Identifying Auditor Stopping Rules in Decision Making Under Uncertainty

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Abstract

A stopping rule is a mechanism whereby the decision maker chooses to stop the search for information and make a decision (Gigerenzer and Selten 2001). This study analyses rich verbal protocol data provided by experienced auditors completing a detailed risk identification case to increase our understanding how stopping rules are applied by auditors, the impact of different stopping rules on judgment performance, and the influence of task-specific experience and the availability of a decision aid on the relationship between stopping rules and performance. The results revealed that while auditors use a combination of stopping rules, those rules involving the development of a mental model of the client were generally favoured and led to superior performance. Participants generally ignored a decision aid checklist that was made available as a structured alternative to their own stopping rule.

Key words: Stopping rule, judgment, decision making, verbal protocol, significant risk

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1. Introduction

An audit of the financial statements involves the collection and evaluation of evidence to determine whether a firm's financial statements are fairly stated (IAASB 2007a). Essential to this process is how auditors select evidence and determine whether the accumulated evidence is sufficient to make critical decisions. While much is known about the effectiveness and efficiency with which auditors evaluate a given set of evidence (as reviewed by Nelson and Tan (2005)) and, to a lesser extent, the type of evidence auditors search for in constructing the evidence set (Asare, Trompeter, and Wright 2000), very little is known about how auditors decide that there is sufficient evidence upon which to make their judgment. That is, how do auditors decide to suspend the search for information and make a judgment?

A stopping rule is a mechanism or decision process whereby the decision maker chooses to stop the search for information, finalise the evidence set and make a decision (Gigerenzer and Selten 2001). Stopping rules may be relatively simple, such as stopping after collecting a predetermined number of evidence items or relatively mechanistic such as the completion of a standard checklist. They can also be much more complex, such as constructing a mental model of the audit client and comparing that mental model to one's past experiences to determine whether any piece of the mental model is inconsistent with these experiences (Bell, Peecher, and Solomon 2005). When using a mental model, the auditor stops searching for information when there are no inconsistencies.

The incorrect selection and/or application of a stoping rule have the potential to adversely impact on audit effectiveness and efficiency. Too little audit evidence may result in the non-detection of a material misstatement, too much and the audit may be inefficient and unprofitable. Even if auditors, through training and experience, are able to accurately and

efficiently evaluate audit evidence in order to reach a correct conclusion, those efforts will be thwarted if the evidence set generated by the application of a stopping rule is sub-optimal.

Despite the fundamental importance of stopping rules for an effective and efficient audit, very little is known about how auditors use stopping rules. Indeed, we are aware of only one paper that investigates the impact of stopping rules in an audit context. Gillett and Peytcheva (2007) found that audit conclusions were dependent on the stopping rule that the auditors believed was employed to collect the audit evidence. These authors, however, do not examine either the selection or application of the stopping rule.

Using verbal protocol analysis, experienced auditors (Seniors and Mmanagers), and a detailed task involving the identification of significant risks at the planning stage of the audit, our study begins to address this deficiency in the literature.

Our results revealed that auditors do not use a single stopping rule, but rather a hybrid combination with the development of a mental model of the entity and its operations at the core. This is consistent with the requirements of auditing standards (IAASB 2007b) in that auditors are using a mental model based approach to collect evidence, build an understanding of the client and decide when enough is known about the client in order to stop and make a judgment to the client's significant risks. Although the use of different stopping rules did not influence the characteristics of the evidence set generated, greater use of mental model stopping rules seems to lead to more effective interpretation and evaluation of the evidence set. Moreover, our results reveal that there is a relationship between task-specific experience, use of a mental model stopping rule and superior performance in the identification of significant risks.

The introduction of a decision aid in this study, a checklist that provided a mechanistic and 'safe' alternative to an auditor's individual and potentially inferior stopping

rule did not interfere with the way in which the task was performed. Most participants ignored the checklist and a few used it as a review tool at the end of the task.

Our study provides a theoretical contribution to the stopping rule literature by examining what stopping rules are used in more critical and unstructured decision making situations. The limited research to date (for example Nickles (1995)) has examined stopping rules in simple information search tasks with decisions made by students. A contribution is also made to the literature on behavioural decision theory by examining how common characteristics of the audit environment (the task-specific experience of auditors and the use of checklist decision aids) affect the stopping rules used by auditors and how those rules are used to generate sets of sufficient and appropriate evidence for decision making.

A practical contribution is made by examining the impact of checklists on the application by auditors of stopping rules and risk identification. This provides guidance on when checklists should be used. A regulatory contribution is made by providing evidence on what approaches auditors are using to collect sufficient and appropriate evidence to gather an understanding of the client as mandated by International Standard on Auditing (ISA) 315, Understanding the Entity and Its Environment and Assessing the Risks of Material Misstatement (IAASB 2007b).

The remainder of our paper is organised as follows. Section II provides background to the use and different types of stopping rules. Section III outlines the research questions examined. Section IV details the methodology employed with Section V reporting the results. Section VI provides summary and concluding remarks.

2. Stopping rules

2.1. Background

The stopping rule plays a vital part in the decision making process. Without a rule to decide when the information search should be terminated, the search could theoretically

continue forever. The effort-accuracy framework (Payne, Bettman, and Johnson 1993) implies that decision makers have a means by which to stop the search for information as part of their overall decision strategy but does not specify what stopping rules are available.

Stopping rules have two origins in the literature. First, from psychological research in the area titled ‘deferred decision making’ or ‘optional stopping’ (Busemeyer and Rapoport 1988; Pitz, Reinhold, and Geller 1969) and second, from the area of ‘decision heuristics’ (Gigerenzer and Selten 2001). Deferred decision making refers to situations where the decision maker must decide whether to search for additional information (at cost) or stop and make the decision required (Pitz, Reinhold, and Geller 1969). The decision heuristics literature is based on the premise that because of the bounded rationality of humans (Simon 1957), we use heuristics to in decision making rather than complex, mathematical-based models seen in the deferred decision making literature (Gigerenzer and Selten 2001). Gigerenzer (2001) posits that human decision making consists of a toolbox of strategies, those for searching for information, to stop the search for information and to make a decision based on the information gathered.

