Auditor recall and evaluation of internal control information: does task-specific knowledge mitigate part-list interference?

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Abstract
Part-list interference occurs when reading a few items from a previously viewed list interferes with recall of the remaining items. The purpose of this study is to examine if the review of an incomplete flowchart, following the review of a complete narrative, interferes with auditors' recall and evaluation of internal control information. The potential interaction between auditors' internal control knowledge and the extent of part-list interference is also investigated. The results indicate there was a significant interaction between knowledge and part-list interference, suggesting that interference related to an incomplete flowchart occurred primarily with less knowledgeable auditors. Therefore, higher levels of knowledge may reduce interference when recall cues are organized schematically, as found in flowcharts.

Introduction

Research in psychology and accounting suggests that documentation, statistical models, or expert systems used to assist an individual's judgment may have potentially harmful, as well as beneficial, effects (DeNisi *et al.*, 1989; Ashton, 1990). For example, a consistent finding of "fault tree" research is that possible causes of malfunctions not listed by a decision aid may go unnoticed by the problem solver (Dube-Rioux and Russo, 1988; Fischhoff *et al.,* 1978; Hirt and Castellan, 1988). A fault tree is a way of trouble-shooting where each branch of the tree lists a set of related potential causes of the problem. A limitation of this decision aid is that if the cause of the problem is not listed in the fault tree, it may not be recalled. Thus, use of the fault tree may interfere with the recall of other potential explanations. One theory that has been proposed for the inaccessibility of information that is available in memory is part-list interference (Hoch, 1984).

Part-list interference occurs when information in working memory inhibits the retrieval of additional information stored in long-term memory (Sloman *et al.*, 1991). In an auditing context, the recent acquisition of audit evidence could potentially interfere with the recall of other related information previously stored in memory. For example, as an auditor reviews information supplied by the accounting staff of the auditee, the recall of information gathered several weeks or months earlier may be inhibited. Although it is appropriate and perhaps necessary for the auditor to review documentation of evidence gathered previously, Moeckel and Plumlee (1989) suggest that auditors may choose not to consult audit workpapers because they are over-confident in their memories of audit information. Moreover, competitive pressures may lead auditors to place greater reliance on the client for

internal control information (Gramling, 2000), which may only be superficially reviewed by the auditor (Kelley and Margheim, 1990). In addition, research in psychology indicates that the larger the portion of recall cues given, the more interference may result (Nickerson, 1984). Therefore, the omission or misrepresentation of only a few activities in documentation of an accounting system may be both difficult for auditors to detect, and particularly damaging to their memories. This is an important issue because if auditors are unable to accurately recall important weaknesses of the accounting system, errors or irregularities could be left undetected by the audit, potentially reducing audit effectiveness. Conversely, if auditors cannot recall important strengths of the accounting system, unnecessary audit testing could result in a lessening of audit efficiency (Smith *et al.*, 1998).

The purpose of this study is to examine if the review of an incomplete flowchart, following the review of a complete narrative, affects auditors' recall and evaluation of internal control information. Specifically, the potential interaction between task-specific knowledge and part-list interference is investigated. Part-list interference research in psychology primarily has used recall cues composed of a subset of words or sentences from a previously reviewed list. This study extends previous research by examining if recall cues presented in a flowchart format also result in interference. Based on Frederick (1991) who theorizes that auditors organize their knowledge schematically, since information is organized schematically in flowcharts, temporal linkages among controls may not inhibit the recall of more knowledgeable auditors.

The findings of this study indicate that auditors with higher levels of knowledge

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appeared less susceptible to the effects of part-list interference than auditors with lower levels of knowledge. Therefore, knowledge may mitigate interference when recall cues are schematically organized. These findings may extend to other fields beyond auditing, such as computer programming and engineering, where flowcharts are commonly used. Unlike previous research in accounting and psychology that suggests that decision aids may cause part-list interference in a variety of task settings, the results of this study suggest that flowcharts may not cause interference when knowledgeable individuals use them.

