usage aims to reduce uncertainty, more information is needed to reach a sufficient threshold to make a decision when information is less reliable.

Table 11. Univariate tests of hypothesis 3

Hypothesis 3 - Task structure						
Variable	STRUCTURE	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	Semi-struc.	132	129.6			
	Unstruct.	139	142.1	17103.0	-1.32	0.189
TOT_CUE_TIME	Semi-struc.	132	133.1			
	Unstruct.	139	138.8	17565.0	-0.59	0.550
JUDG_TIME	Semi-struc.	132	129.6			
	Unstruct.	139	142.1	17111.0	-1.30	0.194
NUMBER_INF	Semi-struc.	132	130.7			
	Unstruct.	139	141.1	17247.0	-1.13	0.258
NUMBER_INF_9	Semi-struc.	132	136.8			
	Unstruct.	139	135.2	18059.0	0.17	0.867
NUMBER_IMP_CUE	Semi-struc.	132	125.9			
	Unstruct.	139	145.6	16621.5	-2.08	0.039

Notes:
The variables are defined as follows:
STRUCTURE = Level of task structure (Semi-structured/Unstructured)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

As shown in Table 12, there is a significant increase in used time as indicated by two variables TOT_TIME (p = 0.069) and JUDG_TIME (p = 0.010) when the information comes from a less reliable source. The fact that the variable NUMBER_INF (p = 0.210) is not significant, but NUMBER_INF_9 (p = 0.020) is, suggests that cues are processed in a more effortful way when information comes from a less reliable source. Thus, information that comes from a more reliable source generates more "short visits" compared with less reliable information. This suggests that more reliable information is processed more superficially than less reliable information. However, used time on cue screens is not affected by information reliability, as the variable TOT_CUE_TIME (p = 0.290) is not significant. Overall, these univariate results are consistent with hypothesis 4.

Table 12. Univariate tests of hypothesis 4

Hypothesis 4 - Information reliability						
Variable	RELIABILITY	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	More reliab.	127	126.8			
	Less reliab.	144	144.1	16102.0	-1.82	0.069
TOT_CUE_TIME	More reliab.	127	130.6			
	Less reliab.	144	140.7	16589.5	-1.06	0.290
JUDG_TIME	More reliab.	127	122.9			
	Less reliab.	144	147.6	15605.5	-2.59	0.010
NUMBER_INF	More reliab.	127	129.9			
	Less reliab.	144	141.4	16492.0	-1.25	0.210
NUMBER_INF_9	More reliab.	127	124.3			
	Less reliab.	144	146.4	15782.0	-2.34	0.020
NUMBER_IMP_CUE	More reliab.	127	131.0			
	Less reliab.	144	140.4	16639.5	-1.00	0.322

Notes:
The variables are defined as follows:
RELIABILITY = Level of information reliability (More/Less reliable)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

The fifth hypothesis of the study predicts that in the context of high RMM, a less experienced auditor uses information more extensively than an experienced one. Previous research indicates that the level of conservatism and professional skepticism of an auditor may be conditional on auditor experience. This is particularly emphasized when RMM is high and leads to different degrees of information usage depending on experience level. Thus, less experienced subjects may display greater conservatism and professional skepticism, which causes them to use additional effort to find negative information or errors from the available information.

Table 13. Univariate tests of hypothesis 5

Hypothesis 5 – High RMM and experience						
Variable	EXPERIENCE	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	Less exper.	43	80.5			
	Experienced	87	58.1	3459.5	3.18	0.002
TOT_CUE_TIME	Less exper.	43	79.5			
	Experienced	87	58.6	3420.0	2.98	0.003
JUDG_TIME	Less exper.	43	76.2			
	Experienced	87	60.2	3278.0	2.28	0.022
NUMBER_INF	Less exper.	43	75.6			
	Experienced	87	60.5	3252.5	2.19	0.028
NUMBER_INF_9	Less exper.	43	78.7			
	Experienced	87	59.0	3384.0	2.83	0.005
NUMBER_IMP_CUE	Less exper.	43	70.3			
	Experienced	87	63.1	3021.5	1.02	0.309

Notes:
The variables are defined as follows:
EXPERIENCE = Level of experience (Less experienced/Experienced)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

As shown in Table 13, the results are consistent with the results of Table 9 (auditor experience). Five measures out of six indicate at the 1% and 5% significance levels that experienced auditors use less time and cues in their decision-making than less experienced subjects when RMM is high. The untabulated results from the low RMM treatments indicate that only one variable, NUMBER_INF_9 ($p = 0.020$), is significant at the 5% level, while the other four variables are significant at the 10% level. This finding suggests that the differences in information usage are stronger between less experienced subjects and experienced auditors when RMM is high. Thus, the results are consistent with hypothesis 5.

The sixth hypothesis of the study predicts that the level of task structure does not affect the information usage of experienced auditors. Previous research indicates that differences between experienced and less experienced auditors in information usage behavior might exist only when the task is unstructured. In particular, experienced auditors' better knowledge of task-specific information may help them perform their information usage in the same manner as in semi-structured tasks. By contrast, a less experienced auditor who lacks this knowledge in unstructured tasks may use more comprehensively available information to alleviate the increased uncertainty.

Table 14. Univariate tests of hypothesis 6

Hypothesis 6 – Experienced auditors and task structure						
Variable	STRUCTURE	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	Semi-struc.	92	91.6			
	Unstruct.	93	94.3	8431.0	-0.34	0.732
TOT_CUE_TIME	Semi-struc.	92	93.1			
	Unstruct.	93	92.9	8568.0	0.03	0.975
JUDG_TIME	Semi-struc.	92	91.5			
	Unstruct.	93	94.5	8419.0	-0.38	0.708
NUMBER_INF	Semi-struc.	92	90.4			
	Unstruct.	93	95.6	8319.0	-0.67	0.502
NUMBER_INF_9	Semi-struc.	92	94.0			
	Unstruct.	93	92.1	8641.5	0.24	0.814
NUMBER_IMP_CUE	Semi-struc.	92	85.3			
	Unstruct.	93	100.6	7846.5	-1.96	0.050

Notes:
The variables are defined as follows:
STRUCTURE = Level of task structure (Semi-structured/Unstructured)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

The univariate results for hypothesis 6 are reported in Table 14. These results show no significant differences in information usage between semi-structured and unstructured tasks among experienced auditors. However, as these results are virtually the same as those in Table 11 (task structure), the above finding may also hold among less experienced subjects. The untabulated results from the less experienced group indicate that the variable TOT_TIME ($p = 0.048$) is significant and show that they use more total time for unstructured than for semi-structured tasks. The variable JUDG_TIME ($p = 0.117$) is also almost significant at the 10% level, while the other variables are clearly non-significant. Thus, these results lend some support for hypothesis 6.

The final hypothesis of the study predicts that in the context of less reliable information, less experienced auditors use information more extensively than experienced auditors. A general theory from psychology (Sacchi & Burigo 2008) suggests that when information is reliable, experienced auditors may reject typical goal-directed information usage strategies, use less cognitive efforts and apply sequential information search strategies that are similar to those used by less experienced decision-makers. By contrast, when the available information is less reliable, differences in information usage strategies between less experienced and more experienced auditors are expected to emerge.

As shown in Table 15, there are no significant results in information usage between less experienced and experienced auditors when information is less reliable. Thus, hypothesis 7 is not supported by the univariate tests[34]. By contrast, the untabulated results of the more reliable information treatments show significant differences in information usage between experience levels. Five variables, TOT_TIME (p = 0.000), TOT_CUE_TIME (p = 0.002), JUDG_TIME (p = 0.001), NUMBER_INF (p = 0.006) and NUMBER_INF_9 (p = 0.000), are significant at the 1% level, consistently showing that experienced auditors use less time and cues than less experienced subjects. The variable NUMBER_IMP_CUE (p = 0.066) is also significant at the 10% level, further indicating differences.

To summarize, the results of the univariate tests provide varying support for the study's hypotheses. In particular, the results regarding hypotheses 1 (experience), 4 (information reliability) and 5 (experience and RMM) support the hypothesized expectations. Some support is also found for hypotheses 2 (RMM) and 6 (experience and task structure), while hypotheses 3 (task structure) and 7 (experience and information reliability) are not supported.

---

[34] Regarding this hypothesis, further tests examining whether information reliability and auditor experience have an effect on the information usage order are not supported (see Chapter 6.4 for the tests).

Table 15. Univariate tests of hypothesis 7

Hypothesis 7 – Less reliable information and experience						
Variable	EXPERIENCE	N	Mean score	Wilcoxon statistic	Z	Asymptotic Significance (2-tailed)
TOT_TIME	Less exper.	49	78.0			
	Experienced	95	69.6	3824.0	1.14	0.253
TOT_CUE_TIME	Less exper.	49	79.9			
	Experienced.	95	68.7	3915.0	1.53	0.127
JUDG_TIME	Less exper.	49	75.0			
	Experienced	95	71.3	3665.0	0.47	0.637
NUMBER_INF	Less exper.	49	79.1			
	Experienced	95	69.1	3874.0	1.39	0.164
NUMBER_INF_9	Less exper.	49	79.7			
	Experienced	95	68.8	3903.0	1.49	0.135
NUMBER_IMP_CUE	Less exper.	49	72.9			
	Experienced	95	72.3	3570.5	0.07	0.941

Notes:
The variables are defined as follows:
EXPERIENCE = Level of experience (Less experienced/Experienced)
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time used for reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads

6.3 Multivariate analyses

In this section, multivariate analyses are used to test the hypotheses and draw conclusions about whether they are supported or not. The methodologies used to examine the effect of the independent variables on information usage are ANOVA and ordered logistic regression. These two methods are chosen because there are two types of dependent variables. For continuous dependent variables, the ANOVA method is applied (TOT_TIME, TOT_CUE_TIME and JUDG_TIME) and for discrete dependent variables (NUMBER_INF, NUMBER_INF_9 and NUMBER_IMP_CUE), ordered logistic regression is applied.

6.3.1 Continuous dependent variables - ANOVA

Factorial ANOVA is used to test the differences between the group means based on two or more categorical independent variables with a continuous dependent variable. If significant main or interaction effects are found, then follow-up tests (planned comparisons or post-hoc tests) can be used to find out which group means significantly differ from each other.

A 2×2×2×2 factorial ANOVA design is used in this study. Dependent variables are logarithmic transformed to improve the normality assumptions required by ANOVA. Then, the following models are specified:

$$
\begin{aligned}
Y_{ijklm} &= \mu + \text{INEXP}_i + \text{RISK}_j + (\text{INEXP} \times \text{RISK})_{ij} + \text{STRUCTURE}_k + (\text{INEXP} \times \text{STRUCTURE})_{jk} \\
&+ (\text{RISK} \times \text{STRUCTURE})_{jk} + (\text{INEXP} \times \text{RISK} \times \text{STRUCTURE})_{ijk} + \text{RELIABILITY}_l \\
&+ (\text{INEXP} \times \text{RELIABILITY})_{il} + (\text{RISK} \times \text{RELIABILITY})_{jl} + (\text{STRUCTURE} \times \text{RELIABILITY})_{kl} \\
&+ (\text{INEXP} \times \text{RISK} \times \text{RELIABILITY})_{ijl} + (\text{INEXP} \times \text{STRUCTURE} \times \text{RELIABILITY})_{ikl} \\
&+ (\text{RISK} \times \text{STRUCTURE} \times \text{RELIABILITY})_{jkl} + (\text{INEXP} \times \text{RISK} \times \text{STRUCTURE} \times \text{RELIABILITY})_{ijkl} \\
&+ e(\text{INEXP} \times \text{RISK} \times \text{STRUCTURE} \times \text{RELIABILITY})_{ijklm} \qquad (1)
\end{aligned}
$$

Where:

Y = Dependent variable;

LN_TOT_TIME = Natural logarithm of total time spent on the task **(Model 1)**.

LN_TOT_CUE_TIME = Natural logarithm of total time spent on cue screens **(Model 2)**.

LN_JUDG_TIME = Natural logarithm of time spent outside of cue screens **(Model 3)**.

Independent variables:

i = The level of INEXP (0 denotes an experienced, 1 denotes a less experienced auditor).

j = The level of RISK (0 denotes low risk, 1 denotes high risk).

k = The level of STRUCTURE (0 denotes a semi-structured task, 1 denotes an unstructured task).

l = The level of RELIABILITY (0 denotes more reliable information, 1 denotes less reliable information).

m = The subject within treatment (1–16).

The residual plots for Models 1–3 are presented in Appendix 7. The visual inspection of these plots suggests that the residuals of all models are fairly normally distributed. The results for the ANOVA models are presented in Table 16. The findings reported in Panel A show that INEXP and RISK are significant at the 1% and 5% percent levels, respectively. Further, STRUCTURE is almost significant at the 10% level, while RELIABILITY has no significant main effect to the used total time. All the signs of the mean differences are as predicted (not tabulated). These results seem to support H1 and H2 in that the total time for auditors' decision-making is affected by both the level of experience and risk.

