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Analytical procedures and judgment accuracy: A comparison of structured and unstructured audit methodology

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ANALYTICAL PROCEDURES AND JUDGMENT ACCURACY: A COMPARISON OF STRUCTURED AND UNSTRUCTURED AUDIT METHODOLOGY

by

Iris Stuart

A thesis submitted in partial fulfillment
of the requirements for the Doctor of
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PH.D. THESIS

This is to certify that the Ph.D. thesis of

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has been approved by the Examining Committee for the thesis requirement for the Doctor of Philosophy degree in Business Administration at the August 1993 graduation.

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To Bruce, Chris and Scott Stuart.
Thank you for your encouragement and support.

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ABSTRACT

This dissertation investigates the effect of audit firm methodology on auditor performance. Some firms tend to use an unstructured audit approach; others use a structured audit approach. This dissertation uses experimental procedures with expert subjects to determine whether there are performance differences for routine and nonroutine tasks between auditors of the two types of firms.

Audit tasks are described as routine or nonroutine based on the number of exceptions that must be resolved to solve the task and the degree to which the search for information can be standardized. If there are a large number of exceptions and the search for information is not readily described in rational terms, the task is described as a nonroutine task. A task with few exceptions and a rational procedure of investigation is a routine task.

Because of the repetitive nature of routine tasks, performance differences for routine tasks are not expected between auditors in the two types of firms. The experimental results support this prediction.

It is argued that, unstructured audit methodology is more conducive for learning nonroutine tasks. Nonroutine

tasks are not amenable to standardization, so a structured approach with standardized audit procedures places auditors at a disadvantage for learning nonroutine tasks when compared to auditors using an unstructured approach. Consequently, it is expected that there will be performance differences between the two types of firms for these nonroutine tasks. The experimental results support this prediction.

Three covariates are also examined in the performance models: months of experience, the conscientiousness level of the individual, and the general mental ability of the individual. Of these factors, the study shows that general mental ability is the only significant factor for determining auditor performance.

A measure of auditor discretion was used to validate the structure classification. If the classification is valid, auditors in firms with structured audit methodology should report less discretion than is reported auditors in firms with unstructured audit methodology. The results support this hypothesis. In addition, the level of discretion reported by the auditor was positively associated with auditor performance.

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CHAPTER I

MOTIVATION FOR RESEARCH PROJECT

Audit firm methodology differences

Audit methodologies encompass the procedures and techniques that are used to accomplish the audit task of reviewing financial statements for the purpose of issuing an opinion regarding the "fairness" of the published statements. Contemporary audit firms use various audit methodologies. Among the firms, audit methodology procedures vary from (a) highly individualistic, judgment-oriented audit approaches to (b) computer driven, template-oriented, algorithm, approaches to auditing. The latter approach to auditing is characterized as structured audit methodology. The former, more individualistic, approach to auditing is most often called unstructured audit methodology. A more complete description of structured and unstructured audit methodology will be developed in due course.

Recent empirical research has examined the advantages and disadvantages of the more structured audit methodology and has shown that audit firms differ in terms of: (1) their structure (Kinney, 1986 and Bamber et al, 1989); (2) their audit manuals (Cushing and Loebbecke, 1986); (3) the

influence of the firms on their members as this can be measured by reviewing (a) the voting behavior of the members of the Auditing Standard Board in conjunction with their membership in firms (Kinney, 1986); (b) the methods used to coordinate audit communication among team members (Bamber and Snowball, 1988); and (c) the role ambiguity and role conflict experienced by auditors (Bamber et al, 1989); (4) the timing of client financial statement releases (William and Dirsmith, 1988); (5) audit report consistency exceptions (Morris and Nichols, 1988); and (6) the factors considered in making inherent risk assessments (Dirsmith and Haskins, 1991).

The concept of audit methodology has been used to describe non-performance differences among audit firms. This concept, however, has not been applied to understanding **performance** differences among auditors. This deficiency in the current research should be overcome, because of the significant influence of audit firm methodology. Audit firm methodology may influence not only audit firm structure, audit manuals, voting behavior, audit communication, role ambiguity, financial statement release dates and the factors considered in inherent risk assessments, but also audit task performance. In order to understand the impact of audit firm methodology on audit task performance, the current

research project examines the effects of structured and unstructured methodology on specific audit tasks.

Earlier empirical studies (e.g. William and Dirsmith, 1988; Morris and Nichols, 1988) focused on the short-term effects of structured audit methodologies, but did not consider the long-term **performance** effects of structured audit methodology. The current research project is designed to identify possible unintended consequences of long-term employment of structured audit methodology on inhibiting auditor performance with nonroutine tasks. Empirical tests are conducted for specific hypotheses testing the use of structured audit methodology in the development of professional expertise.