2.2. Types of stopping rules

Nickles (1995) and Browne and Pitts (2004) provides a set of cognitively manageable stopping rules for use in deferred decision making research. These stopping rules fall into three distinct categories. The first are rules based on judging whether evidence meets a certain threshold. The second is a rule that involves the generation of a mental representation or model. The third is a rule that involves the creation of a mental list.

A threshold stopping rule can use any particular measure for the value of evidence. It involves the ongoing collection of evidence until such time that a predetermined level is reached (magnitude threshold) or the marginal contribution of the most recent evidence item falls to a predetermined level (difference threshold). For example, application of the

magnitude threshold stopping rule may involve the collection of a predetermined number of evidence items or the achievement of a certain level of confidence before the search for evidence will stop. The application of the difference threshold stopping rule may involve checking that enough new knowledge is gained from a piece of evidence to continue the search, if the new knowledge falls below a predetermined level then the search for information is stopped.

The mental model stopping rule involves the decision maker developing arguments that are mental representations of the decision problem. For example, the auditor collects information to construct a model of the audit client. They compare this information to what they know about clients in general (from previous experience). The comparison between the client and past experience may indicate an area of the client mental model that is contradictory to general business practice. This indicates to the auditor that the mental model is not stable or complete and further evidence in the area of contradiction needs to be collected before the evidence search can be terminated. Once contradictions are resolved, either by understanding why there is a contradiction or establishing that there is, in fact, no contradiction, the auditor's mental model of the client is in harmony with what they know both about the client and the environment within which the client operates. When the decision maker keeps returning to the same set of arguments or conclusions, the model is stable and the information search stops (Yates and Carlson 1982).

When using the mental list stopping rule, the decision maker develops or accesses a list of the evidence items he/she believes is necessary to make the decision. Once all items are collected, the search for evidence stops. Mental lists may develop from experience (for example, evidence items that must always be considered for the individual auditor to be comfortable with their judgment), sourced from items that auditing standards require to be considered, and/or from exposure to a firm's standard audit checklists.

3. Research questions

Prior to discussing the research questions of interest in this study, it is useful to first briefly consider the audit context within which the research questions will be examined.

An informative investigation of stopping rules must take place in an unstructured audit environment. Such an environment allows the auditor to guide the search for information and be free of any external constraints that may influence when the search stops. One unstructured component of the audit is the process by which the auditor gains an understanding of the client and identifies the significant risks as part of the planning process. This exercise, mandated by auditing standards (IAASB 2007b), is likely to exhibit significant variation in the extent of search. The auditing standards do not provide auditors with instructions for determining when they have sufficient and appropriate evidence upon which to form their judgment. Discussions with professional standards staff at two Australian Big 4 firms confirmed that this is a task where individual judgment is heavily relied upon. Moreover, it is a task for which the list of potential evidence items is almost limitless. As a consequence, the identification of significant risks as part of the process by which auditors gain an understanding of their client was considered an ideal setting for this study.

3.1. The relation between the stopping rule used and the evidence collected

Previous research indicates that people use a range of different stopping rules in their decision making (Browne and Pitts 2004; Nickles 1995) and that different stopping rules result in differences in the amount of evidence collected (Nickles 1995). What remains an unanswered question is whether different stopping rules are more or less effective in the generation of an appropriate evidence set. Auditors may adapt to the decision environment and be able to generate an appropriate set with any of the three stopping rules. Alternatively, one stopping rule may be superior to others. In this regard, the auditing standards (IAASB 2007b) and one audit firm methodology guide (Bell, Peecher, and Solomon 2005) advocate

the mental model approach – with the belief that this results in more sufficient and appropriate evidence.

The mental model stopping rule involves understanding a client in its entirety, implying a greater breadth of evidence items. The mental model stopping rule also uses pattern-recognition to guide the search for information and when to stop that search. Identifying parts of the pattern that are incomplete or inconsistent guides the search for information.

The stopping rules may also interact with the order in which evidence is gathered to affect the evidence set. If non-diagnostic evidence is encountered early in the process, the search may be prematurely stopped when using the threshold stopping rules. This is due to the fact that the magnitude (that is, the predetermined number of evidence items) will be reached with evidence of limited relevance (remember it is the magnitude and not the informativeness which is important) or the marginal contribution of the evidence collected will quickly fall below that necessary for the auditor to continue the search. This will not be the case in mental model or mental list stopping rules which are less sensitive to the diagnosticity of the evidence encountered. The mental list stopping rule however suffers from the fact that it is insensitive to unique or peculiar circumstances.

There is, therefore, reason to believe that the stopping rule employed might influence the quality of the evidence set on which auditors base their judgments. The quality of an evidence set generated can be examined in terms of the number of evidence items collected, the breadth categories from which evidence is collected, and the depth of items collected within each category (Asare, Trompeter, and Wright 2000)[1]. While previous stopping rule studies have examined the number of evidence items collected (Nickles 1995), none have investigated the impact of the stopping rule on the breadth and depth of evidence, nor have

[1] We discuss these measures of evidence set quality in the Research Method section.

they examined the application of stopping rules in complex tasks which characterise the audit function. We investigate these issues in the first research question.

> **Research Question 1:** Is there a relationship between the choice of stopping rule and the number, breadth and depth of evidence items in the evidence set generated?

3.2. The relation between the stopping rule used and the identification of significant risks

It is known that the evidence set presented to the auditor affects decision performance (Simnett 1996). Therefore, if the choice of stopping rule affects the evidence set, it also has the potential to affect performance. In addition to the generation of the evidence set, the choice of stopping rule could influence the way in which the evidence set is evaluated and, in doing so, affect performance. This relationship is investigated in the second research question.