Table 16. ANOVA tables for continuous variables

Panel A. Dependent variable LN_TOT_TIME (**Model 1**)

Variable	df	Sum of Squares	Mean square	F	p
INEXP	1	2.68	2.68	14.52	0.000
RISK	1	0.72	0.72	3.87	0.050
STRUCTURE (STR)	1	0.49	0.49	2.66	0.104
RELIABILITY (REL)	1	0.33	0.33	1.76	0.186
INEXP × RISK	1	0.15	0.15	0.80	0.370
INEXP × STR	1	0.29	0.29	1.58	0.210
INEXP × REL	1	0.52	0.52	2.81	0.095
RISK × STR	1	0.23	0.23	1.22	0.271
RISK × REL	1	0.08	0.08	0.41	0.524
STR × REL	1	0.27	0.27	1.48	0.224
INEXP × RISK × STR	1	0.56	0.56	3.05	0.082
INEXP × STR × REL	1	0.28	0.28	1.51	0.220
RISK × STR × REL	1	0.18	0.18	0.98	0.323
RISK × REL × INEXP	1	0.00	0.00	0.02	0.891
INEXP × RISK × STR × REL	1	0.10	0.10	0.54	0.463
Model	15	6.44	0.43	2.32	0.004
Error	255	47.14	0.19		
Total	270	53.57			

Panel B. Dependent variable LN_TOT_CUE_TIME (**Model 2**)

Variable	df	Sum of Squares	Mean square	F	p
INEXP	1	3.58	3.58	9.18	0.003
RISK	1	0.26	0.26	0.66	0.418
STRUCTURE (STR)	1	0.06	0.06	0.14	0.704
RELIABILITY (REL)	1	0.18	0.18	0.45	0.504
INEXP × RISK	1	0.11	0.11	0.27	0.605
INEXP × STR	1	0.08	0.08	0.19	0.663
INEXP × REL	1	0.51	0.51	1.31	0.253
RISK × STR	1	0.14	0.14	0.36	0.550
RISK × REL	1	0.10	0.10	0.25	0.618
STR × REL	1	1.08	1.08	2.78	0.097
INEXP × RISK × STR	1	0.31	0.31	0.78	0.377
INEXP × STR × REL	1	0.57	0.57	1.47	0.227
RISK × STR × REL	1	0.00	0.00	0.01	0.930
RISK × REL × INEXP	1	0.06	0.06	0.15	0.702
INEXP × RISK × STR × REL	1	0.00	0.00	0.00	0.946
Model	15	6.36	0.42	1.09	0.369
Error	255	99.56	0.39		
Total	270	105.92			

Table 16. Continued

Panel C. Dependent variable LN_JUDG_TIME (**Model 3**)					
Variable	df	Sum of Squares	Mean square	F	p
INEXP	1	1.16	1.16	6.74	0.010
RISK	1	1.08	1.08	6.27	0.013
STRUCTURE (STR)	1	1.14	1.14	6.62	0.011
RELIABILITY (REL)	1	0.51	0.51	2.93	0.088
INEXP × RISK	1	0.03	0.03	0.15	0.694
INEXP × STR	1	0.71	0.71	4.10	0.044
INEXP × REL	1	0.49	0.49	2.83	0.094
RISK × STR	1	0.10	0.10	0.59	0.443
RISK × REL	1	0.00	0.00	0.00	0.958
STR × REL	1	0.05	0.05	0.29	0.590
INEXP × RISK × STR	1	0.46	0.46	2.70	0.102
INEXP × STR × REL	1	0.18	0.18	1.07	0.302
RISK × STR × REL	1	0.94	0.94	5.43	0.021
RISK × REL × INEXP	1	0.04	0.04	0.21	0.646
INEXP × RISK × STR × REL	1	0.79	0.79	4.58	0.033
Model	15	6.87	0.46	2.66	0.001
Error	255	43.95	0.17		
Total	270	50.82			

Notes:
The variables are defined as follows:
LN_TOT_TIME = Natural logarithm of total time spent on the task
LN_TOT_CUE_TIME = Natural logarithm of total time used for reading cues
LN_JUDG_TIME = Natural logarithm of time spent outside of cue screens
INEXP = A categorical variable with a value of 1 if a subject is less experienced, otherwise 0
RISK = A categorical variable with a value of 1 if a treatment group contains high RMM, otherwise 0
STRUCTURE = A categorical variable with a value of 1 if a treatment group is an unstructured task, otherwise 0
RELIABILITY = A categorical variable with a value of 1 if a treatment group contains the less reliable information manipulation, otherwise 0

The results also show significant two- and three-way interactions with experience at the 10% level. For each significant interaction between the independent variables, an interaction plot is provided. In Figure 11, an interaction plot with experience and reliability is presented. The Tukey–Kramer post-hoc[35] tests indicate the following significant observations. Compared with when an auditor is experienced and information reliable, it takes less time THAN when 1) information is less reliable (mean difference= -0.175, p = 0.031), 2) the subject is less experi-

[35] Alpha 0.05 is used in all post-hoc tests in this study.

enced (mean difference= -0.321, p = 0.002) and 3) information is less reliable and the subject is less experienced (mean difference= -0.300, p = 0.001). This interaction suggests that when information comes from a reliable source, experienced auditors are able to perform tasks in significantly less time compared with all other conditions. This finding is inconsistent with hypothesis 7, which predicts that in the context of less reliable information, a less experienced auditor uses information more extensively than an experienced one. Thus, consistent with the univariate results, the multivariate results show the opposite to be true.

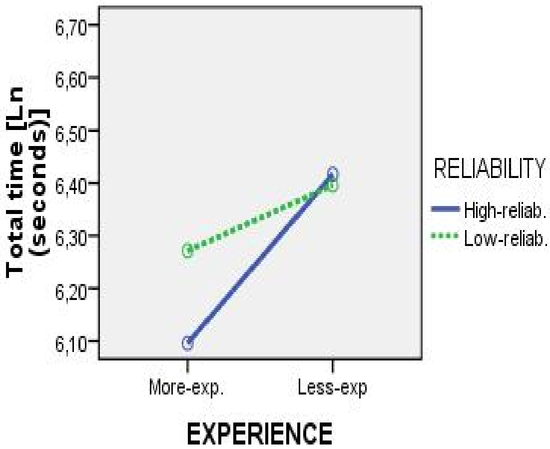

Figure 11. Interaction plot – estimated marginal means for experience and information reliability

In Figure 12, a three-way interaction plot with experience, risk and structure is presented. The Tukey–Kramer post-hoc tests indicate the following significant observations. Compared with when a subject is less experienced, a task is unstructured and risk is high, it takes *more* time THAN when 1) an auditor is experienced, a task semi-structured and risk low (mean difference= 0.535, p = 0.000), 2) an auditor is experienced and risk low (mean difference= 0.475, p = 0.001), 3) an auditor is experienced and a task semi-structured (mean difference= 0.434, p = 0.005) and an auditor is experienced (mean difference= 0.450, p = 0.003). This interaction can be interpreted that when a task is unstructured and risk is high, less experienced subjects use significantly more time than experienced auditors regardless of risk or structure level. Thus, the finding suggests that the simultaneous presence of high risk and an unstructured task might be necessary to see experience effects across experience levels.

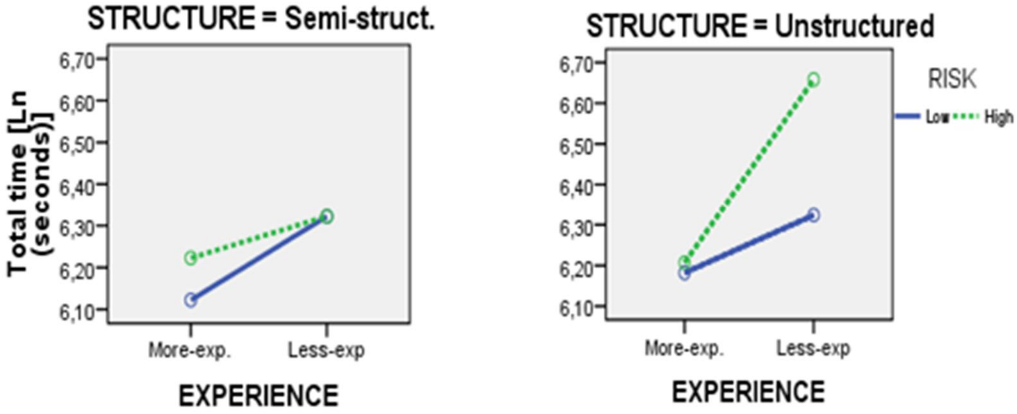

Figure 12. Interaction plots – estimated marginal means for experience, risk and structure

Panel B of Table 16 presents the results from Model 2[36], where time spent on cue screens is a dependent variable. From the main effects, INEXP is significant at the 1% level[37]. This result indicates that less experienced subjects use more time on cue screens than experienced auditors (mean difference = 0.257, not tabulated). This result supports H1. Further, the two-way interaction between RELIABILITY and STRUCTURE is barely significant at the conventional levels. The post-hoc tests show no significant differences in means within this interaction; hence, it is not analyzed further. The non-significance of the other variables and interactions suggests that manipulated variables have no effect on used cue time.

Finally, Panel C of Table 16 presents the results from Model 3, where used cue time is extracted from total time. The dependent variable in this model measures judgment time, i.e. the time used outside of cue screens for processing cues and making task-specific judgments[38]. Panel C shows that all the main effects are significant at the 5% level apart from RELIABILITY, which is significant at the

---

36 While this model overall is not significant (p = 0.369), the removal of all non-significant interactions changes the model to be significant at the 5% level (p = 0.035). In this model, INEXP is still significant at the 1% level (p = 0.003).

37 The multivariate analyses were also run without students. The untabulated results show that INEXP is now significant at the 5% level, while the other results remain virtually the same. Other results of tests without students are discussed in Chapter 6.4.

38 To further point out that this variable measures the time used for processing cues, all discrete dependent variables are added as covariates to this model one by one. All these variables are significant predictors of JUDG_TIME at the 1% level with F-values ranging from 11.2 to 43.5, indicating a significant effect size.

10% level. Again, all signs of mean differences are as predicted (not tabulated). The results also show several two-, three- and four-way interactions. In Figure 13, both two-way interactions are presented, where experience is on the X-axis and STRUCTURE or RELIABILITY is plotted one at a time (A and B).

In Figure 13A, the Tukey–Kramer post-hoc tests indicate that less experienced subjects use significantly more time in unstructured tasks compared with when 1) an auditor is experienced and a task semi-structured (mean difference= 0.292, p = 0.002), 2) an auditor is experienced (mean difference= 0.261, p = 0.006) and 3) a subject is less experienced (mean difference= 0.259, p = 0.033). This result is consistent with hypothesis 6 that predicts that the level of task structure does not affect the information usage of experienced auditors. According to this result, only less experienced subjects are affected by task structure when information usage is measured by the time used to process cues and make judgments.

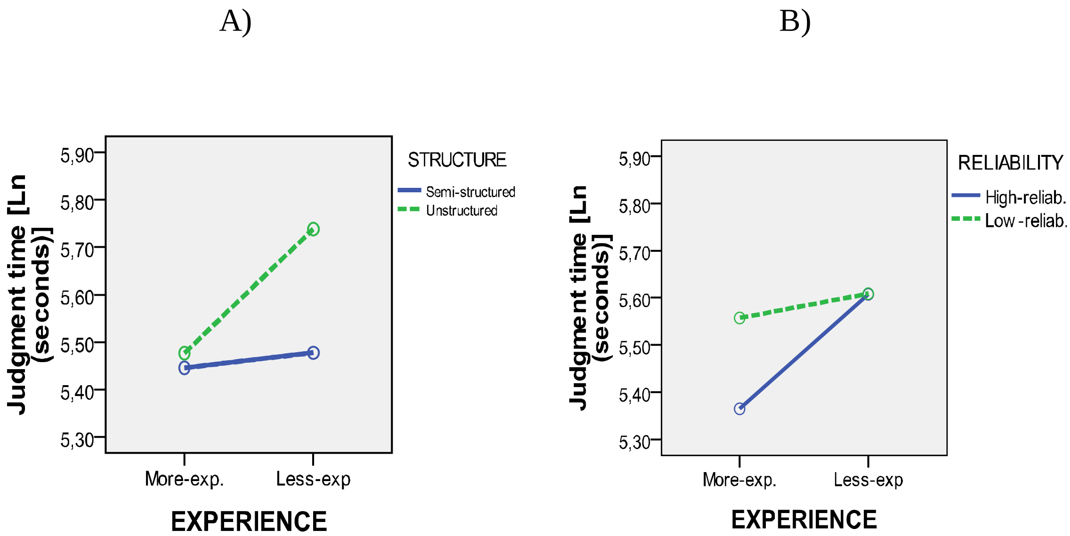

Figure 13. Interaction plots – estimated marginal means for experience and structure/information reliability

Figure 13B shows a similar interaction pattern between experience and reliability to that presented in Figure 11 (total time as a dependent variable). Thus, the analysis is not repeated here. Taken together, these two interactions suggest that the observed interaction is attributable specifically to the used judgment time, but not to the time spent on cue screens.

In Figure 14, a three-way interaction plot with risk, reliability and structure is presented. The Tukey–Kramer post-hoc tests indicate that when “extreme” treatments (defined as “low risk, more reliable information and semi-structured task” vs. “high risk, less reliable information and unstructured task”) are compared, the mean difference in used time is 0.514 (p = 0.002) in the expected direction. This complex interaction can be interpreted that used time increases significantly only when three “uncertainty factors”[39] exist simultaneously. Thus, when one uncertainty factor is present, adding a second uncertainty factor does not cause a significant increase in the dependent variable. However, the simultaneous presence of these three factors increases significantly the time used for processing cues. This finding suggests that the relationships between the uncertainty factors and the dependent variable are non-linear.

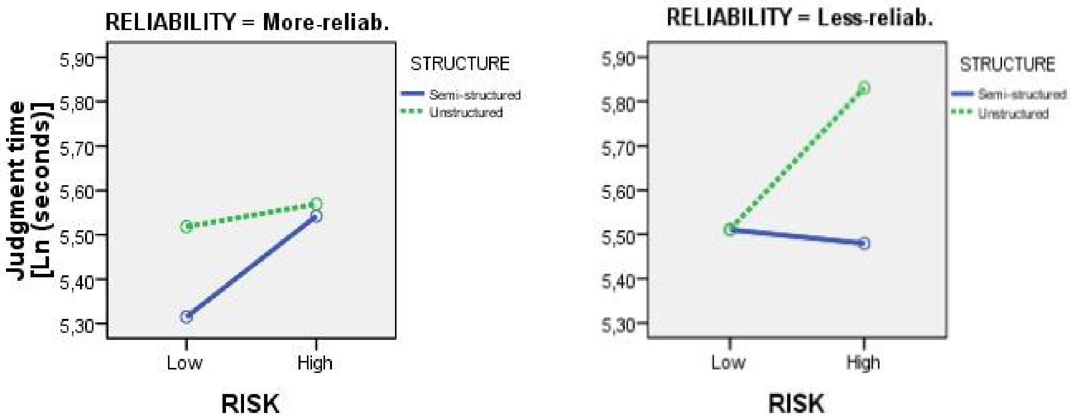

Figure 14. Interaction plots – estimated marginal means for risk, structure and information reliability

Finally, a four-way interaction is examined by comparing the significant differences in means between the cells. The Tukey–Kramer post-hoc tests indicate that compared with when subject is less experienced, risk high, task unstructured and information less reliable (hereafter “extreme”), it takes less time when:

39 The term “uncertainty factor” is used to refer to any of the independent variables when they have a value of 1 (i.e. less experienced auditor/ high risk/unstructured task/ less reliable information).