Literature review and hypothesis development

Internal control evaluation

International audit standards require auditors to perform a rigorous evaluation of internal control (ISA 400). Internal control refers to the extent to which the auditee is capable of preventing or detecting accounting errors and irregularities. Auditors obtain an understanding of internal control to determine the nature, timing and extent of audit testing. The evaluation of internal control weaknesses is important for error detection, fraud detection, and avoidance of audit failure. In addition, significant internal control deficiencies should be reported to client management. Evaluation of internal control strengths is important to avoid unnecessary substantive testing and minimize audit costs. The more auditors can rely on internal control, the less substantive testing may be required. For example, Messier *et al.* (1997) suggest that audit testing may be reduced in the future in favor of additional reliance on internal control. Thus, relying on internal control may be an important means of improving audit efficiency in the coming years (Smith *et al.*, 1998), and is consistent with new audit approaches (Bell *et al.*, 1997).

Internal control evaluation is influenced by the preparation and review of documentation. Auditing research suggests that the format used to document internal controls may structure the information processing activities of auditors (Mock and Turner, 1981). The documentation format may affect the way auditors encode (Plumlee, 1985), retrieve, and evaluate information (Frederick, 1992). Consequently, the format used to document internal control information can impact auditors' decision outcomes (Boritz, 1985). Two formats

auditors commonly use to document their understanding of the client's internal control are the narrative and flowchart. Bierstaker *et al.* (1999) report that 88 percent of the auditors surveyed reported that they use narratives, and 46 percent indicated they use flowcharts[1]. Flowcharts and narratives may emphasize different aspects of the client's internal control system (Purvis, 1989). Flowcharts have a schematic structure related to the flow of documents that reflects an overview of the client's internal control system, whereas the structure of narratives is left to the auditor's discretion (Martin, 1981; Mock and Willingham, 1983).

Incomplete flowcharts and part-list interference

Although it may be easy and efficient to gather internal control documentation from the client, auditors should not rely on client documentation without careful testing and corroboration. This appears to be an important issue in light of a recent study by Gramling (2000). Gramling suggests that under certain conditions auditors subject to competitive pressures may be induced to rely on the work of the client's internal audit department, even when the quality of the internal audit department is suspect. Internal audit departments often supply external auditors with internal control documentation. In addition, Kelley and Margheim (1990) found evidence that auditors are sometimes willing to make only superficial reviews of client documentation, and Margheim and Kelley (1992) suggest that fixed fee billing arrangements may result in auditors relying on client personnel to do more of the audit work.

The dangers of relying on client information, which may be inaccurate or incomplete (Johnson *et al.*, 1991), and the potentially harmful effects that incomplete documentation may have on recall due to part-list interference, could lead to additional audit costs. For example, Bierstaker *et al.* (1999) indicate that interference related to a management explanation for discrepancies in account balances may inhibit auditors' effective use of analytical procedures. In an internal control context, a flowchart supplied by the auditee may be included in current internal control documentation. This flowchart may be incomplete or incorrect, perhaps because there were recent changes to the accounting system and the client failed to update the flowchart. While it is likely that an auditor would not rely solely on the flowchart, such readily available information may interfere with the way additional related information is retrieved from memory.

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Moreover, Rich *et al.* (1997) suggest that preparers use the content and format of their working papers to enhance their reputation with reviewers. This "stylization" of working papers may influence reviewers' judgments about the appropriateness of the work prepared and the conclusions reached. Therefore, the preparer may selectively include internal control information in the audit working papers, which may influence the judgments of their superiors about the reliability of the auditee's internal control system.

Frederick (1992) compared the recall of auditors who received an incomplete internal control narrative to auditors who performed a free recall. Auditors had difficulty generating controls that were not present in the incomplete narrative, despite being asked to list all relevant controls (including those missing from the narrative) for that accounting cycle. Frederick suggests that the narrative reduced the number of controls auditors recalled and diminished the auditors' internal control evaluation performance because of part-list interference.

Part-list interference occurs when information retrieved from memory inhibits the subsequent recall of additional information (Alba and Hutchinson, 1987; Tulving, 1966). A common finding of research in psychology is that participants who were given recall cues recalled a smaller proportion of the uncued items than participants who did not receive cues (Sloman *et al.*, 1991; Brown and Hall, 1979). The larger the portion of recall cues given, the more interference may result (Nickerson, 1984). One explanation for this finding is that presentation of cues during recall strengthens the memory representations of these items, and increases their accessibility relative to the remaining uncued items. Recall of the uncued items is "blocked" by the readily accessible cues (Rundus, 1973).