The performance of the auditor will be considered in the context of several different audit tasks. Other factors, such as individual differences of intelligence and conscientiousness among the auditors as well as differences in their years of audit experience will be considered as possible determinants of auditor performance. As will be discussed, auditor performance is hypothesized to be a function of four factors: (1) audit firm methodology, (2) years of experience, (3) individual differences of intelligence and conscientiousness, and (4) the routine/nonroutine nature of the task.

Audit methodology will be measured in two ways: (1) the classification structure developed by Kinney (1986) and Cushing and Loebbecke (1986) will determine whether auditors work in firms which use structured or unstructured audit methodologies; and (2) an individual measure of auditor discretion will determine whether individual auditors perceive their work environment as being structured or unstructured in a manner consistent with the type of methodological structure used within their firms.

The number of years of audit experience indicates the length of time the auditor worked in a structured or in an unstructured audit environment. The effect of this variable has not been exhaustively investigated. Rather, both experimental and statistical procedures have been taken to control for any potential confounding of years of experience with the impact of audit firm structure on audit performance.

The third factor to be studied is the individual differences which previous research shows to be important in terms of predicting performance among managers: their intelligence and their conscientiousness (Barrick & Mount, 1991). To determine auditor intelligence a general intelligence measure was used to examine the auditor's analytical ability. Auditor conscientiousness was

determined by using a standard individual personality measure often used in the organizational theory area.

This dissertation has an introduction and seven additional chapters. Chapter two discusses the methodologies currently used in auditing firms. Chapter three examines theories that might be helpful in considering the long-term effects of structured audit methodology. Chapter four considers the development of professional expertise in a structured audit environment. Chapter five discusses the experimental design used in this project to investigate the long-term consequences of structured audit methodology. Chapter six examines the experimental measures used in this study. Chapter seven discusses empirical results. Chapter eight examines the implications for future research given the results regarding structured audit methodology.

Two major appendices are also included. Appendix A discusses the role of knowledge in audit judgment. Appendix B reviews prior knowledge-related audit judgment research. Given the role of knowledge in developing an individual's expertise, both issues are significant for an examination of expertise. A brief discussion of the appendices follows.

Relevant research literature

Two bodies of research have emerged to consider the role that knowledge plays in the development of audit

expertise: (1) behavioral decision research; and (2) cognitive science decision research.

Behavioral decision research evaluates the performance of expert auditors based on certain parameters of judgment such as consensus, stability, self-insight and cue-importance. Researchers in this area attempt to determine the presence of expertise by documenting performance differences between experts and novices (e.g. Libby 1981, Libby & Lewis 1982, Ashton 1982, Joyce & Libby 1982). This approach has not been particularly fruitful for establishing and analyzing the presence of audit expertise. Experts are often found to perform no better than novices in the tasks studied (see Bedard, 1989; Johnson, Jamal & Berryman, 1989; and Wright, 1988 for reviews of the relevant accounting papers).

Why have experts performed so badly in the tasks of behavioral research? Recent critics of the research literature have advanced two explanations. First, they note that most behavioral researchers have examined routine audit tasks. However, many expert decision making tasks involve nonroutine task situations. Nonroutine tasks may make very different demands on the expert's ability. A second explanation focuses on the behavioral researchers use of experience as a surrogate for expertise. Recent research studies have suggested that expertise is task specific and

that expertise in one area does not imply expertise in all related areas as the behavioral researchers emphasis upon years of experience might suggest (e.g. Bonner, 1990 and A. Ashton. 1991). Years of experience may not be an appropriate measure of expertise. Past behavioral decision research may have failed to find expert-novice differences because of its lack of precision in modelling how experience may affect decisions.

The cognitive view of expertise is based on knowledge differences between experts and novices. Cognitive psychologists define expertise in terms of the knowledge of an expert rather than the decision behavior of an expert. The failure of behavioral decision research to consistently demonstrate that expert decision makers outperform novices has led to an interest in the role of **knowledge** in shaping audit decision making. For cognitive researchers understanding the cause of performance differences requires specification of the nature of experience related knowledge differences and the mechanisms through which they affect judgment. Many auditing decisions rely heavily on the task-related knowledge that the experienced auditor brings to the job (for example, knowledge about accounting systems or internal control). Given this reliance on information retrieved from memory, a complete picture of the audit decision making process must place substantial weight on the

accumulated knowledge of the expert and how it is brought to bear on the decision.

The current research project builds on the lessons learned from both the behavioral and the cognitive research streams. For example, the current project uses performance differences from the behavioral school to evaluate expertise, and considers tasks which include routine and nonroutine audit decisions. Further, the current experiment can not be criticized on the grounds that it does not tap the auditor's expertise with nonroutine tasks. The premise of the experiment arises from the cognitive science viewpoint regarding the importance of knowledge differences in distinguishing expertise. In particular, the current research project presupposes that the structure of the accounting firm affects the knowledge base of the auditor. Differences in the knowledge base of the auditor result in differences in performance. The tasks used in this study are designed for the potential knowledge and experience level of the subjects. Years of experience is treated as a confounding factor in the model, rather than a surrogate for experience.