1. A task is semi-structured (mean difference= -0.736, p = 0.016),
2. an auditor is experienced and information more reliable (mean difference= -0.398, p = 0.021),
3. an auditor is experienced, information more reliable and a task semi-structured (mean difference= -0.636, p = 0.024),
4. an auditor is experienced, risk low and a task semi-structured (mean difference= -0.585, p = 0.043),
5. an auditor is experienced, risk low and information more reliable (mean difference= -0.667, p = 0.010),
6. an auditor is experienced, risk low, a task semi-structured and information more reliable (mean difference= -0.786, p = 0.001).

Five out of these six observations suggest that in many cases experienced auditors are able to use less judgment time compared with the extreme situation. In particular, observations 3, 4 and 5 indicate that the presence of one uncertainty factor does not significantly increase experienced auditors' judgment time. This result also holds in observation 2 where two uncertainty factors are present. Thus, the results indicate that experienced auditors may be able process cues in an almost similar way despite there being only one (or indeed no) uncertainty factors present. However, because of the high complexity of this interaction and the few observations in some cells, one must be cautious when making conclusions about this interaction[40].

6.3.2 Discrete dependent variables – ordered logistic regression

As the other dependent variables (NUMBER_INF, NUMBER_INF_9 and NUMBER_IMP_CUE) of the study are discrete variables and count data by their nature, using an ordinary least squares regression would violate the normality assumption of residuals. Instead, an ordered logistic regression can be used when modeling categorical dependent variables and categories of responses can be ordered. Ordered logit models are especially suitable when dependent variable values are recorded ordinally, but it is desirable to consider dependent variables as continuous (Flom 2010).

Thus, this study's dependent discrete variables are modeled using ordered logit models, as the number of used information can be ordered. However, as shown in Panel B of Table 3, these variables have very little variance, while their ranges are

[40] Because the smallest cell has only six observations (see Appendix 6), this interaction has a significant risk of Type I error and thus it is not discussed in the further parts of this study.

considerably high (from 0 to 25). Further, the distribution of NUMBER_INF indicates that 40.2% of subjects used all 12 cues at once (not tabulated). Consequently, there are many levels with only few observations. Thus, in order to improve model fit, the levels of each dependent variable are equalized to three similar-sized (about) categories for the number of used information: low, medium and high. After the combination of the levels, the following ordered logit models are specified:

$$
\begin{aligned}
&Log(Y/(1-Y)) = \beta_0 + \beta_1 INEXP + \beta_2 RISK + \beta_3 STRUCTURE + \beta_4 RELIABILITY \\
&+ \beta_5 (INEXP \times RISK) + \beta_6 (INEXP \times STRUCTURE) + \beta_7 (INEXP \times RELIABILITY) \\
&+ \beta_8 (RISK \times STRCTURE) + \beta_9 (RISK \times RELIABILITY) + \beta_{10} (STRUCTURE \times RELIABILITY) \\
&+ \beta_{11} (INEXP \times RISK \times STRUCTURE) + \beta_{12} (INEXP \times STRUCTURE \times RELIABILITY) \\
&+ \beta_{13} (RISK \times STRUCTURE \times RELIABILITY) + \beta_{14} (RISK \times RELIABILITY \times INEXP) \\
&+ \beta_{15} (INEXP \times RISK \times STRUCTURE \times RELIABILITY) \qquad (2)
\end{aligned}
$$

Where:

Y = Dependent variable:

NUMBER_INF = Total number of read cues, including multiple reads **(Model 4)**.

NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads **(Model 5)**.

NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads **(Model 6)**.

Independent variables:

RISK = A dummy variable with a value of 1 if a treatment group contains a high RMM manipulation, otherwise 0.

RELIABILITY = A dummy variable with a value of 1 if a treatment group contains a less reliable information manipulation, otherwise 0.

STRUCTURE = A dummy variable with a value of 1 if a treatment group is an unstructured task, otherwise 0.

INEXP = A dummy variable with a value of 1 if an auditor is less experienced, otherwise 0.

Table 17 reports the results for Models 4–6. These results generally indicate few statistically significant relationships between the independent and dependent variables. RELIABILITY has a positive and significant coefficient in two models, suggesting that less experienced subjects select quantitatively more information than experienced auditors. The results also show few three- and four-factor interactions at the 10% level.

Table 17. Ordered logistic regression analyses for discrete variables

Variable	(4) NUMBER _INF	(5) NUMBER _INF_9	(6) NUMBER_IMP _CUE
Intercept1	-1.911 ***	-2.623 ***	-1.252 ***
	(21.72)	(34.64)	(8.89)
Intercept2	-0.009	-0.047	0.336
	(0.00)	(0.01)	(0.66)
INEXP	0.635	0.918	1.257
	(0.67)	(1.21)	(2.06)
RISK	-0.571	0.008	-0.683
	(0.89)	(0.00)	(1.35)
STRUCTURE (STR)	0.451	-0.007	0.458
	(0.69)	(0.00)	(0.69)
RELIABILITY (REL)	0.872 *	1.014 *	0.198
	(2.77)	(3.35)	(0.13)
INEXP × RISK	1.135	0.715	0.418
	(1.12)	(0.40)	(0.13)
INEXP × STR	1.041	0.930	-0.901
	(0.83)	(0.58)	(0.57)
INEXP × REL	-0.547	-0.598	-0.676
	(0.30)	(0.31)	(0.41)
RISK × STR	0.571	0.214	0.885
	(0.89)	(0.07)	(1.24)
RISK × REL	0.001	-0.081	0.847
	(0.00)	(0.01)	(1.17)
STR × REL	-0.653	-0.254	0.655
	(0.78)	(0.11)	(0.72)
INEXP × RISK × STR	-2.113	-1.201	-0.619
	(1.97)	(0.57)	(0.16)
INEXP × STR × REL	-0.982	-0.828	-0.241
	(0.47)	(0.30)	(0.03)
RISK × STR × REL	-1.052	-0.285	-2.417 **
	(0.86)	(0.06)	(4.79)
RISK × REL × INEXP	-1.275	-0.914	-1.303
	(0.79)	(0.37)	(0.80)
INEXP × RISK × STR × REL	3.844 *	2.451	2.581
	(3.45)	(1.33)	(1.59)
-2 Log Likelihood	552.1	514.3	574.8
Likelihood ratio, $\chi 2$	23.3 ***	24.0 ***	19.8 ***
Pseudo R^2	4.1 %	4.5 %	3.3 %
AIC	586.1	548.3	608.8

Table 17. Continued

Notes:
Wald Chi-Squares are reported in parentheses. Statistical significance based on two-tailed tests at the 1%, 5% and 10% levels are denoted by ***, ** and *, respectively.
The variables are defined as follows:
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads
INEXP = A dummy variable with a value of 1 if an auditor is less experienced, otherwise 0
RISK = A dummy variable with a value of 1 if a treat. group contains a high RMM manipulation, otherwise 0
STRUCTURE = A dummy variable with a value of 1 if a treatment group is an unstructured task, otherwise 0
RELIABILITY = A dummy variable with a value of 1 if a treatment group contains a less reliable information manipulation, otherwise 0

Owing to the complex interpretations of these interactions, all the coefficients of these models are re-estimated with alternative independent variables. In these models, TREATMENT and INEXP are independent variables. To further ease interpretation, treatment 1 is set as the reference category to which other treatment groups are compared. This choice is made on the basis of this study's theory that predicts that information usage should be at its lowest level when risk is low, information is reliable and a task is semi-structured (i.e. treatment 1). The following models have identical intercepts and model statistics to the models reported in Table 17.

$$Log(Y/(1-Y)) = \beta_0 + \beta_1 TR_2 + \beta_2 TR_3 + \beta_3 TR_4 + \beta_4 TR_5 + \beta_5 TR_6 + \beta_6 TR_7 + \beta_7 TR_8$$
$$+ \beta_8 INEXP + \beta_9 TR_2 \times INEXP + \beta_{10} TR_3 \times INEXP + \beta_{11} TR_4 \times INEXP$$
$$+ \beta_{12} TR_5 \times INEXP + \beta_{13} TR_6 \times INEXP + \beta_{14} TR_7 \times INEXP + \beta_{15} TR_8 \times INEXP \qquad (3)$$

Where:

Dependent variables are as previously defined.

Independent variables:

TR_2 = A dummy variable with a value of 1 if a treatment group is two (i.e. low risk, less reliable information, semi-structured task), otherwise 0.

TR_3 = A dummy variable with a value of 1 if a treatment group is three (i.e. high risk, more reliable information, semi-structured task), otherwise 0.

TR_4 = A dummy variable with a value of 1 if a treatment group is four (i.e. high risk, less reliable information, semi-structured task), otherwise 0.

TR_5 = A dummy variable with a value of 1 if a treatment group is five (i.e. low risk, more reliable information, unstructured task), otherwise 0.

TR_6 = A dummy variable with a value of 1 if a treatment group is six (i.e. low risk, less reliable information, unstructured task), otherwise 0.

TR_7 = A dummy variable with a value of 1 if a treatment group is seven (i.e. high risk, more reliable information, unstructured task), otherwise 0.

TR_8 = A dummy variable with a value of 1 if a treatment group is eight (i.e. high risk, less reliable information, unstructured task), otherwise 0.

INEXP = A dummy variable with a value of 1 if an auditor is less experienced, otherwise 0.

Table 18 reports the coefficients of the TREATMENT and INEXP[41] variables in Models 4 to 6. In Model 3, TR_2 is the only significant coefficient, while in Model 4 both TR_2 and TR_4 are significant at the 10% level, indicating evidence that less reliable information is needed more for decision-making, but only in semi-structured tasks. In Model 6, two coefficients, TR_6 and TR_6*INEXP, are significant at the 5% and 10% levels, respectively. This finding suggests that less reliable information attracts using important cues in this treatment group, but the effect is only limited to experienced auditors as the interaction variable's (TR_6*INEXP) coefficient is negative. Taken together, the results from Models 4–6 show only weak support for hypothesis 4.

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[41] Because the models are virtually the same, the coefficients and significance levels of INEXP are identical to those reported in Table 17. However, they are repeated here to ease the interpretation of the interaction variables.

Table 18. Coefficients of discrete variables with TREATMENT and IN-EXP as the independent variables

Variable	(4) NUMBER _INF	(5) NUMBER _INF_9	(6) NUMBER_IMP _CUE
TR_1 - Low risk, More rel., Semi-str. (reference treatment)	0.000	0.000	0.000
TR_2 -Low risk, Less rel., Semi-str.	0.872 *	1.014 *	0.198
	(2.77)	(3.35)	(0.13)
TR_3-High risk, More rel., Semi-str.	-0.571	0.008	-0.684
	(0.89)	(0.00)	(1.35)
TR_4-High risk, Less rel., Semi-str.	0.302	0.942 *	0.361
	(0.27)	(2.64)	(0.42)
TR_5 - Low risk, More rel., Unstr.	0.451	-0.007	0.458
	(0.69)	(0.00)	(0.69)
TR_6-Low risk, Less rel., Unstr.	0.670	0.753	1.311 **
	(1.56)	(1.79)	(5.18)
TR_7-High risk, More rel., Unstr.	0.451	0.215	0.659
	(0.69)	(0.14)	(1.38)
TR_8-High risk, Less rel., Unstr.	-0381	0.610	-0.059
	(0.41)	(1.06)	(0.01)
INEXP	0.635	0.918	1.257
	(0.67)	(1.21)	(2.06)
TR_1 * INEXP (reference treatment)	0.000	0.000	0.000
TR_2 * INEXP	-0.547	-0.598	-0.676
	(0.30)	(0.31)	(0.41)
TR_3 * INEXP	1.135	0.715	0.418
	(1.12)	(0.40)	(0.13)
TR_4 * INEXP	-0.686	-0.796	-1.561
	(0.42)	(0.53)	(2.02)
TR_5 * INEXP	1.041	0.930	-0.901
	(0.83)	(0.58)	(0.57)
TR_6 * INEXP	-0.488	-0.496	-1.818 *
	(0.25)	(0.24)	(2.89)
TR_7 * INEXP	0.063	0.444	-1.102
	(0.00)	(0.17)	(1.03)
TR_8 * INEXP	1.104	0.555	-0.741
	(0.90)	(0.23)	(0.40)

Notes:
Wald Chi-Squares are reported in parentheses. Statistical significance based on two-tailed tests at the 1%, 5% and 10% levels are denoted by ***, ** and *, respectively.
The variables are defined as follows:
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance has been self-evaluated to be more than 4, including multiple reads
TR_1 = A reference treatment (i.e. low risk, more reliable information, semi-structured task), where other treatments are compared
TR_2 = A dummy variable with a value of 1 if a treatment group is two (i.e. low risk, less reliable information, semi-structured task), otherwise 0

TR_3 = A dummy variable with a value of 1 if a treatment group is three (i.e. high risk, more reliable information, semi-structured task), otherwise 0
TR_4 = A dummy variable with a value of 1 if a treatment group is four (i.e. high risk, less reliable information, semi-structured task), otherwise 0
TR_5 = A dummy variable with a value of 1 if a treatment group is five (i.e. low risk, more reliable information, unstructured task), otherwise 0
TR_6 = A dummy variable with a value of 1 if a treatment group is six (i.e. low risk, less reliable information, unstructured task), otherwise 0
TR_7 = A dummy variable with a value of 1 if a treatment group is seven (i.e. high risk, more reliable information, unstructured task), otherwise 0
TR_8 = A dummy variable with a value of 1 if a treatment group is eight (i.e. high risk, less reliable information, unstructured task), otherwise 0
INEXP = A dummy variable with a value of 1 if an auditor is less experienced, otherwise 0

To summarize, the results of these multivariate tests show consistent support for H1. The results also provide some support for H2 and H6, while many of the statistical tests are non-significant. There is also weak support for H3 and H4, while the empirical results do not support H5 or H7. The implications of these results as well as the other found non-hypothesized interactions are discussed in Chapter 6.6.