> **Research Question 2:** Is there a relationship between the choice of stopping rule and the number of significant risks identified?

3.3. The impact of task-specific experience

Each stopping rule requires a minimum level of task-specific experience for effective use. For example, a graduate auditor with very little experience may not be able to use the mental model stopping rule effectively because he or she has under-developed expectations about what an audit client should look like (in their mental model). Therefore, their relatively simple model may become stable earlier than the more complex and rich model of an auditor with greater task-specific experience. This may result in some significant risks not being identified. We anticipate that the relationship between task-specific experience and stopping rule selection and application to be complex. These complexities are addressed in the following discussion.

Threshold stopping rules can require a range of task-specific experience. For example, if the auditor is using a threshold of a particular value or volume of evidence (magnitude

threshold), they need sufficient experience to set an appropriate threshold. Too low a threshold and the evidence set will be insufficient, too high and the evidence will be excessive. However if a difference threshold is used, then experience is unlikely to have the same influence. The question to be asked by the auditor is "did I learn anything new?" If the marginal contribution to knowledge is above a predetermined level, the evidence search continues. The influence of experience will be limited to setting the appropriate marginal contribution threshold.

The successful application of mental model stopping rules requires a high level of task-specific experience. Research has indicated that experience improves the problem representations (Christ 1993) and mental models (Hammersley 2006) of auditors. Therefore the greater the task-specific experience, the more developed the mental model and the greater the ability to identify gaps in the mental model and to therefore, continue the search for sufficient and appropriate evidence.

A high level of task-specific experience may also be required for the successful application of the mental list stopping rule. If the mental list is developed with experience, inexperienced auditors will not have sufficient items included on that checklist. If however the mental list comes from memorising either auditing standards or firm-specific checklists, then there is likely to be fewer experience related differences in the evidence set generated.

Auditors may not, however, select the most appropriate stopping rule for their level of experience. In this regard, Browne and Pitts (2004) predicted that participants (information systems analysts) with greater experience would use the mental list or mental model stopping rules. However their results revealed that the majority of participants with a very high level of task-specific experience selected a difference threshold stopping rule that requires a very low level of task-specific experience for effective execution. As a result, the link between task-specific experience and the selection of a stopping rule is unclear.

Experience may have numerous effects on the selection of stopping rules. Auditors with greater task-specific experience may automatically select a more complex rule because their cognitive structure is more complex. Or they may have a better-developed effort-accuracy framework and select a simple rule because it may be as effective as a more complex one (as shown in Browne and Pitts (2004)). Auditors with greater task-specific experience are also more likely to have received greater feedback on their previous attempts at risk identification which can be used to inform future stopping rule choices.

Auditors with greater task-specific experience may search for information they believe is more diagnostic first. This may result in them meeting the appropriate threshold or completing their mental model in a relatively shorter period of time compared to those with less task-specific experience. It may mean that their evidence set is made up of more diagnostic evidence items. If a lesser experienced auditor uses the difference threshold stopping rule (ceasing when nothing new is learned), and does not have enough experience to know which cues are most diagnostic, then the search for information may be terminated after only a few pieces of information are obtained. The evidence set may be insufficient.

In addition, a particular stopping rule may lead to an appropriate evidence set. However, if the auditor has insufficient task-specific experience to be able to identify risks from the information set, performance may be inadequate.

From the preceding paragraphs it can be seen that there are numerous potential outcomes regarding the impact of task-specific experience on the use of stopping rules, the determination of whether sufficient and appropriate evidence has been collected and the identification of significant risks. These uncertainties are investigated in the following research questions.

Research Question 3a: Is there a relationship between task-specific experience and the stopping rule used by auditors?

Research Question 3b: Is there a relationship between task-specific experience and the evidence set collected?

Research Question 3c: Is there a relationship between task-specific experience and the identification of significant risks?

3.4. The impact of decision aids – checklists

The presence of a decision aid potentially affects the effort-accuracy trade-off made by the auditor. The decision aid has the potential to reduce the effort the auditor must expend in deciding whether to stop the search but may increase the effort required to apply the decision aid if it requires a lot of evidence to be collected. The accuracy of the decision aid will also have an impact. If the auditor believes that the decision aid is more accurate than their own stopping rule, or if its application is "safer" than using the auditor's own potentially less defensible stopping rule, then using the decision aid becomes more attractive.

Research indicates that auditors are often reluctant to rely on decision aids (Abdolmohammadi 1991; Boatsman, Moeckel, and Pei 1997; Eining, Jones, and Loebbecke 1997). In contrast, Glover, Prawitt, and Spilker (1997) report that auditors over-rely on a checklist decision aid, even when they know that it is inaccurate. Their results indicate that when an auditor is given a checklist, the auditor adopts a strategy of effort-minimisation, possibly at the expense of the quality of the judgment or decision made. This is contrary to the aim of decision aids to reduce cognitive load on users so that more effort can be devoted to making the judgment. Thus the decision aid may replace the auditor's own stopping rule because it minimises the cognitive effort that the auditor must expend.

There are a number of potential disadvantages associated with using checklists in an unstructured task like identifying significant risks. Checklists are highly structured and may not fit with the task environment resulting in diminished effectiveness (Glover, Prawitt, and Spilker 1997), possibly because of the irrelevant evidence it may introduce (Asare and Wright 2004). They are also not designed to detect risks from patterns, instead directing a tick-the-box mentality (Asare and Wright 2004).

Hence a checklist may result in insufficient evidence if it replaces the auditor's stopping rule. It may have a positive impact if it supplements the auditors' stopping rule. Alternatively, the auditor may choose to ignore the decision aid altogether and continue using their own preferred stopping rule.

As a supplement, the auditor will continue to use their selected stopping rule while using the checklist to double check the information they have already collected, either at the beginning, during or at the end of the information search. It may prompt them to collect information that they had not considered.