Specific studies which provide additional detail relating to the conclusions from the behavioral and cognitive streams of literature are summarized in Appendix B. For additional detail, please refer to this appendix.

CHAPTER II

METHODOLOGIES CURRENTLY USED IN AUDITING FIRMS

Auditing standards do not specify the particular methodology to be used by an auditing firm in gathering the requisite evidence for an opinion. Auditing standards stipulate only general guidelines for conducting an audit. The third standard of field work states that:

> Sufficient competent evidential matter is to be obtained through inspection, observation, inquiries, and confirmations to afford a reasonable basis for an opinion regarding the financial statements under audit (AICPA, 1990).

Accounting firms are free to develop any auditing approach that allows them to gather the evidence needed to issue an opinion, as long as they can document that they have collected "sufficient, competent evidential matter". Under these guidelines, various auditing approaches are employed which range from highly structured audit plans to less structured, more individualistic, audit approaches. The following paragraphs describe the methodologies currently used in auditing firms.

Cushing and Loebbecke (1986)

The issue of highly structured versus less structured audit approaches has only recently received attention in terms of empirical research. Cushing and Loebbecke's book Comparison of Audit Methodologies of Large Accounting Firms (1986) describes a continuum of audit methodology ranging from a highly structured audit methodology to an unstructured judgment-based audit methodology. This continuum was developed by the authors based on a review of the audit manuals of twelve large accounting firms. Cushing and Loebbecke used their review of the audit manuals to gain an understanding of the **audit process** (the technology) used in these firms. Due to the confidentiality arrangement of the study, Cushing and Loebbecke were not allowed to list the specific firms in each category.

Kinney (1986)

Kinney (1986) classified the Big Eight firms as structured, semi-structured, or unstructured based on the audit firm partners **evaluation** of their audit methodology. He verified that his classification was reasonable compared with the Cushing and Loebbecke information. In Kinney's classification: Peat, Marwick, Mitchell; Deloitte, Haskins, and Sells; and Touche Ross were classified as structured firms. Coopers and Lybrand and Price Waterhouse were classified as unstructured firms. Arthur Andersen, Arthur

Young, and Ernst and Whinney were classified as intermediate structure firms.

Structured audit methodology

The following discussion of structured and unstructured audit methodology describes the two extreme points of the structure continuum. Individual firm variability is to be expected, with no firm operating at a level of completely structured or completely unstructured audit methodology. Audit methodology may be most accurately described in terms of the degree of structure in the firm, but I have adopted the more common usage of the terms structured and unstructured audit methodology to describe the two types of methodology. The audit methodology of the semi-structured firm falls somewhere between the structured and unstructured approach, having some of the elements of the structured methodology, but not all.

Cushing and Loebbecke (1986) and Kinney (1986) describe a structured audit methodology as having the following characteristics: an audit approach that is systematic; a prescribed, logical sequence of procedures and documentation; a comprehensive, integrated set of audit policies and tools used to conduct the audit; decision making in the hands of the central firm rather than the individual auditor; and an emphasis on auditor consensus--

where every individual following the standard audit program should arrive at the same conclusion.

As discussed by Cushing and Loebbecke (1986) and Kinney (1986), highly structured firms place strong emphases on pre-engagement planning, the explicit definition of staffing responsibilities on each audit, a reliance on specialists, and the quantification of audit risk. These emphases are encouraged by detailed, comprehensive guidance in the form of audit programs. Structured audit firms shift the control of audit decision making away from the individual auditor toward the central firm. For example, the central firm determines the relationship between reliance on internal controls and the subsequent substantive testwork. The central firm also determines the standard audit program required in **all** situations and uses standard procedures to determine materiality. Accounting firms which use structured approaches assume that auditor consensus is desirable. This emphasis on consensus is reflected in their approach to auditing (for example structured firms use internal control evaluation that leads to prescribed audit plans, and formal scoring rules to integrate audit test results).

Unstructured audit methodology

Cushing and Loebbecke (1986) and Kinney (1986) describe the audit methodology of an unstructured judgment-based firm

as one with the following characteristics: strong emphasis is placed on pre-engagement planning and developing an understanding of the client; individual auditor judgment is accepted and expected; reasonable variations in audit plans and audit reports are accepted; and the individual auditor is the decision maker, not the central firm.