6.4 Supplementary analyses and robustness tests

The objective of this section is to provide supplementary analyses and to test the robustness of the previous analyses. First, I investigate whether the independent variables auditor experience, risk, task structure and information reliability affect information usage order. As discussed in the theory part with hypothesis development 1, the audit literature (e.g. Biggs & Mock 1983; Bonner & Pennington 1991) suggests that experienced auditors apply directed search strategies compared with less experienced auditors, who usually acquire information in the order in which it is presented. Furthermore, theoretical arguments behind hypothesis development 7 predict that particularly under less reliable information differences in information usage order across different experience levels are expected to emerge.

To test this, an order score is calculated where a higher score indicates greater deviance from the usage of presentation order (i.e. from top down reading order in information menu). For example, a subject who read the 12 cues in presentation order would score 0, while the opposite reading order would score maximum points (12). Although the univariate results show that low experience is negatively associated with the order score (Wilcoxon = 10715.0, $p = 0.096$; not tabulated) and high RMM is positively associated with information usage score (Wilcoxon =

18791.5, p =0.078; not tabulated), the multivariate analyses (not tabulated) fail to find any significant relationships between the key variables of interest and information usage order.

Next, I begin robustness tests by investigating whether the cut-off points of two discrete dependent variables influence the main results. As the variables NUMBER_IMP_CUE and NUMBER_INF_9 have somewhat arbitrary limits of importance and time (i.e. more than 4 cue importance and more than 9 seconds, respectively), other cut-off points are also tested. Thus, all models with NUMBER_INF_9 are re-estimated with using alternative cut-off points of 4 and 14 seconds and NUMBER_IMP_CUE with importance values of more than 3 and 5, respectively.

The results (not tabulated) of using alternative cut-off points of 4 and 14 seconds (NUMBER_INF_4 and NUMBER_INF_14) are generally consistent with the results reported in Tables 17 and 18. The two exceptions are that with the cut-off point of 14 seconds treatment 2 is no longer significant at the 10% level, while treatment 6 becomes significant. Moreover, with different cut-off point for number of important cues, the results in both models generally hold. The only notable exception is that INEXP*TR_6 is no longer significant when 5 is used as a cut-off point for the number of important cues.

Next, I investigate whether the cut-off points for INEXP significantly affect the results of Models 1–3. The untabulated results show that the results are generally robust when task-specific experience's cut-off point is increased or decreased by one unit from 5 on a scale of 0 to 8 (see Chapter 5.7). Almost all main effects are still significant at conventional levels when the cut-off point is decreased by one unit. The only exception is Model 3 where the two-way interactions related to auditor experience are no longer significant. However, it must be noted that using this cut-off point reduces the number of less experienced subjects from 86 to only 70, which also reduces the overall fit of the models. By contrast, when the cut-off point is increased by one unit, the results are consistent with the main analyses and almost all statistical significances are even stronger than in the main analyses. This cut-off point classifies 101 subjects as less experienced compared to the cut-off point 5 where number of less experienced subjects were 86. Using the alternative cut-off point of 6 improves the model fit and produces residuals that more closely follow the normal distribution.

Finally, I analyze Models 1–3 without students to see whether the results are driven by subjects who are not auditing professionals. The untabulated results indicate that RISK is no longer significant in Model 1 (i.e. risk is not affecting the amount of total time used). However, consistent with the main analyses, the variable

RISK in the Model 3 is still found significant at the 5% level. The other main difference is that RELIABILITY is no longer significant in Models 1 and 3, indicating that information reliability does not affect information usage. However, it should be noted again that excluding students reduces the overall fit of the models and leaves only 66 less experienced subjects to the analyses. To address the problem of low number of less experienced subjects, I estimate the models after re-defining the variable INEXP by increasing variable's cut-off point from 5 to 6 similarly than in the previous robustness test (see the above paragraph). I also exclude all the students from this analysis resulting in 81 subjects of low task-specific experience. After the re-definition, the model fit improves and the estimated results are generally consistent with those reported in the main analyses. There are however three notable exceptions. First, results reported in Appendix 8 show that STRUCTURE is now also significant at the 10% level in the Model 1 and has also a significant interaction with the experience. Second, interaction between INEXP and RELIABILITY is no longer significant in Models 1 and 3. However, both of these Models have now significant three-way interaction between INEXP, RELIABILITY and STRUCTURE at the 10% level. Thus, there is still an interaction between experience and reliability, but now its effect depends on structure as well. Also in the Model 3 there is a new significant three-way interaction between INEXP, RISK and STRUCTURE at the 5% level. Third, INEXP is barely insignificant (p = 0.119) in the Model 2 indicating that cues are not read longer time by less experienced subjects when the students are "replaced" by other less experienced auditors. Thus, robustness tests suggest that long cue times are related to subjects having no or little prior task-specific experience.

To summarize, the results of robustness tests show that alternative cut-off points of INEXP have fairly small effect on the main results, when the model fits and residuals are on the similar level as in the main analyses. Results also hold when students are excluded. While the significances of some interactions depend on the used cut-off point, their number is not significantly affected by it. This consistent finding about the high number of interactions supports the study's general conclusion, that the relationship between uncertainty factors and the information usage variables are often non-linear (see Chapter 6.6 for further discussion).

6.5 Analyses of independent variables effect on task-specific judgments

The objective of this section is to investigate the role of the independent variables on auditors' decision-making and judgments. While the multivariate analyses suggested that the independent variables have a modest effect on information usage, it is possible that these factors have a stronger effect on actual client continuance and acceptance judgments and the pre-planning judgments of engagements. For instance, the client acceptance literature has showed that riskier clients are less likely to be accepted as new clients (Asare & Knechel 1995; Johnstone 2000) and are charged higher audit fees (Johnstone & Bedard 2003).

As described in Chapter 5.4, in the client continuance task a subject was asked to make four task-related judgments. In the first judgment, the subject was asked to make a probability estimate of recommending continuance with an existing client. The second estimate related to the judgment confidence level. In the third estimate, the subject was asked to recommend the number of audit hours for the next year's audit (compared with the last audit). The fourth question asked subjects to estimate the audit fee. All items were presented on an 11-point scale. In the client acceptance task, the questions were almost identical. The notable difference was that in audit hour and fee estimates the reference point was now a typical same sized firm from the same industry.

Owing to these slightly differently presented questions in audit hour and fee estimates between the tasks, the models with the above-defined four dependent variables are estimated separately. In Panel A (B) of Table 19, treatment group 1 (5) is set to be the reference category in which treatments 2(6) to 4(8) are compared. Otherwise, these ordinal regression models have the same independent variables and the interaction variables of the models are the same as those in Eq. 3. The descriptive statistics of these variables are reported in Appendix 9.

Panel A of Table 19 presents the results for the client continuance task. The results of Model 1 indicate that the probability of recommending continuance decreases to its lowest level when RMM is high and information is less reliable, as the coefficient estimate is negative and significant at the 1% level. The coefficients of TR_2 and TR_3 are also negative and significant at the 10% level, indicating that the existence of high RMM or less reliable information alone decreases the probability of recommending continuance compared with treatment 1.

The results of Model 2 show that the coefficient of TR_4 is negative and significant at the 1% level, indicating that the existence of high RMM and less reliable information at the same time decrease subject confidence about their judgment accuracy. The results of Models 3 and 4 indicate that the coefficients of TR_2 and TR_4 are significant at the 1% level. This finding suggests that subjects regardless of their experience level increase their projected audit hour and fee estimates when information is less reliable.

Panel B presents the results for the client acceptance task. The results of Model 5 indicate that only firms in TR_8 are less likely to be accepted as new clients. Further, INEXP is now significant at the 10% level, indicating that less experience further increases the acceptance likelihood of a prospective client. The latter finding is consistent with previous studies (e.g. Libby 1995; Abdolmohammadi & Wright 1987) that have stated that less experienced auditors are more conservative in their judgments than experienced auditors. The results of Models 6–8 are similar to the corresponding models of the client continuance task. The one notable change is that high RMM (TR_6) is now also significant in the HOUR_ESTIM and FEE_ESTIM models.

Table 19. Ordinal regression models estimated to test how the independent variables affect task-specific judgments in semi-structured and unstructured tasks

Panel A. Regression analyses of task-specific judgment variables for the continuance task

	(1)	(2)	(3)	(4)
Variable	JUDGMENT	JUDG_CONF	HOUR_ESTIM	FEE_ESTIM
TR_1 - Low risk, More rel., Semi-str. (reference treatment)	0.000	0.000	0.000	0.000
TR_2 -Low risk, Less rel., Semi-str.	-1.037 *	-0.375	1.363 ***	1.868 ***
	(3.57)	(0.54)	(6.77)	(10.71)
TR_3-High risk, More rel. Semi-str.	-1.124 *	-0.831	0.880	0.890
	(3.63)	(2.08)	(2.63)	(2.56)
TR_4-High risk, Less rel., Semi-str.	-2.142 ***	-2.063 ***	1.504 ***	1.789 ***
	(13.17)	(12.35)	(7.35)	(10.16)
INEXP	-0.443	-1.042	-0.470	-0.276
	(0.25)	(1.61)	(0.32)	(0.09)
TR_1 * INEXP (reference treatment)	0.000	0.000	0.000	0.000
TR_2 * INEXP	0.336	1.138	0.792	0.456
	(0.10)	(1.61)	(0.56)	(0.17)
TR_3 * INEXP	-0.836	-0.183	0.701	0.223
	(0.54)	(0.03)	(0.42)	(0.04)
TR_4 * INEXP	0.300	1.474	1.306	0.722
	(0.08)	(1.97)	(1.46)	(0.40)
-2 Log Likelihood	395.2	397.5	388.0	
Likelihood ratio, $\chi 2$	23.0 ***	17.5 ***	20.9 ***	21.5 ***
Pseudo R^2	5.5 %	4.2 %	5.1 %	5.5 %
AIC	427.23	427.46	411.96	391.75

Table 19. Continued

Panel B. Regression analyses of task-specific judgment variables for the acceptance task				
	(1)	(2)	(3)	(4)
Variable	JUDGMENT	JUDG_CONF	HOUR_ESTIM	FEE_ESTIM
TR_5 - Low risk, More rel., Unstr. (reference treatment)	0.000	0.000	0.000	0.000
TR_6-Low risk, Less rel., Unstr.	-0.912 *	-0.260	1.342 **	1.498 ***
	(3.26)	(0.29)	(6.05)	(7.78)
TR_7-High risk, More rel., Unstr.	0.337	-0.066	1.678 ***	1.594 ***
	(0.45)	(0.02)	(9.60)	(8.75)
TR_8-High risk, Less rel., Unstr.	-1.124 **	-0.944 *	1.815 ***	1.989 ***
	(4.65)	(3.01)	(11.65)	(12.82)
INEXP	-1.512 *	-1.244	0.147	0.061
	(3.61)	(2.50)	(0.04)	(0.01)
TR_5 * INEXP (reference treatment)	0.000	0.000	0.000	0.000
TR_6 * INEXP	1.405	1.305	0.173	0.634
	(2.06)	(1.82)	(0.03)	(0.36)
TR_7 * INEXP	1.571	0.474	-1.181	-0.545
	(2.40)	(0.23)	(1.47)	(0.29)
TR_8 * INEXP	0.472	-0.326	0.442	-0.126
	(0.19)	(0.09)	(0.18)	(0.01)
-2 Log Likelihood	447.8	430.1	422.5	373.9
Likelihood ratio, $\chi 2$	12.8 **	14.1 **	23.0 ***	20.4 ***
Pseudo R^2	2.8 %	3.2 %	5.2 %	5.2 %
AIC	475.85	460.01	450.48	397.94

Notes:

Wald Chi-Squares are reported in parentheses. Statistical significance based on two-tailed tests at the 1%, 5% and 10% levels are denoted by ***, ** and *, respectively.

The variables are defined as follows (on an 11-point Likert-type scale, if not otherwise stated)*:*

JUDGMENT = Probability judgment of recommending client continuance (Panel A) or acceptance (Panel B)

JUDG_CONF = Level of confidence in client continuance (Panel A) or acceptance (Panel B) judgment

HOUR_ESTIM = Estimate of planned audit hours compared with last year (Panel A) or average number scaled to client size and industry (Panel B)

FEE_ESTIM = Estimate of planned audit fee compared with last year (Panel A) or average amount scaled to client size and industry (Panel B)

TR_1 = A reference treatment (i.e. low risk, more reliable information, semi-structured task), where other treatments are compared (Panel A)

TR_2 = A dummy variable with a value of 1 if a treatment group is two (i.e. low risk, less reliable information, semi-structured task), otherwise 0

TR_3 = A dummy variable with a value of 1 if a treatment group is three (i.e. high risk, more reliable information, semi-structured task), otherwise 0

TR_4 = A dummy variable with a value of 1 if a treatment group is four (i.e. high risk, less reliable information, semi-structured task), otherwise 0

TR_5 = A reference treatment (i.e. low risk, more reliable information, unstructured task), where other treatments are compared (Panel B)

TR_6 = A dummy variable with a value of 1 if a treatment group is six (i.e. low risk, less reliable information, unstructured task), otherwise 0

TR_7 = A dummy variable with a value of 1 if a treatment group is seven (i.e. high risk, more reliable information, unstructured task), otherwise 0

TR_8 = A dummy variable with a value of 1 if a treatment group is eight (i.e. high risk, less reliable information, unstructured task), otherwise 0

INEXP = A dummy variable with a value of 1 if an auditor is less experienced, otherwise 0

The results of Panel B are generally consistent with previous client acceptance studies[42] (e.g. Johnstone 2000; Johnstone & Bedard 2003; Asare, Cohen & Trompeter 2005) that were conducted in a different legal environment. The present results particularly support the findings of Beaulieu (2001) and Asare, Cohen and Trompeter (2005) that future evidence collection strategies and the planned number of audit hours are adjusted depending on client riskiness.