While much of the part-list interference literature has used lists of words or sentences, there have also been a number of studies in psychology that have used interference tasks of a different nature than the original tasks. For example, Gathercole *et al.* (1983), Watkins and Watkins (1980), and Broadbent *et al.* (1978) found that participants' recall of lists of words was interfered with when they were asked to write or speak numbers. Recent research by Duff and Lansky (1995) found no interaction between mode of presentation (auditory or visual) and mode of interference (auditory or visual) on their participants' recall of word lists. Part-list interference research has also

combined words and pictures. Peynircioglu (1987), for instance, found that words interfered with participants' identification of pictures. In fact, Peynircioglu (1987, p. 440) concludes that the effects of interference extend "far beyond the list recall condition in which it is usually studied." Studies such as Heathcote (1994) have also demonstrated that interference effects extend into non-memory domains. One issue that has not been examined by prior research in accounting or psychology is whether or not part-list interference occurs with flowcharts.

When information is organized schematically (as in flowcharts), interference may be less likely to occur. Frederick (1991) theorized that a schematic organization of internal control information may create strong temporal linkages among controls, so that interference may be less likely to occur during part-list cueing. Although Frederick found that auditors did experience interference in his study, he used a combination of part-list and category cueing simultaneously. Therefore, it is unknown whether the interference was due to the part-list or category cue. Moreover, Frederick did *not* use incomplete flowcharts as retrieval cues, though he did indicate that flowcharts are an example of schematically organized information. This motivates extension of prior research to test whether part-list interference occurs with flowcharts, where the retrieval cues are schematically organized.

Task-specific knowledge
Research in psychology has shown that relevant knowledge is an important determinant of recall and problem-solving performance (Chase and Simon, 1973; Weisberg and Alba, 1981; Chi *et al.*, 1982). In auditing research, Frederick (1991) suggests that auditors' greater knowledge allowed them to recall more controls than students. Frederick used auditors' experience as a proxy for internal control knowledge. However, experience and knowledge should not be equated because auditors with an equivalent amount of experience may still have knowledge differences (Marchant, 1990).

The value of using knowledge measures as independent variables has been noted by accounting researchers (Davis and Solomon, 1989; Libby, 1989), but rarely used (Libby, 1995). Bonner (1990) states that many previous studies on experience effects in auditing have not considered the role of task-specific knowledge, nor how task-specific knowledge can affect performance in audit judgment tasks. The knowledge test used in the present study is based on Frederick (1991)

and Bonner and Pennington (1991). Frederick (1991) states that in order to evaluate internal controls, auditors must have the knowledge of the controls that should be present. Bonner and Pennington (1991) suggest that when evaluating internal control the auditor must:
- conceptualize the ideal system of controls for the transaction cycle under consideration; and
- hypothesize errors that could occur if controls are weak or nonexistent.

The auditor ultimately uses this knowledge to evaluate the client's current system. Based on previous research that indicates that knowledge may affect the recall and evaluation of internal control information, a knowledge measure is included as an independent variable (see Methods section).

Interaction between part-list interference and knowledge

Knowledge may interact with documentation format to affect recall. For example, Frederick (1991) found that auditors recalled more internal controls when they were organized schematically (based on the temporal flow of documents) as opposed to taxonomically (based on internal control objectives), but students did not exhibit such differences. Frederick suggests that as a result of their more complete knowledge, auditors were able to use the temporal associations found in the schematically structured control information to guide their recall. Although previous research in psychology (Fischhoff *et al.*, 1978) and accounting (Frederick, 1991) has demonstrated that knowledgeable individuals are susceptible to interference in a variety of task settings, including the recall of internal controls, these studies did not include flowcharts. Unlike narratives, which are structured at the auditor's discretion, flowcharts are structured schematically. Based on Frederick (1991), who suggests that auditors organize their knowledge schematically, the temporal linkages present in a flowchart may be more salient and accessible to more knowledgeable auditors than less knowledgeable auditors. More knowledgeable auditors may be able to use these temporal linkages to guide their recall of controls missing from the flowchart. However, less knowledgeable auditors may be unable to use the schematic structure of the flowchart as a retrieval guide. Moreover, information contained in the flowchart may interfere with less knowledgeable auditors' recall of the missing controls.