As discussed by Cushing and Loebbecke (1986) and Kinney (1986), unstructured firms emphasize pre-engagement planning and the use of detailed internal control questionnaires, but the remainder of the audit process is not described in a detailed manner. Unstructured firms recognize the need for individual **judgment**. They accept reasonable variations in audit work plans and reports. Unstructured firms use less structured guidance and leave more decisions to the **judgment** of the auditor. Statistical sampling may be used, but it is not required. Internal control evaluation aids may be used, but they do not necessarily lead to a particular pre-determined audit plan. In firms that use unstructured audit technology, methods for integrating test results with the audit plan and for consideration of audit risk are not formalized. Unstructured audit firms believe the individual auditor is in a better position to formulate decision criteria than is the central firm.

Advantages and disadvantages of structured audit methodology

Cushing and Loebbecke (1986) discuss several advantages of structured audit approaches. These advantages include: improvement of audit performance because of consistency of documentation and audit procedures; more efficient audits which result in competitive audit fees; standardized documentation which demonstrably indicates compliance with accounting and auditing standards to meet the needs of outside regulators, and standardization of audit activities which indicates that sufficient competent evidential matter is gathered to support the opinion issued and to protect the audit firm from litigation.

One consequence of the recent congressional activity involving the accounting profession, such as the Metcalf Commission, is the requirement that the auditing profession demonstrate improvement in audit performance (Dirsmith and McAllister, 1982, p. 65). The **easiest** way to satisfy this requirement may be to standardize audit activities, that is, to develop structured audit procedures. This approach is easiest because the standardized documentation does not require the group to whom the auditor reports to have knowledge of audit task uncertainties or inter-relationships (Dirsmith and McAllister, 1982, p. 65-66). The auditing process in a standardized audit approach can be described in

a simplified, orderly fashion, easily understandable to outside reviewers.

Cushing and Loebbecke (1986, p. 43) cite several disadvantages in using structured audit technology. These include: (1) the inflexibility of the structured approach; (2) the inefficiency of structured procedures in less complex audit environments; and (3) the inability of structured approaches to develop the professional judgment of auditors. These disadvantages will be discussed briefly in the following sections. The third disadvantage--the potential inability of structured audit methodology to develop professional judgment is potentially the most damaging and is the focus of this dissertation. According to Cushing and Loebbecke (1986, p. 43)

> A structured audit approach could also cause some auditors to be less effective in all audit environments. Whenever there is extensive use of such audit tools as preprinted audit programs, questionnaires, and checklists to provide structure, the auditor may become mechanistic in his or her thinking. This could cause the auditor to fail to observe important facts, or to fail to reason through to appropriate judgments and conclusions.

The structured audit approach may be <u>inflexible</u> when audit situations vary from the typical audit that is presupposed in the structured model. The documentation required to change the standard audit approach into a format appropriate for the situation may be more work than a simple adherence to the standard audit program. Using structured

audit approaches for non-typical client environments or for less complex audit situations may be inefficient. Standardized audit procedures may force an auditor to perform unnecessary procedures or create additional documentation in situations merely to comply with the requirements of structure. In such situations, these cumbersome additions will result in inefficient audits.

The structured audit approach might also cause auditors to be less effective in all audit settings, not only in non-typical client environments. Frequent use of preprinted audit programs, questionnaires and checklists may encourage auditors to become mechanistic in their thinking. Auditors trained to rely on such aids may fail to observe important facts in the particular situation or be unable to make appropriate judgments (Cushing and Loebbecke, 1986). Mechanistic work plans may not be conducive to the development of audit expertise and may affect auditor performance. This is the focus of this dissertation.

Trend toward structured audit methodology

The trend in the last twenty years is toward structured audit methodology. Several accounting researchers have commented on this trend. For example, Joyce and Libby (1982, p. 110) noted that:

> A number of public accounting firms have developed what is known in the judgment literature as "expert measurement and mechanical combination models." These

> models substitute structure for part of the audit judgment process to ensure that all important variables are evaluated and then combined into a decision in a consistent fashion.

Ashton and Willingham (1988, p. 1) discuss the use of judgment models, also known as decision aids:

> While audit decision aids have a long history, they are presently assuming greater importance as the auditing profession is in a period of transition from experience-based to research-based audit approaches.

The decision aids discussed in Ashton and Willingham (1988) are part of a body of research known as "human information processing" or "behavioral decision theory". These fields of research are interested in understanding, evaluating, and improving the decision making process. Ashton & Willingham noted that the attempt to improve the quality of decision making in auditing has been reinforced by recent governmental activities emphasizing audit effectiveness and by the competitive audit market emphasizing audit efficiency (Ashton & Willingham 1988, p. 1). Individuals favoring decision aids maintain that audit effectiveness and efficiency can be improved by using structured audit methodology.

Few individuals would argue with the trend toward structured audit approaches. Stringer (1981) for example, wrote:

> I believe there is a slow but steady progress toward (1) more structured approaches in the development and application of audit programs, questionnaires, flowcharts, and other means for conveying audit instructions and documenting and evaluating information

> obtained, and (2) the use of quantitative methods for performing and evaluating the results of substantive audit tests. In this respect, future research could be directed to studying the existence or desirability of this perceived trend.