If the checklist is a substitute for the auditor's own stopping rule, the auditor will blindly collect information on the checklist without considering if any additional information may be missing. The evidence set is likely to be large and may be sufficient, but the auditor is less likely to have engaged with the evidence and may simply skim read the information to try and identify the significant risks. Alternatively, the auditor, as part of their effort-accuracy trade-off, may decide to conserve cognitive effort during the information search process by using only the checklist, but use that conserved effort later when evaluating the information to identify the significant risks. There is greater risk in this study that the evidence will be inappropriately evaluated.

Finally, if the checklist is ignored, then the decision aid will have no impact on the judgments related to the sufficiency and appropriateness of evidence. The uncertainty with regard to the influence of the decision aid (checklist) on stopping rule selection, stopping rule application, and the significant risks identified is investigated in the following research questions.

Research Question 4a: Is there a relationship between the presence of a checklist and the stopping rules used by auditors?

Research Question 4b: Is there a relationship between the presence of a checklist and the evidence set collected?

Research Question 4c: Is there a relationship between the presence of a checklist and the identification of significant risks by auditors?

3.5. Interaction between task-specific experience and checklist

Auditors with greater task-specific experience may decide not to use a checklist because they may be more confident in their own internal stopping rules. If they decide to use the checklist, then it may be a supplement to their own stopping rule, possibly acting as a memory-jogger (Eining, Jones, and Loebbecke 1997). Their own stopping rule may also direct them to information that may not be requested by the checklist. Auditors with less task-specific experience may be more likely to rely on a firm-provided checklist because their stopping rules may be less developed. They may have less confidence in their own stopping rules. They may also be unable to detect an inadequacy in a checklist. This poses the greatest danger as insufficient evidence will be collected.

Research Question 5a: Does the presence of a checklist influence the relationship between task-specific experience and the stopping rule used by auditors?

Research Question 5b: Does the presence of a checklist influence the relationship between task-specific experience and the evidence set collected?

Research Question 5c: Does the presence of a checklist influence the relationship between task-specific experience and the identification of significant risks?

4. Research method

The research on stopping rules in general is in the exploratory stages. To further facilitate this exploration, think aloud verbal protocol methodology was employed. The use of verbal protocol analysis allows us to benefit from the large and rich data set generated by this method. It also permits a more direct examination of the stopping rules employed without having to rely exclusively on participants' self insight.

4.1. Participants

Participants were ten Managers and ten Seniors from Big 4 and second tier accounting firms in Sydney, Australia. On average, seniors had 5.25 years of audit experience while managers had on average 6.65 years of experience. All participants reported that they had previous experience in identifying significant risks as part of the planning phase of the audit. An important feature of this paper is the number and seniority of the participants who completed the research materials and provided detailed verbal protocols for analysis. Participants were provided with a $30 gift voucher in appreciation for their involvement in the study.

4.2. Task and experimental procedures

A requirement of the case employed in this study was that it be sufficiently large so as to allow participants the opportunity to activate a stopping rule. Too small a case and participants would not need a stopping rule, choosing instead to look at everything provided to them. To construct the case, an Australian listed wine producer was used as a foundation. Financial statements, newspaper articles and other publicly available information were collected. Any identifying information such as company or personnel names were changed and financial information was scaled to reduce the possibility of recognition. In total, the case comprised 89 workpapers (124 pages). The workpapers were provided in an indexed folder.

The folder of information given to participants was organised into four distinct sections – financial information, company information, industry information and newspaper articles. Within the company information, workpapers were ordered alphabetically. The newspaper articles were ordered by date (oldest to newest). Each workpaper was cross-referenced to any other workpapers that were related to the topic. This was performed because cross-referencing is commonly used by auditors to navigate audit documentation. The case materials were extensively pilot tested on academic colleagues with audit

experience and audit practitioners. In particular, the audit practitioners indicated that the materials were representative, both in terms of volume and contents of those that would be available to auditors identifying significant risks in practice.

Due to their proprietary nature, Big 4 audit firms were not prepared to give permission for their audit checklists to be used in our study. Therefore, a generic checklist was developed using Appendix 1 contained in ISA 315 (IAASB 2007b) which recommends a number of areas that auditors should investigate to gather an understanding of the client sufficient to allow the identification of significant risks. Key items from the appendix were identified and included in our checklist under the headings of: external/industry factors, nature of the entity, objectives and strategy, financial performance, and internal controls. In total, the checklist contained twenty items with each item referenced to the key workpaper in the case materials.

The setting for the case is a pre-tender meeting to be attended by the participant, other team members, and the audit partner. The participant was informed that the case company has approached the firm to provide a tender for audit services in the future. Prior to the audit firm committing to make a presentation to the Board, the participant is assigned the task of identifying the significant risks from a folder of information available to them. The participant was informed that the significant risks identified would be used in discussions amongst senior staff to determine whether the firm should making a presentation and tender to the Board of the case company. To clarify the concept of ‘significant risk’, participants were also given a definition from ISA 315.109 (IAASB 2007b) and reminded that the partner is not interested in reading about every conceivable risk - only the most significant risks that would affect the planning and execution of the audit.

Participants were also informed that they were not required to examine all the workpapers in the folder and that they could work through any materials they chose in

whatever sequence they desired. The objective was to encourage participants to search for information and stop searching for information. Those in the checklist condition were also informed that the checklist was a generic one used by the firm and that its use was entirely optional.

The task was performed at the participant's work place in a conference room or office, without noise or distraction. One of the authors was present throughout the entire task to provide instructions and clarify any questions the participant may have about the task. Standard "think aloud" instructions were given to participants in accordance with Ericsson and Simon (1993). To increase the participant's ability to "think aloud" while completing the task and remove any unease at being recorded, a practice task was completed. At any time during the task if the participant fell silent for an extended period of time, they were reminded to continue thinking aloud with the phrase "keep talking". At the end of the task demographic information, including the participant's task-specific experience, was collected. Those who received the checklist were also requested to answer two questions on the extent to which they used the checklist to search for information and to decide when the task was complete. Participants were also asked not to discuss the task with their colleagues as data collection was ongoing.