In addition, Frederick (1992) suggests that part-list interference may diminish auditors'

internal control evaluation performance. However, that study only considered incomplete narratives, and did not incorporate partial information in a schematically structured format. Schematically structured information may interfere with the internal control evaluation of less knowledgeable auditors, but not more knowledgeable auditors for the reasons stated above. The following hypotheses are based on this theory:

H1. The recall of less knowledgeable auditors who review a narrative and incomplete flowchart will be diminished, however, the recall of more knowledgeable auditors who review a narrative and incomplete flowchart will not be diminished.

H2. The internal control evaluation of less knowledgeable auditors who review a narrative and incomplete flowchart will be diminished, however, the internal control evaluation of more knowledgeable auditors who review a narrative and incomplete flowchart will not be diminished.

Methods

Participants
An experiment was administered to groups of auditors at three separate training sessions. The author was present at each session. Participants consisted of 61 auditors with two to five years of audit experience employed at a large international accounting firm. The firm offered training with, and used, both narratives and flowcharts to document internal control[2]. Auditors with between two and five years of experience were selected because they typically have had experience with internal control evaluation and the sales and collections cycle (Purvis, 1989; Abdolmohammadi, 1993).

Materials
The case materials included:
- background information that described a hypothetical client;
- a narrative description of the client's accounting procedures for the sales and collections cycle; and when appropriate;
- an incomplete flowchart[3].

The incomplete flowchart was formed by taking a complete flowchart and splitting it into two portions that contained approximately equal information (accounting procedures) about the hypothetical client[4]. The incomplete flowchart did *not* contain any additional

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information relative to the narrative (i.e. the flowchart used symbols to depict what the narrative stated in words).

Design and procedure

Participants received a booklet containing an introduction, general instructions, case materials, the tasks to be completed, answer forms and a questionnaire. The introduction stated that the purpose of the study was to examine auditors' decisions concerning internal control evaluation. Participants were told that all responses would be kept confidential. A monitor was present during the experiment to ensure that all participants worked independently. The tasks completed by participants are discussed in chronological order below.

Auditors first read the introductory instructions, and then completed a task-specific knowledge test (free recall task) methodologically similar to the one used by Bonner *et al.* (1992). Participants were given five minutes to write down as many of the major control features in a sales and collections system as they could recall. After the knowledge test, auditors randomly received one of two documentation formats:

1 Auditors in the no flowchart condition (NOFLOW) received a narrative description of the auditee's accounting procedures.
2 Auditors in the incomplete flowchart condition (INCOMPLETE) received a narrative and subsequently an incomplete flowchart (see below).

Hereafter, accounting procedures depicted in the incomplete flowchart are referred to as "cued," while the missing procedures are referred to as "uncued." Auditors were asked to study background information on a hypothetical client (New England Hardware) and review a narrative of the client's accounting procedures for the sales and collections cycle[5]. All auditors were informed that they would be required to evaluate the internal control information for the hypothetical client, but were unaware that they would be asked to recall it (Christ, 1993).

When auditors finished reviewing the client information, they filled out a questionnaire on their experience. Participants received the questionnaire prior to the recall of the accounting procedures of New England Hardware to clear short-term memory (Tulving, 1983). After completing the questionnaire, auditors in the INCOMPLETE group were informed that the client had made an internal control flowchart of the sales and collections system available to

them. To be consistent with part-list cueing research (Sloman *et al.*, 1991) the incomplete flowchart (i.e. the retrieval cue) was retained by the INCOMPLETE auditors while they recalled the accounting procedures of the client, and then evaluated internal control strengths and weaknesses. Auditors in the NOFLOW group were asked to recall and evaluate internal control information without a flowchart. Answer forms provided to participants were similar to those used by Plumlee (1985). The answer forms defined a "strength" as a control which provides a high likelihood of detecting or preventing certain irregularities or errors, and a "weakness" as the absence of a necessary control or a control which is likely to fail to detect or prevent an irregularity or error. No time limit was set for recalling internal control information, however, all auditors completed the entire experiment in approximately one hour.