Bamber (1993) suggests that the use of such audit technology and decision aids is a potential area of study for behavioral accounting researchers. According to Bamber, technology and decision aids represent the most direct way to improve decision making performance. Bamber states:

> Readily available computer power facilitates the use of decision aids and expert systems. The objective of much of this technology is to disseminate expertise throughout the organization by allowing the inexperienced to perform specific tasks as experts (Bamber 1993, p. 18).

The current research project is a step toward determining whether the trend toward decision aids and structured audit methodology is desirable in its main features.

Several explanations are offered by Cushing and Loebbecke (1986) for this trend--including (1) increased competition among large accounting firms, (2) increased regulation of auditing, (3) increasing audit litigation and (4) increasing complexity of the economic environment. The development of a structured audit methodology has been one significant way that accounting firms have responded to these changes in the business environment. These trends will be discussed briefly in the following paragraphs.

An accounting firm may seek to achieve more efficient audits with a structured audit approach. This approach may allow them to price their audits more competitively. Responding to the demands of audit regulations, structured audit technologies--which require the same general approach on all audits--often facilitate compliance with auditing standards. This approach provides checklists and review procedures to ensure compliance with accounting regulations. It also provides a standard method for documenting audit evidence and conclusions in a manner that may withstand legal scrutiny. To address the third trend in litigation, structured audit technologies provide special audit tools to help the accounting firm deal with complex audit environments. These audit tools include EDP internal control questionnaires and computer audit software.

Increased regulation of the accounting profession seems closely related to increasing societal expectations of the audit function. The use of structured audit approaches, which at least give the appearance of actively doing something to improve audit performance, is a "common" response to these increased expectations. The danger of such an approach is that the documented minimum standards of auditing might well become working maximums (Dirsmith and McAllister, 1982, p. 227). That is, companies may appear to

gain from this standardization, but the documented minimum standards may harm auditor performance.

Unintended consequences of the trend toward more structured audit methodology

The trend toward structured audit methodology may have unintended consequences. For example, auditing methods which are easily quantifiable are likely to be retained at the expense of more analytical procedures which are not quantifiable and which require more individualized judgment on the part of the auditor. Structured audit methodology, which places audit judgment in the hands of the central firm or the standardized audit program developed by the central firm, attempts to replace individual auditor judgment. Auditor intuition may be lost because it is difficult to quantify and because the documented and minimal standards do not require it. Auditor expertise may not develop to the same extent it would if less structured approaches were used. In firms using structured audit methodology, standardization of the audit process provides solutions to many situations previously requiring individual auditor judgment.

Long-term costs of more structured audit methodology

Whether structured audit methodology is effective in helping accounting firms respond to increased competition,

regulation and litigation is unclear. Even if structured approaches are effective on a short-term basis in responding to outside pressures on audit firms, the **long-term** costs of structured audit approaches have not been considered. Several questions can be posed. Do audit clients want an auditor or a decision rule? What may be the long-term effects on the accounting profession of replacing audit judgment with audit structure? (This question is the focus of this dissertation). If the trend toward increased structure of audit decision processes continues, where will the accounting profession be in ten years? The accounting profession has always recognized that individual auditors must use professional expertise (judgment) in performing an audit. How does this more individualized judgment--necessary and significant for efficient performance--develop within structured audit approaches?

CHAPTER III

EXTANT THEORIES FOR EXAMINING THE LONG-TERM EFFECTS OF STRUCTURED AND UNSTRUCTURED AUDIT METHODOLOGY

Cushing and Loebbecke (1986) have suggested several disadvantages in a structured audit approach (inflexibility in structuring the audit, inefficiency of audit procedures in less complex environments, and limitations in the development of professional judgment). Because, in addition to its deficiencies, structured audit methodology also has distinct advantages (standardization and consistency of documentation), it is important to use a sophisticated instrument in evaluating the long-term consequences of structured audit methodology. Organizational theory which distinguishes between mechanistic and organic organizational types provides such a means of evaluating structured and unstructured audit methodology.

From the perspective of this theoretical framework, structured and unstructured audit firms may be classified as two distinctive organizational types: structured audit firms are mechanistic organizations; unstructured audit firms are organic organizations. Discussion of the distinct features of mechanistic and organic organizational types both demonstrates the appropriateness of this classification

of audit firms and enables the examination of some long-term consequences of using structured audit methodology. Such classification and evaluation is significant, given the increasing popularity of structured audit methodology. In this context, use of the theoretical distinction to describe features of structured audit procedure may well illumine certain unintended consequences of the methodology, particularly its limitations on the development of professional judgment. If auditors in firms with structured audit methodology fail to develop the same level of professional judgment as auditors in firms with unstructured audit methodology (as suggested by Cushing and Loebbecke, 1986), structured audit methodology may have a serious detrimental consequence for the development of professional expertise among its practitioners.