4.3. Variables

Task-specific experience was manipulated at two levels (Senior and Manager) as was checklist (present or absent). The stopping rule employed, which was either an independent or dependent variable depending on the research question examined, was a measured variable, the details of which are provided below. Task performance was measured as the number of significant risks identified. Evidence set characteristics were measured on three dimensions; the number, breadth and depth of workpapers acquired. Details of how these variables were measured are provided below.

4.3.1. Measuring the stopping rules used

Verbal protocol analysis was used in this study to enable the stopping rule(s) used by participants to be identified. The protocols were transcribed verbatim by a transcription professional and then closely reviewed by one of the authors in conjunction with the original audio. Once they were satisfied that the transcripts were accurate, they were parsed into episodes. An episode is the smallest unit of thought or cognition.

Traditionally, operators used to code verbal protocol transcripts fall into three categories – inputs, processing and outputs. Input operators are associated with acquiring information from the materials given. Output operators are associated with the decision to be made in the task (in this case, the decision that a particular item is a significant risk or deciding that the task is at an end). Processing involves any form of information transformation – using mental functions on information acquired in order to get to the output. A stopping rule is a cognitive process whereby the participant is determining whether they have sufficient and appropriate evidence. Therefore, stopping rules will most likely be seen in the 'processing' operators[2]. Coding of the protocol episodes proceeded in two stages. Stage 1 identified the processing operators and Stage 2 coded the processing operators in light of the stopping rules they were consistent with.

Operators for Stage 1 of the coding scheme were developed based on the commonly used categories of inputs, processing and outputs. Some operators were obtained from the existing applicable literature. Protocols from the pilot studies were examined and as many episodes as possible coded from the existing literature. Any episodes that did not fit an existing operator were examined in an emergent approach and new operators developed. The Stage 1 coding scheme was also tested for clarity and to identify any descriptions that were

[2] It is likely that the way a participant acquires information (inputs) may also be reflective of the stopping rule used. However, data collected in the verbal protocols and the structure of the task are not sufficient to identify the stopping rule based on search strategy.

ambiguous through the use of a test coder. The test coder was given the coding scheme and asked to code the protocol from one of the pilot studies. The researcher then compared their coding with that of the test coder – differences were analyzed and the coding scheme clarified. The Stage 1 coding was developed and extensively tested before the Stage 2 coding was developed.

Operators for Stage 2 of the coding scheme were developed from the literature on stopping rules. The threshold stopping rules focus on reaching some predetermined amount of evidence – so as information is acquired, the participant will comment on how it impacts the amount they are seeking to collect. The mental model stopping rule is based on building a mental picture of the firm – so as information is acquired, the participant should display behaviour consistent with linking that information with that which they already know and forming conclusions based on that information. The mental list stopping rule is based on the search for specific information. It is related to a checklist rather than evidence that has been acquired or an evolving understanding of the entity. As such, processing consistent with a mental list stopping rule will not exhibit any reference to previous evidence or understanding of the entity.

Coding for both Stage 1 and Stage 2 was undertaken by one of the authors. In order to test the reliability of the coding, all of the protocols were independently coded and revealed that the initial coding was reliable. Any disagreements between coders were resolved and analysis is based on the final agreed upon coding.

4.3.2. Measure of task performance

Participants were required to identify the significant risks that would affect the planning of the audit. The performance of the task by participants is measured by the number of significant risks identified. Seven significant risks were identified by the researcher and auditing faculty involved in the pilot testing prior to the data being collected. A review of the

risks identified by participants completing the task revealed no further unidentified significant risks.

4.3.3. Evidence set characteristics

Three characteristics of the evidence set were calculated – the total number of workpapers acquired, the breadth of workpapers acquired and the depth of workpapers acquired (Asare, Trompeter, and Wright 2000). The protocol episodes coded as inputs were matched with the workpaper containing the information acquired. The total number of workpapers is based on a count of the unique (individual) workpapers referred to in the protocol. This does not count duplicates – for example, four lines of protocol where the participant is reading from a single workpaper is counted as only one workpaper. The breadth of workpapers acquired was based on how many of the eight categories of workpapers were covered by the workpapers acquired. The categories were from ISA 315 (IAASB 2007b) which identifies eight major categories of potential information that auditors may need to acquire to obtain an understanding of the client sufficient to identify the significant risks[3]. Each workpaper was allocated to one of these eight categories. As long as at least one workpaper under a category was acquired, this category was considered to have been covered when measuring this variable. The depth of workpapers acquired took into consideration the number of workpapers and was calculated as the proportion of all workpapers under that category that were acquired.

[3] The eight categories were Industry, Regulatory and Other External Factors; Measurement and Review of the Entity's Financial Performance; Nature of the Entity – Business Operations; Nature of the Entity – Financing; Nature of the Entity – Financial Reporting; Nature of the Entity – Investments; Nature of the Entity – Ownership and Governance Arrangements; and Objectives and Strategies and Related Business Risks.

5. Results

5.1. Descriptive statistics

Descriptive statistics reported by experience (rank) and checklist (present or absent) are reported in Table 1.

<Insert Table 1 here>

The number of words in each verbal protocol reveals that participants took the task seriously and this was also the impression given to the author involved in collecting, transcribing and coding the verbal protocols. On average, participants reviewed half of the available workpapers and covered most of the eight breadth categories of evidence. Participants however generally only identified fewer than half of the seven significant risks.