Dependent variables

To be consistent with previous part-list interference research auditors' recall of uncued information only was examined (Frederick, 1991; Duff and Lansky, 1995). The first dependent variable in this study, RECALL, is the number of uncued accounting procedures that auditors accurately recalled. In addition, two other dependent variables, WEAK and STRONG, were examined to investigate the effect of part-list interference on auditors' evaluation of internal control information. The variable WEAK represents the number of uncued internal control weaknesses auditors evaluated, and STRONG represents the number of uncued internal control strengths auditors evaluated.

In order to score auditors' internal control evaluation performance, a list of internal control weaknesses and strengths was determined by an expert panel of three managers (at the same firm as other participants). A Delphi approach was employed (Leape *et al.*, 1992; Wright, 1988; Bedard *et al.*, 1998) to achieve consensus on the final list of strengths and weaknesses (see the Appendix for the list of uncued strengths and weaknesses).

Independent variables

A dummy variable, FORMAT, was assigned a value of zero for NOFLOW auditors and one for auditors in INCOMPLETE group. The knowledge variable (KNOW) was measured using the number of controls pertaining to the sales and collections cycle accurately recalled during the knowledge test. Audit

textbooks and training manuals were used to verify that listed controls were stated correctly and were from the sales and collections cycle. The author and a doctoral student with public accounting experience independently performed the classification of recalled controls (agreement was 90 percent; $k = 0.456$; $z = 5.92$; $p < 0.0001$). All disagreements were reconciled between the coders.

In order to perform t-tests it was necessary to dichotomize KNOW. The knowledge variable was dichotomized based on the median score of nine. A total of 29 auditors were at or below the median, and 32 were above. The mean knowledge score of auditors at or below the median was 6.44, and the mean knowledge score of auditors above the median was 14.34. This difference is statistically significant ($t = 11.86$; $p = 0.0001$).

Results

Recall
Panel A of Table I shows auditors' mean recall of uncued accounting procedures. Within the low knowledge group, auditors in the NOFLOW condition had a mean recall score of 3.0, compared to 1.57 for auditors in the INCOMPLETE condition. Within the high knowledge group, auditors in the NOFLOW condition had a mean recall score of 4.47, compared to 2.65 for auditors in the INCOMPLETE condition. To examine the interaction between knowledge and part-list interference on auditors' recall, t-tests were performed. Results reveal only a marginally significant part-list interference effect for both low

knowledge auditors ($t = 1.4$; $p = 0.08$) and high knowledge auditors ($t = 1.54$; $p = 0.07$). Therefore, *H1* is not supported.

Internal control evaluation
Panel B of Table I shows auditors' mean evaluation of uncued internal control weaknesses. Within the low knowledge group, auditors in the NOFLOW condition had a mean WEAK score of 0.47, compared to 0.00 for auditors in the INCOMPLETE condition. Within the high knowledge group, auditors in the NOFLOW condition had a mean WEAK score of 0.73, compared to 0.53 for auditors in the INCOMPLETE condition. Consistent with expectations, the results of t-tests indicate a significant part-list interference effect for low knowledge auditors ($t = 2.43$; $p = 0.015$), but not for high knowledge auditors ($t = 0.71$; $p = 0.24$).

Panel C of Table I shows auditors' mean evaluation of uncued internal control strengths. Within the low knowledge group, auditors in the NOFLOW condition had a mean STRONG score of 1.07, compared to 0.43 for auditors in the INCOMPLETE condition. Within the high knowledge group, auditors in the NOFLOW condition had a mean WEAK score of 1.13, compared to 0.71 for auditors in the INCOMPLETE condition. Consistent with expectations, the results of t-tests indicate a significant part-list interference effect for low knowledge auditors ($t = 2.01$; $p = 0.03$), but not for high knowledge auditors ($t = 1.27$; $p = 0.11$). Overall, these results provide strong support for *H2*[6].