Overall, the pattern of results reported in Table 19 suggests that auditors respond to changes in RMM and information reliability in their client continuance and acceptance judgments as well as in the related pre-planning judgments of the engagement. Specifically, the results of "extreme conditions" on both tasks (i.e. treatments 4 and 8) indicate strongly that high RMM and less reliable information together lead to significant judgment revisions.

6.5.1 Effect of information usage on task-specific judgments

As reasoned in the development of hypotheses 2 (RMM) and 4 (information reliability), it is proposed that auditors use extensive information usage as a compensatory mechanism to reduce uncertainty in the decision-making process. Thus, subjects who perform extensive information usage may make more positive judgments about client continuance/acceptance and lower estimations of future audit hours and fees, as the information in this experiment indicates no negative issues about the client. By contrast, subjects who use less information compensate for this uncertainty by making more conservative judgments and by increasing their projections of future audit hours and fees.

To test if the level of information usage and task-specific judgments are related, all models in Table 19 are extended with the continuous and discrete information usage variables. They are added as covariates one-by-one to these models to avoid multicollinearity problems.

The untabulated results show that none of the continuous information usage variables is statistically significant in the models. By contrast, when three discrete variables are added one-by-one to these models, the results are mixed. In a few of the models where JUDGMENT and JUDG_CONF are dependent variables, the coefficients of the models indicate that a greater quantitative usage of cues leads

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[42] Unlike Johnstone (2000), the aim of this study was not to rank risk management strategies (avoiding risky clients vs. risk mitigation strategies in engagement), but rather to observe their usage.

to a lower probability of client continuance and acceptance as well as lower judgment confidence. However, in the majority of these models, the coefficients are not statistically significant.

The most robust finding in other models is that in FEE_ESTIM models, the coefficients of discrete variables are positive and significant at the 5% level. Thus, a greater quantitative usage of cues leads to a higher estimate of planned audit fees than a lower usage of cues.

Taken together, the results suggest that the extensiveness of information usage is not strongly related to task-specific judgments. However, some evidence of these analyses suggests that greater quantitative information usage implies negative client attractiveness, which specifically decreases the probability of positive client continuance and acceptance judgments and increases projections of future audit fees. Therefore, the results do not suggest that auditors' more extensive information usage compensates for uncertainty, i.e. would lead to more positive judgments that are related to continuance or acceptance.

6.6 Summary and discussion of the results

Overall, the results show that several independent variables affect auditors' information usage when time spent on the task is used as a measure. Specifically, I find that these independent variables also interact with each other, meaning that time spent on the task is conditional on a combination of several independent variables at the same time. By contrast, when information usage is measured by the number of used information (i.e. count measures), this study finds only a very weak relationship between the dependent and independent variables. The main findings of the study are discussed below.

First, the results show semi-strong support that auditor experience affects information usage. This study finds that experienced auditors use less total time for tasks than less experienced subjects. Consistently, both refined measures of time indicate that experienced auditors use less time for reading cues on cue screens as well as processing those cues outside of those screens. However, robustness tests suggest that longer cue screen times are only related to subjects having no or very little prior task-specific experience.

This shorter cue time does not seem to be explained by the number of cues selected from the information menu, as experience was not significant when the count measures were dependent variables. This implies that experienced auditors may have better developed reading techniques or shorter assimilation times on cue screens, which is more effortless than the approaches used by less experienced subjects. For example, experienced auditors may have scanned the cues to find critical items instead of reading each cue word-for-word[43]. The results also show that experienced auditors used significantly less time for processing cues outside of cue screens. Thus, these findings suggests that higher task-specific experience leads to the less effortful examination of each single cue when – presumably[44] – reading these and a lower processing time of cues.

The above results are in line with the findings of Davis (1996), who showed that experienced auditors used less time in control risk assessment tasks. However, he also found that experienced auditors acquired fewer cues, which may explain the decreased time. Further, the findings that time to read cues decreases as experience increases is consistent with the findings of Moroney (2007) who had similar findings when the audit experience was measured by industry-expertise. All this suggests that one of the reasons for the better efficiency of experienced auditors in audit tasks may be their advanced cue reading/assimilation techniques and evaluation/combining of cues.

Second, this study finds some evidence that there exists a relationship between level of RMM and auditors' information usage. Specifically, I find that high RMM increases total time spent on the task and time used outside of cue screens, but not time spent on cue screens. This finding implies that auditors also read and assimilate selected cues in a conventional way in a risky setting, but demonstrate greater effort in their cue processing. Thus, instead of altering their usual reading techniques, auditors seem to react to the environmental uncertainty by evaluating each used cue's "information value" for their task-specific judgments carefully under high RMM.

Third, this study finds evidence that more time is used to process information in unstructured tasks than in semi-structured tasks. However, a significant two-way interaction indicates that only less experienced subjects are affected by task structure, as they use more time outside of cue screens in unstructured tasks. The results also suggest that task structure interacts with other variables when infor-

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43 Alternatively, they may have deemed cues more often to be irrelevant or unimportant after second reading and returned to the information menu. However, the descriptive statistics in Table 5 do not support this possibility, as the overall self-evaluated cue importance values were virtually the same for experienced auditors and less experienced subjects.

44 There is an inherent limitation in cue time and judgment time measures, as some subjects may process cues on cue screens, while others may only read cues and process them while making task-specific judgments. However, I am not aware of any study that has pointed out that a more and less experienced auditor systematically differ in this sense.

mation usage is measured by total time used. A significant three-way interaction indicates that regardless of task structure and risk, experienced auditors use less total time than less experienced subjects in unstructured tasks when RMM is high. However, as this interaction is not significant with the refined time measures (cue or judgment time), it is not clear which part of information usage is most affected by auditor experience. Taken together, these two significant interactions suggest that when a decision-making situation becomes difficult to less experienced subjects because of unstructured tasks, experienced auditors' expertise becomes salient. The present findings are in line with the general conclusion from the auditor expertise literature (e.g. Abdolmohammadi & Wright 1987; Tan & Kao 1999), indicating that experience effects exist only in the most difficult tasks.

Fourth, this study finds evidence that the presence of less reliable information increases the time used outside of cue screens. This finding suggests that less reliable information is processed more effortful than more reliable information, while the reading and assimilation time of cues is unaffected. Surprisingly, this finding does not support the ad hoc expectations of increased overall uncertainty, where one would expect information from a less reliable source to be processed in a more effortful manner in all decision-making steps in order to find any contradictions[45]. The results also show weak support that quantitatively more information is selected when available information is less reliable.

The results further show some interaction between information reliability and auditor experience. While experience's main effect indicates that less experienced subjects used more time than experienced auditors, two separate two-way interactions show that when information is less reliable, experienced auditors no longer use significantly less time when measured by total time or time used outside of cue screens. These two interactions show that experienced auditors' less effortful cue processing is only limited to when information is reliable. Whether experienced auditors' more efficient behavior under reliable information stems from strategic (e.g. intentional decisions to process information with less effortful way) or cognitive (e.g. more powerful processing ways) reasons (see also Joe 2003 for a discussion of these reasons) merits further investigation in future research.

Overall, the results regarding more extensive information usage given less reliable information are consistent with the findings of the psychological literature, stating that low credibility sources induce less persuasion than highly credible

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[45] Additional comparisons between cues show some support for this expectation, as the univariate tests (not tabulated) show that six out of the 12 cues are read for significantly longer when they are from a less reliable source.

sources (Pornpitakpan 2004) and that auditors are sensitive to source credibility in their decision-making (e.g. Goodwin 1999; Glover, Jiambalvo & Kennedy 2000).

Fifth, a significant three-way interaction between information reliability, task structure and RMM indicates that used judgment time increases non-linearly as those factors with high values increase. In Figure 15, it is posited that the presence of one of those uncertainty factors triggers an auditor to increase attentiveness to information usage. For instance, this could happen because an auditor switches from a normal audit representation to a problem audit representation when there is an indication of a problem (Waller & Felix 1984; Asare & Knechel 1995). However, adding a second uncertainty factor does not cause a linear increase in judgment time. It is proposed that once an auditor has engaged in more careful information processing, adding a second uncertainty factor does not alter or alters very little his/her course of action regarding how the information will be processed. However, the simultaneous presence of three uncertainty factors (i.e. adding one more factor) significantly increases used judgment time compared with no factors. One explanation for this finding is that auditors do not increase linearly their efforts for information processing when the number of uncertainty factors increases, because they have few different information processing styles or modes for problem audits. Again, this finding merits further investigation in future research.

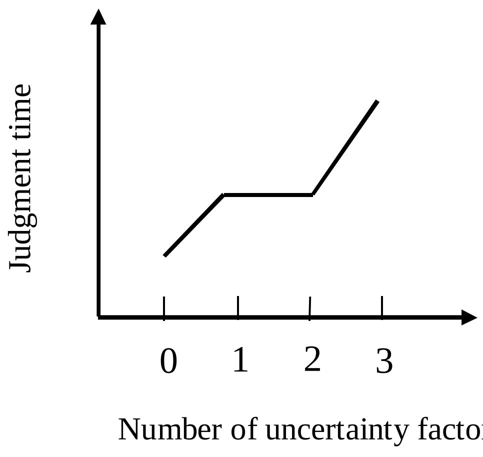

Figure 15. Non-linear increase in judgment time depending on the number of uncertainty factors

Finally, when the effect of auditor experience, RMM and information reliability on information usage and on the respective task-specific judgments are compared, the results indicate that the levels of those variables affect decision outcomes more compared with the antecedent decision-making process. Specifically, the results of this study suggest that auditors' task-specific judgments are often adjusted depending on level of risk and information reliability. At the same time, preceding information usage is also affected, but less significantly. The several magnitudes of statistical significances in the analyses suggest that when RMM is high and information is less reliable, auditors' task-specific judgments differ significantly from less severe conditions, while their information usage behavior is also affected, but to a lesser degree compared with judgments.

7 CONCLUSIONS

The final chapter begins with a summary of the study. The first section also discusses the practical implications of the results and draws conclusions about the study from its theoretical perspective. Possibilities for future research are also discussed, because the majority of the study's findings are preliminary observations that call for additional evidence. The study concludes with the limitations of the study. The final section focuses on the internal and external validity issues of the present experiment, which should be taken into account when evaluating the generalizability of the results.

7.1 Summary of the study and practical implications

In many circumstances, an individual auditor conducts information usage alone without communicating his/her findings to other auditors (Hammersley 2006). Auditors usually work in environments where information load is very high, which may also reduce the likelihood of information sharing (Hammersley 2006). Consequently, it is important to study an individual auditor's decision-making process, even when auditors work in multi-person environments.

The present study examines auditors' information usage in a single audit task. The purpose of this study was to relax the assumption that individual, environmental, task-related and cue-related factors have only direct effects on information usage. More specifically, four factors are investigated in a single study to examine whether these factors' potential effects are conditional on the levels of other factors.

The theoretical framework of this study consists of three parts. In the first part, auditors' information acquisition and usage, its role in decision-making and common research approaches of the area are discussed. While there are no normative or unified theories of individuals' information acquisition and usage processes, several models and theories (e.g. Waller & Felix 1984; Bonner & Pennington 1991; Moroney 2007; Schultz, Bierstaker & O'Donnell 2010) suggest that the process sequentially progresses from the initial problem representation, which guides the extent and nature of actual information acquisition and usage.

In the second part, previous research on the factors that affect auditors' information acquisition and usage are presented. Based on the auditors' information acquisition and usage taxonomy proposed by El-Masry and Hansen (2008), previous studies of the determinants of information acquisition and usage are classified into four categories (individual factors, environmental factors, task-related factors and cue-related factors). This study contributes theoretically to the original taxonomy of El-Masry and Hansen (2008) by expanding it using interaction effects between these four factors.

The expanded taxonomy suggests that a large number of factors from these categories interact with each other. Studies have produced a considerable amount of evidence that auditor experience and the presence of accountability mitigates or even reduces many judgmental biases related to auditors' information acquisition and usage processes. For instance, evidence suggests that the negative effects of irrelevant information (Shelton 1999) and the recency effect (Kennedy 1993) on task-specific judgments are eliminated when a task is performed by an experienced auditor or accountability is present, respectively. Overall, the expanded taxonomy suggests that in order to understand auditors' information acquisition and usage behavior, the effects of factorial interactions should be taken into account.

The final part of the theoretical framework begins with a presentation of the factors selected for the empirical analyses. The rationale behind this selection is based on capturing the factors that have gathered less attention at an audit task level and/or those that have important and previously identified factors in the auditing context that have meaningful theoretical interactions with the first-mentioned factors. Finally, the hypotheses of the study are developed based on previous accounting and psychology studies.

For the empirical part of the study, data are obtained through a computerized web-experiment that uses advanced process tracing methods to capture subjects' information usage in multiple ways. Subjects' information usage is measured by six dependent variables. It is posited that a rich set of variables captures the extensive set of effects that independent variables may have on subjects' information usage. These variables encompass used time for the task and the number of used information as well as refined measures of these variables. However, all empirical analyses are carried out using one dependent variable at a time in the models.