In general, most participants worked through the folder of workpapers sequentially – starting at the financial statements. It was common for participants to use the financial statements to identify accounts balances that looked unusual and then be vigilant for information on these account balances while working through the folder. For some risks, but particularly for related party transactions, a number of participants immediately identified a significant risk after reading a single workpaper – indicative of a mental list stopping rule. Another common process displayed by participants was the conduct of a recap of all the significant risks they identified and the placing of those risks in the context of the client, indicative of a mental model stopping rule.

Stage 2 coding of the protocols (identification of processing consistent with the three stopping rules) revealed that participants generally used all three stopping rules (threshold, mental model and mental list) to varying degrees in order to complete the task. Consistent with present auditing standards and practice, extensive use is made of the mental model stopping rule.

Table 2 reports descriptive statistics on the proportion of processing consistent with each of the three stopping rules.

<Insert Table 2 here>

5.2. Research Question 1 – the impact of stopping rules on evidence

Research Question 1 was concerned with a potential relationship between the choice of stopping rule and the quality of the evidence set generated. As noted above, the protocol data revealed that participants did not use a single stopping rule in the completion of the task, choosing instead to use a combination of the three stopping rules. One consistency identified was the fact that all participants used the mental model stopping rule to some degree – from 42% of their processing to 95%. In light of the extensive use of the mental model stopping rule, analysis of the relationships between stopping rule and evidence set characteristics was based primarily on the proportion of processing reflective of a mental model stopping rule.

Table 3 reports Pearson correlation coefficients examining the relationship between the proportion of the mental model stopping rule processing and characteristics of the evidence set generated.

<Insert Table 3 here>

Our data revealed no statistically significant relationship between the proportion of processing consistent with a mental model stopping rule and the total number of workpapers examined (r =.334, two-tailed p = .151), breadth of workpapers (r =.333, two-tailed p = .151) or the depth of workpapers (two-tailed p >.10 for all eight categories except for financial reporting)[4].

[4] We also analyzed our data using the proportion of processing consistent with the threshold stopping rules and the mental list stopping rules. Although results relating to the threshold stopping rule were consistent with those for mental model, the proportion of mental list processing was negatively correlated with the total number of workpapers (r =-.497, two-tailed p = .026) and the depth of workpapers examined for half of the eight workpaper categories (two-tailed p <.05)

We also split our sample at the median (77% of processing) to compare the evidence set of those participants revealing high and low levels of processing consistent with a mental model stopping rule. These results are consistent with the correlation analysis. There were no statistically significant differences between those high and low in mental model stopping rule processing (all two-tailed $p > .10$).

Whilst there is the possibility that use of the mental list stopping rule will result in a inferior evidence set, the results of this analysis are generally consistent with the understanding that the choice of stopping rule does not influence the quality of the evidence set on which auditors make judgments.

5.3. Research Question 2 – the impact of stopping rules on identifying significant risks

Research Question 2 was concerned with a potential relationship between the choice of stopping rule and the number of significant risks identified. The Pearson correlation co-efficient reporting the strength of the relationship between the proportion of the mental model stopping rule processing and the number of significant risks identified was positive and significant ($r = .447$, $p = .048$). Greater use of the mental model stopping rule is associated with superior performance in the identification of significant risks. Analysis based on the median split of the proportion of mental model stopping rule processing did not reveal any statistically significant differences in the number of significant risks identified between those with high levels (mean: 2.78 risks) and low levels (mean: 3.36 risks) of mental model stopping rule processing ($t = -.752$, $p = .462$). Although not conclusive, the results are consistent with the understanding that the mental model stoping rule leads to superior performance. Considered together with the results from Research Question 1, it appears that while a choice of stopping rule does not influence the acquisition of evidence items, it does impact on the effectiveness with which that evidence set is evaluated and interpreted.

5.4. Research Question 3 – the impact of task-specific experience

Research Question 3 was concerned with the potential relationship between task-specific experience (that is, past experience in the identification of significant risks) and the use of particular stopping rules, evidence set characteristics, and task performance. Recall that participants indicated the number of times they had previously completed an identification of significant risk task within four bands: 1-5 times, 6-10 times, 11-15 times, and more than 15 times. Table 4 reports descriptive statistics across the four levels of task-specific experience.

<Insert Table 4 here>

A one-way ANOVA revealed that there was a relationship between task-specific experience and the proportion of processing consistent with the mental model stopping rule (F = 10.138, p =.001). There is no evidence to support a relationship between task-specific experience and the breadth of workpapers acquired (F = 1.443, p = .267) however there is a marginally significant relationship with the number of significant risks identified (F = 2.933, p = .065). Post hoc Tukey, Gabriel and Hochberg tests reveal no significant differences between any of the groups in pairwise tests.

Although not the focus of a specific research question, it is useful to note that task-specific experience also may affect how a participant executed or used the stopping rule. For example, Participant 2 (a manager having previously completed between one and five significant risk exercises) identified six of seven significant risks using the mental model stopping rule (95% of processing consistent with the mental model stopping rule). In comparison, Participants 10 and 12 (seniors having previously completed between ten and fifteen and more than fifteen significant risk exercises respectively) also used the mental model stopping rule (85% and 93% of processing respectively) but only identified three out of seven significant risks.

5.5. Research Question 4 – the impact of a checklist

In Research Question 4, it was posited that a checklist, if present, may override or otherwise interfere with a participant's preferred stopping rule. None of participants in the study blindly followed the checklist. Of the nine participants given the checklist, only four referred the checklist during the task (one Manager and three Seniors) – and of those only three actually used it (one Senior reviewed the checklist at the start of the task and then did not use it). Given the limited extent to which the checklist was used by those who received it, it was not surprising to find no statistically significant differences between those provided with and those not provided with the checklist in terms of proportion of processing consistent with the mental model stopping rule (t = -.641, two-tailed p = .530), number of workpapers (t = -.032, two-tailed p = .975), breadth of workpapers (t = 1.342, two-tailed p = .196) and number of significant risks identified (t = .281, two-tailed p = .782). The verbal protocol data revealed that participants that did use the checklist during the task did so at the end of the task. It appears they were using the checklist as a memory aid to ensure they did not miss anything during their own investigations (Eining, Jones, and Loebbecke 1997).