Table I
Recall and evaluation of internal control information

FORMAT	n	Low KNOW Mean	STD	n	High KNOW Mean	STD	n	Total Mean	STD
Panel A: Mean RECALL scores by levels of KNOW and FORMAT									
NOFLOW	15	3.00	2.65	15	4.47	3.22	30	3.73	2.99
INCOMPLETE	14	1.57	2.79	17	2.65	3.43	31	2.16	3.15
Total	29	2.31	2.77	32	3.50	3.41	61	2.93	3.15
t-test (*p*-value)		1.4	0.08		1.54	0.07		2.0	0.025
Panel B: Mean WEAK scores by levels of KNOW and FORMAT									
NOFLOW	15	0.47	0.74	15	0.73	0.88	30	0.60	0.81
INCOMPLETE	14	0.00	0.00	17	0.53	0.72	31	0.29	0.59
Total	29	0.24	0.57	32	0.63	0.79	61	0.44	0.72
t-test (*p*-value)		2.4	0.015		0.71	0.24		1.7	0.05
Panel C: Mean STRONG scores by levels of KNOW and FORMAT									
NOFLOW	15	1.07	1.03	15	1.13	0.83	30	1.10	0.92
INCOMPLETE	14	0.42	0.65	17	0.71	1.05	31	0.58	0.89
Total	29	0.76	0.91	32	0.91	0.96	61	0.84	0.93
t-test (*p*-value)		2.0	0.025		1.27	0.11		2.24	0.015

Notes: NOFLOW = narrative only; INCOMPLETE = narrative plus incomplete flowchart

Discussion and implications

Consistent with expectations, auditors with lower levels of internal control knowledge appeared to experience part-list interference when they evaluated internal control strengths and weaknesses based on a partial flowchart, but the internal control evaluation of auditors with higher levels of internal control knowledge was not interfered with by the partial flowchart. Although prior research has demonstrated that knowledgeable individuals experience part-list interference, it appears that when the retrieval cues are schematically organized, as in flowcharts, knowledgeable individuals are less susceptible to the part-list interference effect. This finding suggests that the temporal linkages present in a flowchart are more salient to more knowledgeable auditors than less knowledgeable auditors. More knowledgeable auditors appeared to access these temporal linkages to guide their evaluation of the controls missing from the flowchart, mitigating part-list interference.

Results for auditors' recall of accounting procedures were not significant. One explanation for these weak results is that auditors focused primarily on the evaluation of internal control strengths and weaknesses, and were less concerned about the specific accounting procedures of the hypothetical client. Furthermore, results appear to be strongest for auditors' evaluation of internal control weaknesses, perhaps because of the asymmetrical loss function.

Limitations
A potential limitation of this study is that another interference condition with information that was not schematically organized may have been useful as a basis of comparison. However, decades of research in psychology have demonstrated the effects of interference with a wide variety of subjects and task settings (Nickerson, 1984). In addition, recent research in accounting has shown the effects of interference on auditors' recall and evaluation of internal control information (Frederick, 1991, 1992). What is unique to this study is that interference did not occur with knowledgeable subjects when the part-list was schematically organized, which is a major contribution to the part-list interference and fault tree literature.

Another potential limitation is that the results of this study are based on auditors from a single firm to avoid firm-specific differences (e.g. training, decision tools, audit approach) that may exist between firms. Future research could examine whether the results of this study generalize to other audit firms. However, auditors commonly use both narratives and flowcharts to document their understanding of the client's internal control (Bierstaker *et al.*, 1999). Also, the measures of auditor knowledge and internal control evaluation performance used in this study are imperfect. Future research could attempt to further refine the measures of task-specific knowledge and internal control evaluation performance used here. For example, a knowledge measure could be developed that more thoroughly tests both auditors' knowledge of ideal controls and errors that could result from weak or missing controls (Bonner and Pennington, 1991). However, both of these measures were based on previous research (Frederick, 1991; Plumlee, 1985).

Implications for practice and research
This study has several important implications for audit practice. First, auditors should not rely on client documentation without careful testing and corroboration. Recent research by Gramling (2000), for example, suggests that under certain conditions auditors may rely on the work of an internal audit department of questionable quality in response to a partner preference for efficiency. Internal audit departments commonly supply external auditors with internal control documentation. Moreover, Kelley and Margheim (1990) found evidence that auditors are sometimes willing to make only superficial reviews of client documentation, and Margheim and Kelley (1992) suggest that as a result of fixed fee billing arrangements auditors may rely on client personnel to do more of the audit work. The dangers of relying on client information, which may be inaccurate or incomplete (Johnson *et al.*, 1991), and the potentially harmful effects that incomplete documentation may have on recall due to part-list interference, could lead to additional audit costs. In practice omissions or inaccuracies relating to only a few internal control activities could influence an auditor's internal control evaluation. Since research in psychology indicates that the larger the portion of recall cues given, the more interference may result (Nickerson, 1984), the omission or misrepresentation of only a few internal control activities in documentation prepared by the client may be both difficult for auditors to detect, and particularly damaging on their recall. However, if auditors evaluate internal control and carefully document their findings prior to consulting any written documentation provided by the client, such

recall difficulties may be avoidable. Future research is needed to investigate the effectiveness of this approach.