Structured or mechanistic firms

Auditing firms using structured audit methodology have been described as mechanistic organizations by Dirsmith and McAllister (1982). According to these authors, mechanistic organizations have the following characteristics: (1) decision making and control occur at the upper levels of the organization; (2) management action is unilateral; (3) task specialization facilitates understanding of the whole; and (4) information is centralized. Mechanistic organizations

assume that people prefer to be told what to do (Burns and Stalker, 1961).

Classifying auditing firms with structured audit methodology as mechanistic organizations appears appropriate for several reasons. First, in firms with structured audit methodology decision making occurs at the upper levels of the organization. In such firms, top management develops a standard audit program that requires uniform documentation. They also prepare strict guidelines regulating the steps to follow in the decision making process. For example, in structured firms, the quantity of substantive testwork is determined by the degree of reliance on internal controls. The extent of reliance on internal controls is previously pre-determined in the process of following the prescribed steps in the audit program. Second, management action is unilateral. The directives come from the top and flow in one direction only. Decisions are not open to the judgment of the auditor. The auditor merely documents the results of the work performed and follows the predetermined plan for the audit.

Third, task specialization occurs in firms using structured audit methodology. The audit is broken down into smaller parts (examples of smaller parts are cash, accounts receivable, expenses and fixed assets). Each auditor is

assigned to a specific part of the audit, with little concern for other parts of the audit.

Fourth, information in firms with structured audit methodology is centralized to conform with firm requirements. Audit evidence is gathered on each engagement according to firm standards rather than the judgment of the individual auditor. Quantitative information which can be measured and recorded is more valuable than the more messy qualitative information which eludes quantification and therefore lacks value.

Unstructured or organic firms

Auditing firms using unstructured audit methodology have been described by Dirsmith and McAllister (1982) as organic organizations. Organic organizations have the following characteristics: (1) decision making is widely done throughout the organization; (2) the organization emphasizes mutual dependence, cooperation based on trust, confidence, and high professional competence; (3) jobs are constantly enlarged and interrelated with an emphasis on a concern for the whole; and (4) information is decentralized. The basic assumptions of organic organization theory also contrast with those of the mechanistic theory. Organic organizations assume that people are capable of being responsible and productive employees, rather than people who prefer to be told what to do (Burns and Stalker, 1961).

Classifying auditing firms with unstructured audit methodology as organic organizations appears appropriate for several reasons. First, actual decision making (not simply completion of forms or making pre-determined decisions) is done at all levels of the audit firm in a firm using unstructured-judgment-based audit methodology. Decision making is required at all levels of the organization because the audit program does not tell the auditor what decision to make. Second, auditors depend on the work of others in an unstructured firm. Every auditor assumes responsibility for the whole job, rather than simply performing the portion of audit tasks assigned to them. Third, the job of the auditor in an unstructured firm is an enlarged job, not a specialized job. All audit team members are responsible for using professional judgment in assessing the financial position of the client. Fourth, information is decentralized because all auditors are required to make judgments and must have access to all client information to make the appropriate decision.

The organic theory of organizations believes that the whole is greater than the sum of its parts. The organic auditor sees the **integration** of facts as the primary factor in knowledge acquisition--the observation of raw data is a secondary factor in knowledge acquisition. The organicist views knowledge acquisition as an iterative process--facts

are observed, integrated into the whole, contradictions are exposed and facts and fragments (whether **quantitative** or **qualitative**) are combined to a higher level of integration (Burns and Stalker, 1961). Qualitative evidence is considered to be on equal footing with quantitative evidence (Dirsmith and Haskins, 1991, p. 66).

The organic model tends to develop greater organizational flexibility, commitment, responsibility, effectiveness in problem solving and adaptability to the environment. The mechanistic model is least effective in dealing with change and the development of innovative ideas. The greatest strength of the mechanistic organization is its ability to handle routine matters and to survive in an environment that is stable and benign (Burns and Stalker, 1961).

The professional accounting firm

The organic type of organization appears to have more characteristics of a professional organization than does the mechanistic type of organization. For example, in an organization founded on professional competence, (such as an accounting firm, a law office, or a medical clinic) one would expect that decision making is done by the professional staff at all levels of the organization. Experts in various fields need to exercise professional judgment and demonstrate their competence as they function

within their organizations. Insofar as mechanistic organizations emphasize directives "from above" which preclude individual judgment and stress uniformity of procedure and documentation, those who work in such firms may be hampered, in effect, because they lack authority to make decisions and have been limited in their development of professional judgment, a growth which can only occur through the experience of decision making. The mechanistic organization does not appear to enhance the professional dimension of auditing.