One possible reason why the checklist had very little impact is that the task may not be suited to the use of a checklist. Identifying significant risks is a highly unstructured task and participants may not have felt comfortable using a checklist in that situation. One participant began the task by looking at the checklist items but after examining the first three items, discarded it in favour of their own approach. The other participants who were provided with the, but didn't use, the checklist given to them briefly glanced at the checklist without making comment. Interestingly, another participant indicated that the checklist provided was similar to that used in their firm, but still chose not to use it.

It would seem that a checklist is not particularly useful in this situation and its presence did not appear to interfere with the participants' preferred approach. In our

discussion surrounding research question 4, we were concerned that auditors (especially inexperienced auditors) would see the checklist as a 'safer' option than using their own potentially inferior stopping rule. The lack of accountability in the current study may have worked against us finding any checklist effect.

5.6. Research Question 5 – the interaction between task-specific experience and a checklist

Research Question 5 was concerned with a potential interaction between task-specific experience and the presence of a checklist in influencing the use of particular stopping rules, the characteristics of the evidence set, and/or the identification of significant risks. A 2x2 ANOVA revealed no statistically significant interaction between the presence of a checklist and hierarchical position (rank) in terms of the proportion of processing consistent with the mental model stopping rule ($F = 0.285$, $p = .601$), total number of workpapers ($F = 0.921$, $p = .351$) or breadth of workpaper categories ($F = 2.612$, $p = .126$).

The raw results for significant risks identified reveal a potential interaction between the variables of interest. Seniors identified more risks in the absence of the checklist (mean 2.8) than when the checklist was present (mean 2.0). The opposite was the case for managers. Managers identified more risks when the checklist was present (mean 4.8) than when it was absent (mean 3.2). The interaction, however, was not statistically significant ($F = 2.899$, $p = .108$).

Surprisingly, Managers appear to perform better when they have the checklist available to them. The one manager who used the checklist did so as a memory aid at the end of the task (Eining, Jones, and Loebbecke 1997) to consolidate their thoughts on what items may be significant risks. This participant stated: "Okay. Let's go through the checklist now that's been prepared by us and see if there's anything else that we need to worry about."

Analysis of the protocols however did not show any additional significant risks being identified with the use of the checklist.

In any case, the limited extent to which the checklists were used, despite their availability, limits the extent to which we can draw conclusions on this research question.

5.7. Sensitivity analysis

One reason for the choice a wine producer as the context for the case in this study was to minimise the impact of any potential industry experience or specialisation. Given the location of the participants (that is, Sydney Australia) it was anticipated that very few, if any, would have wine industry experience. However, other industry specialisation effects may be present – specifically financial services. Auditors with a financial services industry specialisation do not come into contact with issues surrounding inventory (one of the significant risks in the task) and therefore, may have had more difficulty with the task than those with manufacturing experience. To investigate this, we re-ran all statistical tests after excluding the three participants whose specialisation was related to financial services (for example – banking, and insurance specialisations). Exclusion of these participants did not change statistical inferences or conclusions reported above. Interestingly, two participants did have experience in the alcoholic beverage industry. One participant was a Senior and had previously audited a major international beverage company – however, this participant did not identify the write-down of inventory as a significant risk. The other participant was a Manager and had audited a distilled spirits importer and distributor and did identify inventory as a significant risk.

6. Discussion and concluding remarks

Motivated by the importance of stopping rules in audit judgment and the lack of understanding surrounding the use of stopping rules in audit settings, this study used

experienced auditors and verbal protocol analysis to inform an understanding of the way in which stopping rules are used and the factors that may influence their effective use. Analysis of the verbal protocol data revealed that auditors primarily use the mental model stopping rule when identifying significant risks for a potential audit client. However, unlike previous research where participants appear to be using only one stopping rule (Browne and Pitts 2004; Nickles, Curley, and Benson 1995) – auditors in this study appear to be using the mental model in conjunction with another stopping rule (either threshold or mental list). It is possible that in a smaller task or one that is more structured, auditors may, consistent with prior research, revert to using a single stopping rule.

Although our results are consistent with the understanding that the choice of stopping rule employed does not influence the evidence set generated, use of the mental model stopping rule seems to assist in the effective interpretation of this evidence set. The level of task-specific experience was found to influence the extent to which a mental model stopping rule is employed. These results provide evidence that auditors are meeting the requirements of ISA 315 (IAASB 2007b) by using more of a mental model based approach to build their understanding of the client.

In such an unstructured task, our data revealed that auditors either ignore a checklist or use it as a memory aid supplementing their own stopping rule – going through checklist items at the end of the task to ensure that no potential areas of risk have been omitted. There was no evidence of auditors blindly following checklists, providing evidence that audit firms are training staff in a more appropriate methodology than anecdotal reports of blind obedience. These results must, however, be interpreted with regard to the fact that if participants were held accountable for their judgments, there may have been greater incentives to employ the ‘safe’ option stopping rule available with the use of the checklist.

Not withstanding the important conclusions that we are able to draw from such a rich data set, the findings of the study do need to be interpreted with reference to its limitations. It is possible that not all cognitive processes undertaken by the participant in the conduct of the task have been verbalised. This, however, does not nullify the validity of the data that has been collected but may draw into question the completeness of the data (Ericsson and Simon 1993). Although large when compared to other protocol studies in the auditing literature, our sample of ten Managers and ten Seniors limits the power of our statistical analysis. Verbal protocols are a time and labour intensive research tool and a larger sample size was not feasible.