Second, it appears that less knowledgeable auditors may be particularly susceptible to interference. This finding emphasizes the need for audit superiors to evaluate internal control based on a careful examination of all available evidence, rather than relying on the assessments of less knowledgeable staff (Rich *et al.*, 1997). Failure to properly evaluate internal control could lead to increased audit costs in a variety of ways. If internal control weaknesses are not identified, errors or irregularities may be left undetected by the audit. Audit failure, with the ensuing risk of litigation damages and reputation costs, may occur. In addition, if important strengths of the system are missed or ignored, unnecessary substantive testing may result, potentially diminishing audit efficiency (Smith *et al.,* 1998). Future research is needed to explore if the review process is capable of mitigating the effect of part-list interference on internal control evaluation, as well as other audit tasks. The results of this study suggest the effectiveness of the review process may be influenced by whether or not audit documentation is structured schematically.

Third, flowcharts are used in a wide variety of fields, including computer science and engineering. Future research could investigate the potential for incomplete flowcharts to cause recall difficulties in these contexts, and whether or not task-specific knowledge in these fields is capable of mitigating interference, as suggested by the findings of this study in the auditing domain. In contrast to the fault tree literature, which suggests that the use of decision aids may potentially interfere with recall in a wide variety of domains, the use of flowcharts may not present such a danger if used by knowledgeable individuals. In addition, within the auditing domain, flowcharts are used in other contexts such as understanding the nature of the client's business, assessing business risks, and identifying assurance opportunities (Bell *et al.*, 1997). An examination of whether or not the findings of this study generalize to these other audit settings is another potentially fruitful area for future research.

Notes

1 Internal control questionnaires are also commonly used. However, due to constraints on the number of auditors available to participate in this study, consideration of questionnaires is reserved for future research.

2 In addition, data were collected on auditors' experience with flowcharts. Flowcharting experience did not have a significant effect on auditors' recall or internal control evaluation performance.

3 Practicing auditors at big-five firms were consulted prior to data collection to ensure that the case information was realistic. In addition, participants were asked to rate case realism. On a seven-point Likert scale with 1 being unrealistic and 7 being realistic, the mean score was 5.15 with a standard deviation of 1.13, indicating that auditors felt the case was fairly realistic.

4 Results of pilot testing indicated subjects were aware that the flowchart was incomplete.

5 All case materials and scrap papers were collected to examine if any auditors in the INCOMPLETE or NOFLOW conditions chose to spontaneously create or complete the flowchart. Only one participant spontaneously flowcharted the system, and the results were not significantly affected when data pertaining to that participant were excluded.

6 The results of multiple regression also indicate a significant interaction between knowledge and format ($t = 1.72$; $p < 0.05$).

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Appendix. List of uncued strengths and weaknesses

Uncued strengths
1 Remittance advices are filed chronologically.
2 Deposit slips are prepared in triplicate and filed by date.
3 Monthly bank statements are reconciled promptly by the accounting department and filed by date.
4 Separation of duties between mail clerk and A/R clerk.
5 Separation of duties between A/R clerk and credit manager.
6 Separation of duties between person making bank deposits (A/R clerk) and person reconciling cash (cashier).
7 Remittance advice completed if not available.
8 Mail clerk is supervised.
9 Review function is performed by the sales/accounting department supervisor.
10 Credit manager (accounting department supervisor) reviews all checks for payments of past due accounts.

Uncued weaknesses
1 Checks and remittance advice are not separated/remittance advice created by the mail clerk.
2 The credit function should not be in the accounting department/accounting department manager is also the credit manager.
3 Customer remittances should not come to accounting department.
4 There are two separate cash receipts flows.
5 No review of bank reconciliation.
6 No indication of aging A/R.
7 Checks are not stamped by the mail clerk when the mail is opened.
8 No pre-listing of checks is prepared.