The independent variables (i.e. factors) of the study, namely RMM, task structure and information reliability, are manipulated in a web-experiment between subjects, while subjects' task-specific experience is collected after the experiment. Task structure is varied between subjects by creating two similar audit tasks. Both tasks have 12 almost identical information cues available for decision-making. These cues are presented in an information menu, from where subjects choose information in an unconstrained way for their client continuance/acceptance judgments. The manipulations of RMM (low or high) and information reliability (less reliable or more reliable) are carried out with the phrase manipulations within task texts.

The subject population consists of Finnish CPAs, non-certified auditors and Master's level auditing students. Using the data derived from 271 observations from the experimental tasks, the hypotheses of the study are tested using ANOVA and ordered logistic regression models. Table 20 presents the hypotheses tested and summarizes the results of these tests.

Table 20. Summarized results of the hypotheses testing

Hypotheses of the study and the results of the tests	
Hypothesis	Results of the tests
H1: Less experienced auditors use available information in decision-making more extensively than experienced auditors	Hypothesis is semi-strongly supported by the data. Experienced auditors use less total for tasks, time for reading cues and time for processing cues than less experienced subjects.
H2: Information is used more extensively in decision-making when RMM is high, compared when RMM is low	Hypothesis is supported partly by the data. The results show that high RMM increases the total time used for tasks and the time used for processing cues.
H3: Information is used more extensively in decision-making when a task is less structured compared with when a task is more structured	Hypothesis is supported weakly by the data. The results show that in unstructured tasks more time is used for processing cues than in semi-structured tasks.
H4: Information is used more extensively in decision-making when information is less reliable compared with when it is more reliable	Hypothesis is weakly supported by the data. The only statistically significant main effect indicates that when information is less reliable additional time is used to process cues outside of cue screens.
H5: In the context of high RMM, a less experienced auditor uses information more extensively than an experienced one	Hypothesis is not supported by the data.
H6: The level of task structure does not affect the information usage of experienced auditors	Hypothesis is supported partly by the data. Two significant interactions show that experienced auditors do not use more total time or cue processing time in unstructured tasks than in semi-structured tasks.
H7: In the context of less reliable information, a less experienced auditor uses information more extensively than an experienced one	Hypothesis is not supported by the data. The results find the opposite to be true, namely that there exist experience effects when information is more reliable. Specifically, the results show support that less experienced subjects do not use more time to process cues than experienced auditors when information is less reliable.

The results of the hypothesis testing lead to five main findings. *First*, this study finds that experienced auditors use less overall time for tasks and spend significantly less time on and outside of cue screens than less experienced subjects. These results suggest that experienced auditors read cues more quickly and process cues more efficiently in their JDM processes than less experienced subjects.

Second, this study finds that when RMM is high auditors use more time to perform tasks, and particularly spend more time outside of cue screens, than when RMM is low. This finding suggests that auditors evaluate and combine cues in their JDM processes in a more effortful manner when RMM is high.

Third, this study finds that task structure affects used judgment time. Specifically, I find that in unstructured tasks more time is used outside of cue screens. However, the two significant interactions between structure and experience suggest that only less experienced subjects are affected by task structure and only they spend more time on unstructured tasks than on semi-structured tasks.

Fourth, this study finds that when information is less reliable auditors use more time to perform tasks, and particularly spend more time outside of cue screens, than when information is more reliable. This finding suggests that auditors evaluate and combine cues in their JDM processes in a more effortful manner when information is less reliable. This study also finds evidence of an interaction effect between auditor experience and information reliability. Contrary to expectations, experienced auditors' shorter total time and time usage outside of cue screens diminish when information is less reliable. Thus, these interactions suggest that experienced auditors' more efficient cue processing exist only when information is reliable.

Fifth, this study finds a significant three-way interaction between RMM, task structure and information reliability. This interaction indicates that an increase in the time used outside of cue screens increases non-linearly when the number of factors with a high level of uncertainty increases. I find that the presence of one or two of these factors increases by about the same amount of time compared with when none of these factors is present. However, the presence of all three uncertainty factors increases used time significantly more. This finding suggests that auditors do not increase linearly their efforts for information processing when the number of uncertainty factors increases. It is thus suggested that auditors may have few different information processing styles or modes for problem audits.

The other major findings outside of the hypotheses include that risk, information reliability and auditor experience affect auditors' task-specific judgments. More specifically, this study finds evidence that auditors adapt to high RMM and less reliable information by making more conservative probability estimates in their client continuance and acceptance judgments, especially when both these factors are present at the same time. They also increase significantly auditors' estimates of planned audit hours and fees for these engagements.

The theoretical framework of this study suggests that individual, environmental, task-related and cue-related factors affect auditors' information usage. From the perspective of this framework, the empirical results of this study suggest that an individual factor (auditor experience) is the most influential of the investigated factors, while an environmental factor (RMM), a task-related factor (task structure) and a cue-related factor (information reliability) all affect auditors' information usage, but their observed effect is smaller. Finding an individual factor (auditor experience) as the most significant factor is not surprising, as its effect on information usage has been widely documented in the psychological and audit literature (see e.g. Choo 1989). When the results are examined in light of previous interaction studies, the present study documents two new interactions with task structure and information reliability that evidence experience's positive effects on auditors' decision-making, especially on audit efficiency.

The results of the present study also have implications for practitioners, especially those responsible for forming audit teams or arranging auditor training[46]. When creating time budgets that include lots of lengthy information, it should be noted that less experienced auditors are less efficient at reading and processing information compared with experienced auditors. Complementary, audit firms should consider fine-tuning their training programs and documenting experienced auditors' reading and information processing styles in order to teach those methods to novice auditors.

The time-consuming effect of high RMM and less reliable information should also be taken into account when planning an audit program. The results of this study imply that even using highly experienced auditors in these engagements does not mitigate this effect. In particular, when information is suspected to come from a less reliable source, audit firms should allocate more time in a budget than is usual in order to meet audit deadlines. Audit firms should also take into account that in complex audit tasks less experienced auditors are likely to spend significantly more time than experienced auditors.

From the perspective of the interest groups of audit services, the results support the conclusion that auditors are relatively willing to continue with existing clients

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[46] Audit firms should recognize that "extended" information usage may mean increased audit costs, which should be covered by the audit fee. This is particularly true when the need for greater information usage concerns experienced auditors.

or accept new clients even when engagements are risky or contain less reliable information, but they are likely to change their audit conduct in those engagements. Thus, the evidence suggests that in the current legal environment auditors are less likely to reject unattractive clients, but instead will increase their planned audit hours and charge higher audit fees.

7.2 Suggestions for future research

While the findings of this study are mostly preliminary evidence, which should be examined with different subjects and in other environments, the results do offer many insights that could be investigated in future research. First, the results regarding experienced auditors' advanced reading techniques should be explored in more detail. For instance, an experimental study concentrating solely on reading cues would more effectively disentangle reading styles from actual cue processing. A future study could employ eye-tracking techniques (see Rayner 1998 for a review) to examine whether the reading styles of less experienced and experienced auditors differ fundamentally.

Second, how less reliable information affects information usage should be expanded to other audit tasks to investigate whether the effect is only task-specific. A future study could also manipulate the direction of cues to positive and negative forms to investigate whether this would amplify the processing effort of less reliable cues. For instance, auditors' professional skepticism might mean that less reliable but positive information would be processed more carefully than negative information. A future study could also mix more and less reliable information simultaneously for selection, which would improve the overall research design as these groups would act their natural controls in an experiment.

Third, some of this study's statistically non-significant results may be because not all subjects used their "best" efforts for the experiment. Despite attempts to remove outliers, a controlled experiment might be more appropriate for examining the weak effects of many factors on information usage in future research. Alternatively, the employment of verbal protocol analysis could extend beyond measuring how plain effort duration (i.e. time) and effort intensity (see Cloyd 1997) change along with the current manipulations of factors. The verbalized thoughts of auditors may shed light on the underlying reasons for the observed behavior in this study.

Finally, the theoretical framework of this study suggests several unexplored and meaningful interactions between factors from the four categories. The current results with refined information usage measures should encourage further research on this important topic. Specifically, investigating information usage in the most complex audit tasks (e.g. going-concern tasks) could provide insights into the role of cue reading/assimilating compared with actual cue processing.

7.3 Limitations

As in all experimental studies, there is always the concern of internal and external validity. Internal validity refers to the experimental design quality and specifically to whether observed changes in the dependent variables originated by differences in the independent variables (Peecher & Solomon 2001). Cook and Campbell (1979) identified several internal validity threats that might be present in this study. First, there is the concern of *subject mortality*, which means that systematic factors caused certain types of subjects to drop out during the experiment. For example, certain types of subjects may have experienced excessive fatigue or boredom in the middle of the experiment. The 25 incomplete answers partially support this assumption[47]. However, as the data were recorded in the database in multiple tables as the experiment progressed, this allowed us to examine the issue to some degree. Comparing the first and last recorded tables showed that only seven subjects dropped out during the experiment.

Second, there is a concern over the *self-selection* of certain types of subjects as all participants were volunteers. As the introductory letter explained the purpose of the task (either client continuance or client acceptance), it is possible that auditors who had no interest in these tasks decided not to participate in the experiment. Further, busy auditors may have been omitted because of time constraints. This raises the question of whether it is possible to generalize the results beyond the sample.

It can be argued that volunteered subjects were motivated to participate for several reasons. One reason could be their earlier first-hand experience of the task, i.e. task attraction. This reason is supported by the data, i.e. the average number of task-specific encounters of subjects is more than 20 times. However, this finding does not threaten the results, as task-specific experience was measured as an in-

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[47] However, this seemingly high number of incomplete answers most likely stems from incompatibility or technical problems between web browsers and experimental instruments, as internal controls ought to ensure the completeness of the most critical screens. This circumvention of controls could also happen if the subject used the browser's back button (they were kindly requested not to at the beginning of the experiment).

dependent variable in the study. Moreover, some subjects had no or little task-specific experience. The second suggested reason for participation was the chance to win a prize in a raffle. This explanation is also supported semi-strongly by the data, as the overall response rate for the raffle was 56.6%. Although this option presumably increased the overall response rate, it may have worked as an extrinsic motivation for some subjects to participate without the true intention to use their "professional efforts" in the task (O'Neil & Penrod 2001; Kersten, Wu & Oertel 2011). However, there were attempts to control this behavior (see Chapter 5.8). Finally, the high mean age of subjects (48.8 years) may imply that the sample is biased, suggesting that more recently certified auditors are under-represented in the present study.

Third, there is a threat of the *imitation of treatments*, i.e. that all responses are not independent. Owing to the nature of a web-based experiment, it is impossible to control the validity of observations. Although I asked respondents to answer independently, it is possible that subjects collaborated or discussed the task (during or after) in a way that influenced their decision-making behavior. This possibility cannot be ruled out.

External validity refers to the generalizability of the results beyond the experimental setting (Peecher & Solomon 2001). In experimental studies, there is usually a concern over *population and ecological validity*, which means that the obtained results cannot be generalized to other people, situations or environmental settings (Smith 2003). A wide range of observations from different audit firms and auditors improves the result's generalizability outside the sample. The subject population comprised Finnish CPAs and received observations divided fairly between Big-4, non-Big-4 and no firm subjects. This suggests that the results are not driven by certain audit firms' policies (e.g. manuals or checklists) related to client continuance or acceptance. Also, using students as subjects may have distorted the results, as they might not be as time constrained as auditors. However, additional analyses performed without students are generally consistent with those reported in the main analyses.

By contrast, while it would be tempting to generalize the results to apply to all other environmental settings, it is most likely that they hold only in countries where the risk of litigation is low. For example, previous studies in the US (Asare & Knechel 1995; Johnstone 2000) have found that auditors focus on finding negative information about their prospective clients and avoid all suspicious clients. Thus, this study's high RMM/less reliable information treatments may have led to obvious (without any additional information usage) discontinuance or client rejection decisions in a high risk litigation environment.

Other external validity threats concern the experiment. The exclusion of information that would be available in a mundane environment also limits the generalizability of the results to the real world. It is not possible for a brief client description and 12 cues to capture the richness available on an actual audit client continuance/acceptance judgment. One must be also cautious when drawing conclusions from time-based dependent measures, as they may be noisy because of interruptions and unfocussed behavior during the experiment by some subjects (Cloyd 1997). While these non-laboratory settings, i.e. carrying out an experiment behind own work desk, might even increase external validity, as the environment is semi-natural, a distracting environment (e.g. interruptions at home, watching television at same time) might reduce the focus that normally would be devoted to the task. To diminish this threat, the request letter for participation requested the task be carried out in the customary way and unbrokenly.

However, the concerns of the ecological validity threats of this study are relaxed by some of its findings. These findings also give support for the construct validity of the study. First, the experiment was perceived to be realistic (mean 7.25 on 0–10 scale) by subjects. Second, the results show that the majority of predicted signs are consistent with the theory and hypotheses, while not all results are statistically significant. Third, concerns that the categorization of the manipulated variables (two levels) may lead to the oversimplification of reality and that those levels are either unrealistically low or high are doubtful since the results indicate that the mean difference in both perceived risk and information reliability between high and low groups is fairly small (see Chapter 6.1). Thus, it is unlikely that the results of the study are driven by extreme conditions set in the manipulation phases.

Finally, the estimated magnitudes of the several coefficients and R-squares are small and barely statistically significant at conventional levels, indicating that the investigated factors' role in explaining auditors' information usage is small. Some results might also be task-specific. Thus, the conclusions of this study should be taken cautiously before additional research is conducted on different audit tasks. However, according to Trotman, Tan and Ang (2011) some of these concerns are relaxed "*They [experiments] are less beneficial if one is trying to determine the amount of an effect. Conducting 'horse-races' is usually inappropriate as the results will often be determined by the level at which the variables are set*".

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APPENDICES

Appendix 1. RMM and information reliability manipulations

Manipulation phrases in client continuance -task:

Risk of material misstatement manipulation

1) Low risk:

The main owners of Boat King Oy have retired from the executive management of the company and in recent years, have only participated in the Board of Directors. The main owners are satisfied with the top management of the company. On the basis of first impression and discussion with the management, you consider the Chief Executive Officer and Chief Financial Officer to be qualified and reliable. In your discussions, it has become apparent that they emphasize ethical values and responsibility in the course of business.