CHAPTER IV

THE DEVELOPMENT OF EXPERTISE AND EXAMINATION OF THE CONSEQUENCES OF THE LONG-TERM USE OF STRUCTURED AUDIT METHODOLOGY

Different work experiences

Auditors working in firms which employ structured audit methodology will have different work experiences than auditors who work in firms that use unstructured audit methodology. Because professional expertise develops in relation to work experiences, these different experiences of structure may lead to differences in the individuals' development of professional judgment or expertise. A model that describes the process of **learning from experience** may be useful for examining the consequences of long-term experience of a structured audit methodology, since work experience is a major factor of difference among auditors in firms employing varieties of structured and unstructured audit methodology.

A model of learning from experience

Waller and Felix (1984) develop a model of learning from experience in the audit judgment process. According to this model, the process of learning from experience requires the interaction of new information with the knowledge

structures that have previously been created and stored in long-term memory. The retrieved knowledge both clarifies and is clarified by the new experience. The pre-existing cognitive structures are used to understand the new information and, in turn, the structures are modified in order to accommodate the unique elements of the new information (Waller and Felix, 1984, p. 386).

Waller and Felix suggest that the auditor use three types of knowledge in the audit judgment process: knowledge of generally accepted accounting principles (GAAP), knowledge of generally accepted auditing standards (GAAS), and knowledge of the client's environment. The auditor's objective in the decision making process is to render an opinion with respect to the audit report that the probability of material departures from the information disclosed is small.

Knowledge of GAAP

Initially the auditor's knowledge of accounting rules is exclusively in declarative form. An accounting student is exposed to a vast set of accounting measurement rules in the education setting. Gradually, through repeated use of the accounting rules (by experience), the declarative representation is transferred into a procedural

representation.[1] Work experience both clarifies the declarative representation and elaborates the set of conditions and prescribes actions through procedural representation that is appropriate to the given situations. Ultimately, for the professional auditor, the educative process inherent in the work experience results in the creation of an intricate system of accounting knowledge wherein the technical procedural knowledge is bonded with and tempered by the declarative knowledge (Waller and Felix, 1984, p. 397-398).

Knowledge of GAAS

The auditor's knowledge of auditing is largely the product of experience and observation, not classroom education. Declarative knowledge regarding GAAS will be obtained in an auditing course, but formal instruction merely establishes a framework which then will be greatly modified and elaborated by work experience (Waller and Felix, 1984, p. 398).

Knowledge of client environment

The auditor's knowledge of the client's environment is predominantly declarative. Similar to the acquisition of auditing knowledge, the cognitive structures that organize

[1] Declarative knowledge is factual information (e.g. revenue recognition rules) while procedural knowledge involves knowing how to do something (e.g. assessing the company's ability to stay in business).

the auditor's knowledge of the client environment are primarily the result of work experience, rather than formal education (Waller and Felix, 1984, p. 400).

The role of experience

Given the role of experience in developing the auditor's knowledge of GAAP, GAAS, and the client environment, in the Waller and Felix model, one might expect knowledge differences between auditors in structured and unstructured audit firms. The products of these differences in knowledge are the measurable differences in judgment which constitute the focus of this dissertation.

Knowledge differences develop as the auditor accumulates work experience. For example, at the entry level, few knowledge differences are expected between auditors who go to work in firms with different audit methodologies. Review of the hiring practices of structured and unstructured firms among the large public accounting firms, indicates no significant difference in their hiring practices (for example, see the study in "New Accountant," 1992). As soon as auditors begin working in their firms, however, knowledge differences between the two groups can be determined. The following sections will describe these knowledge differences.

Knowledge differences--GAAP

The standardized, pre-determined work environment of the auditor in a structured firm develops in the auditor the knowledge to solve those problems that are amenable to standardization of procedure. By contrast, the judgmental, individualistic work environment in which an auditor of an unstructured firm functions develops in the unstructured auditor a more general knowledge base from which to make judgments. In brief, auditors in structured firms will gain appropriate knowledge bases to make decisions involving structured tasks, while auditors in unstructured firms will learn how to make judgments--judgments which enable them to complete both structured and unstructured tasks.

The relationship of knowledge base to the frequency of the routinization of problem-solving constitutes the major difference between the structured and unstructured auditors. Where routine plays a major role for the structured approach, in the unstructured approach more emphasis is given to particularized decision making and individual judgment. Experience in decision making contributes to the development of a knowledge base even when routine procedures have not been employed. For example, completion of an audit task that requires knowledge of GAAP might readily be accomplished by a structured auditor who has previously experienced a similar task and resolved it through application of his firm's audit procedures. Facing a

comparable task, the unstructured auditor may resolve it on the basis of a routine procedure that represents the fruit of their previous experiences of similar problems. In addition, however, these auditors are expected by their firms' methodology to attack new problems in ways which transcend routinization and imitation of previous decisions. That is, they are expected to use individual judgment to complete even unfamiliar tasks. This dissertation examines auditor decisions that reflect differences of GAAP knowledge among the two types of auditors.