The analysis of such a rich data set in the present study provides the foundation for future research, not only more specifically focusing the investigation of stopping rules, but also more informatively interpreting any results there from. While current audit research primarily focuses on the interpretation of an evidence set, there is a need to examine how that evidence set is generated. In this regard, the selection and application of a stopping rule is of vital importance. We hope that this study not only informs an understanding of the way in which stopping rules are used by auditors, but also encourages others to investigate this critical area of audit judgment.

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Table 1 – Summary of descriptive statistics – mean, standard deviation and range

	Senior			Manager			Total		
	Mean	Std dev	Range	Mean	Std dev	Range	Mean	Std dev	Range
Checklist		n = 5			n = 4			n = 9	
Number of words[1]	2978.8	2200.07	1162 – 6461	2871.25	944.14	1709 – 3690	2931	1660.6	1162 – 6461
Evidence acquired[2]	47	20.58	29 – 82	43	13.11	26 – 56	45.2	16.75	26 – 82
Breadth of evidence[3]	8	0	8 – 8	8	0	8 – 8	8	0	8 – 8
Depth of evidence[4]	54%	27%	13-100%	57%	19%	13-88%	53%	25%	13-100%
Significant risks identified[5]	2	1.414	1 – 4	4.75	0.957	4 – 6	3.222	1.856	1 – 6
No checklist		n = 5			n = 6			n = 11	
Number of words	3479.2	2609.7	924 – 7678	3665.5	1747.84	1684 – 6302	3580.8	2064.3	924 – 7678
Evidence acquired	39.8	12.97	24 – 56	50.17	17.36	30 – 71	45.5	15.72	24 – 71
Breadth of evidence	7.6	0.55	7 – 8	8	0	8 – 8	7.8	0.40	7 – 8
Depth of evidence	46%	28%	0-100%	57%	24%	13-100%	52%	26%	0-100%
Significant risks identified	2.8	1.789	1 – 5	3.167	1.722	1 – 5	3	1.673	1 – 5
Total		n = 10			n = 10			n = 20	
Number of words	3229	2290.8	924 – 7678	3347.8	1470.6	1684 – 6302	3288.4	1874.5	924 – 7678
Evidence acquired	43.4	16.7	24 – 82	47.3	15.44	26 – 71	45.35	15.76	24 – 82
Breadth of evidence	7.8	0.42	7 – 8	8	0	8 – 8	7.9	0.31	7 – 8
Depth of evidence	50%	28%	0-100%	55%	28%	13-100%	53%	26%	0-100%
Significant risks identified	2.4	1.567	1 – 5	3.8	1.619	1 – 6	3.1	1.714	1 – 6

[1] Number of words in verbal protocol

[2] Evidence acquired is the number of unique workpapers examined during the conduct of the task. In total there were 89 workpapers available to participants.

[3] Breadth of evidence reports how many of the eight different categories of workpapers were acquired.

[4] Depth of evidence reports the average percentage of how many workpapers within each of the eight different categories were acquired.

[5]Significant risks identified reports how many of the seven significant risks were identified by the participants in the conduct of the task

Table 2 – Descriptive statistics on the proportional processing consistent with each stopping rule

	Senior		**Manager**		**Total**	
	Mean	Range	Mean	Range	Mean	Range
Checklist	n = 5		n = 4		n = 9	
Threshold	7.15%	4.35 - 13.25%	9.36%	1.82 - 15.28%	8.13%	1.82 - 15.28%
Mental Model	69.35%	50 - 84.78%	77.13%	64.02 - 95.45%	72.81%	50 - 95.45%
Mental List	11.01%	0 - 23.48%	5.95%	1.82 - 8.77%	8.76%	0 - 23.48%
No checklist	n = 5		n = 6		n = 11	
Threshold	8.45%	2.02 - 25.00%	8.97%	3.77 - 13.89%	8.73%	2.02 - 25%
Mental Model	75.96%	41.67 - 92.94%	77.15%	70.12 - 88.72%	76.61%	41.67 - 92.94%
Mental List	10.49%	1.76 - 29.17%	10.64%	1.03 - 17.07%	10.57%	1.03 - 29.17%
Total	n = 10		n = 10		n = 20	
Threshold	7.8%	2.02 - 25%	9.13%	1.82 - 15.28%	8.46%	1.82 - 25%
Mental Model	72.66%	41.67 - 92.94%	77.14%	64.02 - 95.45%	74.90%	41.67 - 95.45%
Mental List	10.75%	0 - 29.17%	8.76%	1.03 - 17.07%	9.76%	0 - 29.17%

Table 3 – Pearson correlation coefficients for the percentage of processing consistent with a mental model stopping rule

	Pearson's correlation coefficient
Total number of workpapers examined	r = .334 *p* = .151
Breadth of workpapers examined	r = 0.333 *p* = .151
Depth of workpapers examined	
External/industry	r = .219 *p* = .353
Financial performance	r = .198 *p* = .402
Business operations	r = .341 *p* = .141
Financial reporting	r = .460* *p* = .041
Financing	r = .353 *p* = .147
Investments	r = .258 *p* = .272
Ownership/governance	r = .249 *p* = .290
Objectives/strategy	r = .202 *p* = .394

* Correlation is significant at the 0.05 level (2-tailed)

Table 4 – Descriptive statistics using the number of times the participant has undertaken an identification of significant risks as a measure of task-specific experience

		Workpapers acquired	**Breadth of evidence**	**Significant risks identified**
1-5 times	Mean	41.667	8	3.667
n = 3	Std dev	12.423	0	2.517
	Range	34 – 56	8 – 8	1 – 6
6-10 times	Mean	26.5	7.5	1
n = 2	Std dev	3.536	0.707	0
	Range	24 – 29	7 – 8	1 – 1
11-15 times	Mean	51.5	8	2.25
n = 4	Std dev	20.782	0	1.5
	Range	38 – 82	8 – 8	1 – 4
15+ times	Mean	47.546	7.910	3.637
n = 11	Std dev	14.672	.302	1.433
	Range	26 – 71	7-8	1 - 5