2) High risk

The main owners of Boat King Oy have retired from the executive management of the company and in recent years, have only participated in the Board of Directors. Now they are concerned for the long-term profitability of the company. At the meeting of the Board of Directors earlier that year, the main owners have decided to modify the compensation structure of the management so that in the future, a significant part of the Chief Executive Officer's and the Chief Financial Officer's compensation is determined by the previously reported earnings. Your discussions have not entirely convinced you of the management's integrity and motivation to work under new terms.

Information reliability manipulation

1) Low reliability:

The incumbent auditor of the previous assignment has repeatedly been criticized for neglecting the duty of care in your audit firm's internal quality inspections. The auditor has been accused of superficial auditing and poor documentation and is therefore no longer the incumbent auditor of your audit firm.

2) High reliability

The incumbent auditor is one of the most respected auditors in your audit firm and is known as a precise and conscientious auditor who takes his or her job seriously. The former incumbent auditor has withdrawn from the assignment due to retirement.

Manipulation phrases in client acceptance -task:

Risk of material misstatement manipulation

1) Low risk

The main owners of Boat King Oy have retired from the executive management of the company and in recent years, have only participated in the Board of Directors. The main owners are satisfied with the top management of the company. On the basis of first impression, you consider the Chief Executive Officer and Chief Financial Officer to be qualified and reliable. In your discussions, it has become apparent that they emphasize ethical values and responsibility in the course of business.

2) High risk

The main owners of Boat King Oy have retired from the executive management of the company and in recent years, have only participated in the Board of Directors. Now they are concerned for the long-term profitability of the company. Therefore, at the meeting of the Board of Directors earlier that year, they have decided to modify the compensation structure of the management so that in the future, a significant part of the Chief Executive Officer's and the Chief Financial Officer's compensation is determined by the previously reported earnings. On the basis of first impression, you are not entirely convinced of the management's integrity and motivation to work under new terms.

Information reliability manipulation

1) Low reliability

Collecting information on Boat King Oy has been problematic because your assistant, who was responsible for the collecting, has afterwards proven to be careless and incompetent in the field of accounting. In addition, according to your information, the former incumbent auditor of Boat King Oy has repeatedly been criticized in the internal quality inspections and is therefore no longer the incumbent auditor of the audit firm.

2) High reliability

Audit assistant at your audit firm has collected the information on Boat King Oy. The assistant has been working for your audit firm over six months and is regarded by several auditors as an accurate and thorough worker who is able to perform the assigned tasks impeccably. In addition, the former auditor of Boat King Oy has a good reputation and is considered a conscientious auditor. The former incumbent auditor has withdrawn from the assignment due to retirement.

Appendix 2. Variables of the experiment

	Definitions of variables
	Definition
1CL[CUENAME][a]	Self-evaluation of cue importance [11-point Likert-type scale: 0 (not important at all) to 10 (very important)]
1CL[CUENAME]_1[a]	A dummy variable with a value of 1 if the cue has been read at least once, otherwise 0.
1CL[CUENAME]_ORDER[a]	Order of cues in read order [0–12]
1CL[CUENAME]_ORDER2[a]	Order of cues in read order, second time [0–...]
1CL[CUENAME]_CUMUL[a]	Cumulative time spent reading cues [sec]
1CL[CUENAME]_NUMBER[a]	Number of cue reads [0– …]
1CL_EXP	Task-specific experience on client continuance decisions [0; no experience, 1; 1–9 times, 2; 10–19 times, 3; 20–29 times, 4;30+ times]
1CLBACK_NUMBER	Number of background information reads [0– …]
1CLBACKGROUND	Self-evaluation of background information importance [11-point Likert-type scale: 0 (not important at all) to 10 (very important)]
AGE	Age of subject
AUDIT_FIRM2	Name of audit firm [0; not chosen, 1; Deloitte, 2; E&Y, 3; KPMG, 4; PwC, 5; other, 6; no firm/student]
AUDIT_WORK_EXP	A dummy variable with a value of 1 if the student has work experience in auditing, otherwise 0.
AUDIT_WORK_TEN	Tenure of a student's audit experience [months]
AUDITOR_EXP	Amount of total experience as an auditor [99; less than year, 1–19, 20; over 19 years]
BOOKK_WORK_EXP	A dummy variable with a value of 1 if the student has work experience in bookkeeping, otherwise 0.
BOOKK_WORK_TEN	Tenure of a student's bookkeeping experience [months]
CERTIFICATION	Latest auditor certification [1; no cert., 2; JHTT, 3; HTM, 4; KHT]
CERTIFICATION2	A dummy variable with a value of 1 if a subject has any auditor certification, otherwise 0.
CL_EXP	Task-specific experience on client acceptance decisions [0; no experience, 1; 1–9 times, 2; 10–19 times, 3; 20–29 times, 4;30+ times]
CREDIT_UNITS	If subject is a student, number of completed credit units
CU_ACC_FIN	If subject is a student, number of completed accounting and finance credit units
CU_AUDIT	If subject is a student, number of completed auditing courses credit units
FEE_ESTIMATE	Estimate of audit fee [11-point Likert-type scale: 0; significantly less than last year to 10; significantly more than last

	year, where 5 means the same amount as last year or average amount scaled to client size]
GENDER	Gender [1; male, 2; female]
HOUR_ESTIMATE	Estimate of planned audit hours [11-point Likert-type scale: 0; significantly less than last year to 10; significantly more than last year, where 5 means the same number as last year or average number scaled to client size]
HTM_CERT_YEAR	The year when the subject's HTM certification was approved [0/year]
INFOR_COMM	A subject's general feedback of the experiment [open question]
INFOR2_COMM	A subject's thoughts about the purpose of the experiment [open question]
IPADDRESS	IP address of the subject
JHTT_CERT_YEAR	The year when the subject's JHTT certification was approved [0/year]
JUDG_CONFIDENCE	Level of confidence in the continuance/acceptance judgment [11-point Likert-type scale: 0; fully unconfident to 10; fully confident]
JUDGMENT	Probability judgment of recommending client continuance/acceptance [11-point Likert-type scale: 0%; would not recommend at all to 100%; would definitely recommend]
KHT_CERT_YEAR	The year when the subject's KHT certification was approved [0/year]
MANIP_CHECK_RELIA	Manipulation check question of perceived information reliability [11-point Likert-type scale: 0; very unreliable to 10; very reliable]
MANIP_CHECK_RISK	Manipulation check question of perceived RMM [11-point Likert-type scale: 0; very low - 10; very high]
NUMBER_INF	Total number of read cues, including multiple reads [0– …]
RANK	Rank in audit firm [0; not chosen, 1; junior, 2; senior, 3; partner, 4; manager, 5; other
RANK_YEARS	Years in current rank [99; less than year, 1–19, 20; over 19 years]
REALISM	Estimate of the realism of the continuance/acceptance task [11-point Likert-type scale: 0; very unrealistic - 10; very realistic]
TOT_TIME	Total time used for the task [sec]
TRAINING_1CL	Amount of training on client continuance decisions [hours]
TRAINING_CL	Amount of training on client acceptance decisions [hours]
TREATMENT	Number of treatment group [1; semi-struc., low risk, more rel., 2; semi-struc., low risk, less rel., 3; semi-struc., high risk, more rel., 4; semi-struc., high risk, less rel., 5; unstruc., low risk, more rel., 6; unstruc., low risk, less rel., 7; unstruc., high risk, more rel., 8; unstruc., high risk, less rel.]

Notes:

[a] These variables exist for each cue

Appendix 3. Introductory letter

Dear auditing expert,

Making significant evaluations concerning companies on a daily basis is part of your auditing work. Often evaluations are based on your own decisions and deliberation. However, the decision-making process of Finnish auditors has not been researched sufficiently. Therefore, I have compiled a substantial collection of source material on auditors' decision-making process. Now I intend to extend the collection of data with information on auditing experts in practice, that is, Finnish auditors and other people whose work is audit-related.

I am kindly asking you to participate in this study by first examining the information provided and then answering the following questions. This will take approximately 10 minutes. You will be asked to evaluate your willingness to continue as the auditor of a described company. You can base your decision on any information available. Please make the decision independently and without interruptions.

Among those who answer, 3 travel gift certificates of 120 euros in value will be drawn, as well as 10 book prizes signed with dedication of winners' choice. A separate drawing entry form will open after you have answered the questions.

I am conducting my research at the University of Vaasa under the direction of Professor Teija Laitinen. The results of my study will be published in a trade journal and as a dissertation. The research is a part of the Academy of Finland's project on auditing (no. 126630).

All information obtained will be kept completely confidential. Individual responses will be compiled and kept anonymous during the whole process.

If you have any questions concerning the study, or if you are interested in the results of the study, do not hesitate to contact me. Please answer the questions by May 22nd, 2011.

In order to progress through the research, please click the following link:

http://auditresearch.org/kevat2011/________.php

Sincerely,

Tuukka Järvinen

M.Sc. (Econ.), doctoral student

tuja@uwasa.fi, tel. 06-3248542

Appendix 4. Follow-up letter

Dear auditing expert,

A while ago, I contacted you in regard to my doctoral dissertation on auditors' decision-making process. I sent you an e-mail containing a link to a research and asked you to spend 10 minutes of your time to answer it. Maybe you have not had time to answer the questions due to for instance work-related reasons.

Now I contact you again because every answer is important to the success of the research. After examining the information provided, you will be asked to evaluate your willingness to take a new company as a client. You are free to use any information available as the basis of your decision. Please make the decision independently and without interruptions.

In order to progress through the research, please click the following link:

http://auditresearch.org/kevat2011/________.php

As a reward for your time, 3 travel gift certificates of 120 euros in value, and 10 books by professor Erkki K. Laitinen signed with dedication of winner's choice will be drawn among those who answer the questions. A separate drawing entry form will open after you have answered. Entering the drawing is entirely optional.

Please make the decision as soon as possible but by Sunday, the 29th of May, 2011 at the latest. Your answers will be kept completely confidential. Individual responses will be compiled and kept anonymous during the whole process.

If you have already answered the questions, I want to thank you for your answers and for participating in this research.

Sincerely,

Tuukka Järvinen

M.Sc. (Econ.), doctoral student

tuja@uwasa.fi, tel. 06-3248542

Appendix 5. Descriptive statistics of the dependent variables (n=307)

Panel A: Descriptive statistics of the continuous dependent variables (All units in seconds)							
Variable	Mean	Std Dev.	Minimum	Q1	Median	Q2	Max.
TOT_TIME	666.3	589.5	76.0	353.0	539.0	774.0	4947.0
TOT_CUE_TIME	332.9	349.1	0.0	154.0	275.0	419.0	4340.0
JUDG_TIME	333.4	446.6	45.0	178.0	247.0	329.0	4844.0
Panel B: Descriptive statistics of the count dependent variables (All units in counts)							
NUMBER_INF	10.7	3.5	0.0	9.0	12.0	12.0	25.0
NUMBER_INF_9	9.4	4.0	0.0	7.0	10.0	12.0	25.0
NUMBER_IMP_CUE	10.2	3.8	0.0	8.0	11.0	13.0	24.0

Panel C: Pearson's correlation coefficients of dependent variables					
	TOT_CUE _TIME	JUDG _TIME	NUMBER _INF	NUMBER _INF_9	NUMBER _IMP_CUE
TOT_TIME	0.656***	0.807***	0.324 ***	0.364 ***	0.266 ***
TOT_CUE_TIME		0.084	0.355 ***	0.441 ***	0.342 ***
JUDG_TIME			0.152 ***	0.135 **	0.083
NUMBER_INF				0.870 ***	0.804 ***
NUMBER_INF_9					0.729 ***

Notes:
Statistical significance based on two-tailed tests at the 1%, 5% and 10% levels are denoted by ***, ** and *, respectively.
The variables are defined as follows:
TOT_TIME = Total time spent on the task
TOT_CUE_TIME = Total time spent reading cues
JUDG_TIME = Time spent outside of cues (tot_time minus tot_cue_times)
NUMBER_INF = Total number of read cues, including multiple reads
NUMBER_INF_9 = Number of over 9 second read cues, including multiple reads
NUMBER_IMP_CUE = Number of read cues whose importance was self-evaluated to be more than 4, including multiple reads

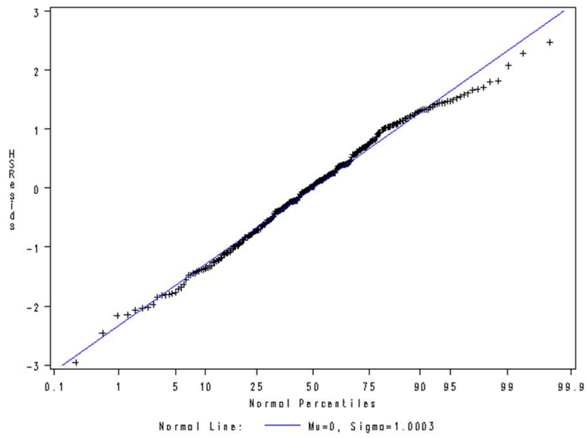
Appendix 6. Descriptive statistics of dependent variables per treatment and experience

Treatment	Less-experienced?	N Obs	Variable (units)	Mean	Std Dev
1	NO	22	TOT_TIME (sec.)	468.77	240.82
Semi-struc.			TOT_CUE_TIME (sec.)	266.09	186.29
Low risk			JUDG_TIME (sec.)	202.68	67.44
More-rel.			NUMBER_INF (counts)	10	3.07
			NUMBER_INF_9 (counts)	8.64	3.35
			NUMBER_IMP_CUE (counts)	9.55	3.22
	YES	6	TOT_TIME (sec.)	614.17	188.39
			TOT_CUE_TIME (sec.)	369.17	121.14
			JUDG_TIME (sec.)	245	142.79
			NUMBER_INF (counts)	11.83	0.41
			NUMBER_INF_9 (counts)	10.83	2.04
			NUMBER_IMP_CUE (counts)	11.33	1.86
2	NO	28	TOT_TIME (sec.)	544.82	245.17
Semi-struc.			TOT_CUE_TIME (sec.)	287.75	177.5
Low risk			JUDG_TIME (sec.)	257.07	126.25
Less-rel.			NUMBER_INF (counts)	10.96	3.19
			NUMBER_INF_9 (counts)	9.82	3.58
			NUMBER_IMP_CUE (counts)	10.07	3.28
	YES	13	TOT_TIME (sec.)	546.85	151.47
			TOT_CUE_TIME (sec.)	275.38	124.61
			JUDG_TIME (sec.)	271.46	83.74
			NUMBER_INF (counts)	11.46	3.62
			NUMBER_INF_9 (counts)	10.85	3.76
			NUMBER_IMP_CUE (counts)	10.54	2.76
3	NO	21	TOT_TIME (sec.)	505.14	229.3
Semi-struc.			TOT_CUE_TIME (sec.)	268.05	159.46
High risk			JUDG_TIME (sec.)	237.1	94.16
More-rel.			NUMBER_INF (counts)	9.43	3.36
			NUMBER_INF_9 (counts)	8.24	3.4
			NUMBER_IMP_CUE (counts)	8.81	3.17
	YES	10	TOT_TIME (sec.)	697	315.95
			TOT_CUE_TIME (sec.)	371.6	178.38
			JUDG_TIME (sec.)	325.4	157.37
			NUMBER_INF (counts)	11.3	2.31
			NUMBER_INF_9 (counts)	10.8	3.01
			NUMBER_IMP_CUE (counts)	11.2	2.74
4	NO	21	TOT_TIME (sec.)	599.33	229.22
Semi-struc.			TOT_CUE_TIME (sec.)	288.05	134.91
High risk			JUDG_TIME (sec.)	311.29	144.62
Less-rel.			NUMBER_INF (counts)	11.05	1.99
			NUMBER_INF_9 (counts)	9.76	2.64
			NUMBER_IMP_CUE (counts)	11.05	2.25
	YES	11	TOT_TIME (sec.)	528.09	181.87
			TOT_CUE_TIME (sec.)	302.27	148.99
			JUDG_TIME (sec.)	225.82	88.7
			NUMBER_INF (counts)	10.82	2.56

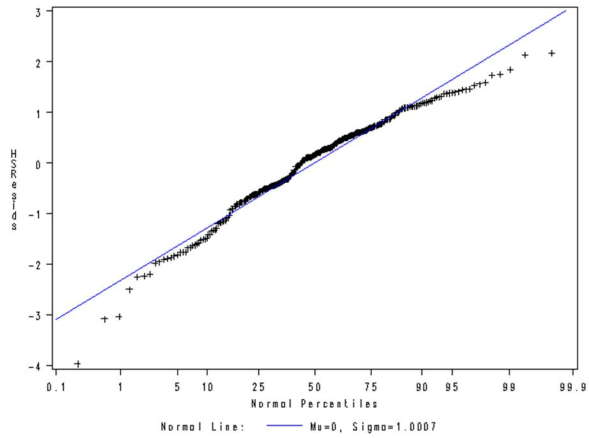
			NUMBER_INF_9 (counts)	10.09	3.45
			NUMBER_IMP_CUE (counts)	9.27	3.44
5	NO	24	TOT_TIME (sec.)	497.63	221.74
Unstruct.			TOT_CUE_TIME (sec.)	256.75	159.21
Low risk			JUDG_TIME (sec.)	240.88	126.21
More-rel.			NUMBER_INF (counts)	10.46	3.13
			NUMBER_INF_9 (counts)	8.21	3.39
			NUMBER_IMP_CUE (counts)	10.38	2.98
	YES	7	TOT_TIME (sec.)	610.71	265.05
			TOT_CUE_TIME (sec.)	281.71	107.72
			JUDG_TIME (sec.)	329	228.11
			NUMBER_INF (counts)	11.43	3.31
			NUMBER_INF_9 (counts)	10.14	3.48
			NUMBER_IMP_CUE (counts)	9.86	5.43
6	NO	24	TOT_TIME (sec.)	565.04	234.32
Unstruct.			TOT_CUE_TIME (sec.)	304.29	170.03
Low risk			JUDG_TIME (sec.)	260.75	93.67
Less-rel.			NUMBER_INF (counts)	11.58	2.47
			NUMBER_INF_9 (counts)	10	3.86
			NUMBER_IMP_CUE (counts)	11.83	3.25
	YES	17	TOT_TIME (sec.)	596.71	232.57
			TOT_CUE_TIME (sec.)	331.59	147.27
			JUDG_TIME (sec.)	265.12	98.9
			NUMBER_INF (counts)	12.18	1.81
			NUMBER_INF_9 (counts)	10.76	2.97
			NUMBER_IMP_CUE (counts)	11.53	3.06
7	NO	23	TOT_TIME (sec.)	492.35	240.06
Unstruct.			TOT_CUE_TIME (sec.)	248.74	142.12
High risk			JUDG_TIME (sec.)	243.61	126.42
More-rel.			NUMBER_INF (counts)	10.74	2.73
			NUMBER_INF_9 (counts)	8.7	3.14
			NUMBER_IMP_CUE (counts)	10.43	3.67
	YES	14	TOT_TIME (sec.)	746.86	291.1
			TOT_CUE_TIME (sec.)	403.21	247.05
			JUDG_TIME (sec.)	343.64	196.49
			NUMBER_INF (counts)	11	3.37
			NUMBER_INF_9 (counts)	10.21	3.98
			NUMBER_IMP_CUE (counts)	10.64	3.43
8	NO	22	TOT_TIME (sec.)	593.86	216.58
Unstruct.			TOT_CUE_TIME (sec.)	288.5	136.42
High risk			JUDG_TIME (sec.)	305.36	155.55
Less-rel.			NUMBER_INF (counts)	10.32	2.92
			NUMBER_INF_9 (counts)	9.59	3.55
			NUMBER_IMP_CUE (counts)	10.14	2.75
	YES	8	TOT_TIME (sec.)	906.38	169.38
			TOT_CUE_TIME (sec.)	452.25	178.34
			JUDG_TIME (sec.)	454.13	178.49
			NUMBER_INF (counts)	13.63	5.34
			NUMBER_INF_9 (counts)	12.75	6.02
			NUMBER_IMP_CUE (counts)	12.38	6.46

Appendix 7. Residual plots for ANOVA models

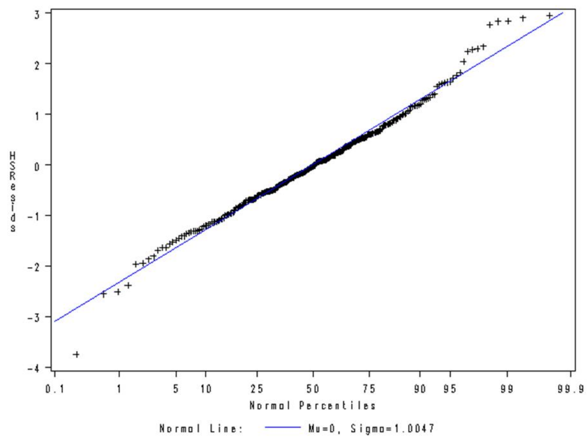
Dependent variable: LN_TOT_TIME



Dependent variable: LN_TOT_CUE_TIME



Dependent variable: LN_JUDG_TIME



Appendix 8. ANOVA tables for continuous variables without students (n=251)

Panel A. Dependent variable LN_TOT_TIME (**Model 1**)

Variable	df	Sum of Squares	Mean square	F	p
INEXP	1	1.28	1.28	6.69	0.010
RISK	1	0.72	0.72	3.79	0.053
STRUCTURE (STR)	1	0.67	0.67	3.53	0.062
RELIABILITY (REL)	1	0.30	0.30	1.56	0.213
INEXP × RISK	1	0.28	0.28	1.46	0.228
INEXP × STR	1	0.81	0.81	4.23	0.041
INEXP × REL	1	0.48	0.48	2.53	0.113
RISK × STR	1	0.13	0.13	0.69	0.408
RISK × REL	1	0.03	0.03	0.15	0.701
STR × REL	1	0.22	0.22	1.18	0.279
INEXP × RISK × STR	1	0.47	0.47	2.46	0.118
INEXP × STR × REL	1	0.56	0.56	2.93	0.088
RISK × STR × REL	1	0.23	0.23	1.22	0.270
RISK × REL × INEXP	1	0.09	0.09	0.47	0.494
INEXP × RISK × STR × REL	1	0.15	0.15	0.78	0.378
Model	15	5.20	0.35	1.82	0.033
Error	235	44.85	0.19		
Total	250				

Panel B. Dependent variable LN_TOT_CUE_TIME (**Model 2**)

Variable	df	Sum of Squares	Mean square	F	p
INEXP	1	0.97	0.97	2.45	0.119
RISK	1	0.04	0.04	0.11	0.744
STRUCTURE (STR)	1	0.07	0.07	0.17	0.677
RELIABILITY (REL)	1	0.08	0.08	0.20	0.655
INEXP × RISK	1	0.03	0.03	0.07	0.796
INEXP × STR	1	0.31	0.31	0.78	0.377
INEXP × REL	1	0.62	0.62	1.57	0.211
RISK × STR	1	0.00	0.00	0.00	0.975
RISK × REL	1	0.06	0.06	0.14	0.706
STR × REL	1	0.42	0.42	1.07	0.303
INEXP × RISK × STR	1	0.02	0.02	0.04	0.838
INEXP × STR × REL	1	0.42	0.42	1.06	0.303
RISK × STR × REL	1	0.02	0.02	0.05	0.818
RISK × REL × INEXP	1	0.58	0.58	1.48	0.225
INEXP × RISK × STR × REL	1	0.06	0.06	0.15	0.700
Model	15	4.11	0.27	0.70	0.787
Error	235	92.5	0.39		
Total	250				

Appendix 8. Continued

Panel C. Dependent variable LN_JUDG_TIME (**Model 3**)

Variable	df	Sum of Squares	Mean square	F	p
INEXP	1	1.11	1.11	6.72	0.010
RISK	1	1.60	1.60	9.67	0.002
STRUCTURE (STR)	1	1.06	1.06	6.41	0.012
RELIABILITY (REL)	1	0.73	0.73	4.41	0.037
INEXP × RISK	1	0.28	0.28	1.69	0.196
INEXP × STR	1	1.03	1.03	6.23	0.013
INEXP × REL	1	0.27	0.27	1.63	0.203
RISK × STR	1	0.14	0.14	0.85	0.358
RISK × REL	1	0.17	0.17	1.04	0.310
STR × REL	1	0.12	0.12	0.75	0.388
INEXP × RISK × STR	1	0.79	0.79	4.80	0.029
INEXP × STR × REL	1	0.57	0.57	3.45	0.064
RISK × STR × REL	1	0.58	0.58	3.52	0.062
RISK × REL × INEXP	1	0.02	0.02	0.13	0.718
INEXP × RISK × STR × REL	1	0.52	0.52	3.52	0.077
Model	15	6.26	0.42	2.52	0.002
Error	235	38.92	0.17		
Total	250				

Notes:

The variables are defined as follows:

LN_TOT_TIME = Natural logarithm of total time spent on the task
LN_TOT_CUE_TIME = Natural logarithm of total time used for reading cues
LN_JUDG_TIME = Natural logarithm of time spent outside of cue screens
INEXP = A categorical variable with a value of 1 if a subject is less experienced, otherwise 0
RISK = A categorical variable with a value of 1 if a treatment group contains high RMM, otherwise 0
STRUCTURE = A categorical variable with a value of 1 if a treat. group is an unstructured task, otherwise 0
RELIABILITY = A categorical variable with a value of 1 if a treatment group contains the less reliable information manipulation, otherwise 0

Appendix 9. Descriptive statistics of the task-specific judgment variables per treatment (See Appendix 2 for definitions of variables)

Client continuance

Treatment	N Obs	Variable	Mean	Std Dev
1	28	JUDGMENT	93.21	8.63
Semi-struc.		JUDG_CONF	9.07	1.02
Low risk		HOUR_ESTIM	6.39	0.99
More-rel.		FEE_ESTIM	6.11	0.96
2	41	JUDGMENT	88.05	10.54
Semi-struc.		JUDG_CONF	8.73	1.07
Low risk		HOUR_ESTIM	7.39	1.20
Less-rel.		FEE_ESTIM	7.10	1.09
3	31	JUDGMENT	80.97	21.66
Semi-struc.		JUDG_CONF	8.23	1.91
High risk		HOUR_ESTIM	6.87	1.15
More-rel.		FEE_ESTIM	6.65	1.11
4	32	JUDGMENT	78.44	16.68
Semi-struc.		JUDG_CONF	7.81	1.87
High risk		HOUR_ESTIM	7.56	1.13
Less-rel.		FEE_ESTIM	7.25	1.02

Client acceptance

Treatment	N Obs	Variable	Mean	Std Dev
5	31	JUDGMENT	87.74	11.17
Unstruct.		JUDG_CONF	8.87	1.02
Low risk		HOUR_ESTIM	5.55	0.85
More-rel.		FEE_ESTIM	5.48	0.89
6	41	JUDGMENT	82.44	13.92
Unstruct.		JUDG_CONF	8.44	1.18
Low risk		HOUR_ESTIM	6.41	1.38
Less-rel.		FEE_ESTIM	6.22	1.24
7	37	JUDGMENT	85.14	15.39
Unstruct.		JUDG_CONF	8.70	1.31
High risk		HOUR_ESTIM	6.32	1.25
More-rel.		FEE_ESTIM	6.19	0.84
8	30	JUDGMENT	78.00	17.69
Unstruct.		JUDG_CONF	7.70	2.17
High risk		HOUR_ESTIM	6.80	1.03
Less-rel.		FEE_ESTIM	6.53	0.86