Knowledge differences--GAAS

The precise interpretation and implementation of the auditing standards, including the general standards, the field work standards and the reporting standards may vary between the structured and unstructured firms. For example, structured firms may specify a complete audit program designed to accumulate "sufficient competent evidential matter" while unstructured firms may leave the development of the audit program to the judgment of the auditor. Differences in GAAS knowledge are not a major focus of this dissertation project.

Knowledge differences--Client information

Based on the Cushing and Loebbecke (1986) and Kinney (1986) descriptions of structured and unstructured audit

approaches, differences in the manner in which auditors gather client information might be expected between the two types of firms. For example, a structured firm's approach to gathering information about the client will be to complete a detailed questionnaire to collect background information. The approach of an unstructured firm may also include the completion of a lengthy questionnaire, but it will involve more documentation than normally required in a questionnaire, in an attempt to get a more complete picture of the organization as a whole. Subjects in this research project will not be given the opportunity to collect varying amounts of client information, so differences in client knowledge are not a focus of this dissertation.

A continuum of judgment expertise

Given the role of experience in shaping the auditor's knowledge, one would expect to note differences in the rate in which expertise develops between auditors from structured and unstructured firms. For example, auditors in structured firms may develop expertise more quickly for tasks that are amenable to standardization in audit procedure, because they are led through the learning process step by step. On the other hand, they may develop expertise more slowly for tasks that are not amenable to standardization. Another difference may be in the level of expertise that develops. For example, some auditors may become more proficient

experts at certain tasks than others depending on their firms' methodology. A model that describes the process of acquiring expertise is useful for examining the consequences of a long-term experience with structured audit methodology.

Gibbins (1988) develops a continuum of task-specific judgment expertise based on Anderson's (1982) theory of skill acquisition. This continuum is useful in considering both the level and the rate of expertise that develops in firms using structured and unstructured audit methodology because the audit methodology used by a firm may affect the rate of development of professional expertise.

Four levels of judgment are represented in this continuum. The decision maker moves from being naive to the task, to educated to the task, to experienced to the task to expert to the task. The length of time it takes an auditor to move from being naive to the task to expert to the task may differ in firms using structured or unstructured audit methodology. The level of judgment expertise reached by a decision maker may also vary depending on the methodology used by the auditing firm. The four levels of judgment are described in the following sections.

Individuals who are **naive to the task** know nothing about the task. They have neither experienced the task nor have they been taught anything about the task. These

individuals move to the next stage as they encounter formal education or gain direct experience with the task.

A decision maker becomes **educated to the task** when the individual has developed a specific knowledge structure for the particular task. This structure has been built in response to the learning situation and is not based on practice performing the task after learning about the task. This person may understand the components of the decision making process, but their ability to use this information will not be connected to their prior practice with the task (Gibbins, 1988, p. 61). The typical accounting student will be in this category.

An educated decision maker becomes an **experienced decision maker** through practice in performing the task. The experienced decision maker has specific task-related knowledge structures which have evolved from the educated stage. At this point, the knowledge structures are more detailed and they may be automatic in their functioning.

An **expert decision maker** is recognized by **others** as being an expert. The criteria may be descriptive; for example, consistency across judgments or consensus with other auditors, or the criteria may be normative; agreement with authoritative standards or compatibility with rational models of decision making. Perhaps people are experts

because they use judgment processes that are different from those used by ordinary people (Gibbins, 1988, p. 61-63).

Auditing firms hire individuals who are educated to the task of working as accountants based on their accounting degrees. They become experienced decision makers through practice in performing the task. Since auditors in firms with structured audit methodology "practice" performing their task in a different manner than auditors in firms with unstructured methodology, different levels of expertise may develop. Structured audit methodology may develop expertise in some of these tasks, while unstructured audit methodology may develop expertise in others. The interaction of audit methodology and task difficulty is now discussed.

Interaction of audit methodology and task routineness

Perrow (1967) describes a continuum distinguishing routine from nonroutine tasks. According to Perrow, two aspects of a task may vary: (1) the number of exceptions that must be handled and (2) the degree to which the search for information is an analyzable or unanalyzable procedure. If there are a large number of exceptions and the search is not logical and analytic, the task is described as nonroutine. This would be true of a more difficult audit task. A task with few exceptions and analyzable investigation procedures is a routine task.

The number of exceptions encountered in a task is determined by the degree to which the stimuli are seen as familiar or unfamiliar. When an exception occurs, the extent to which the search can be conducted in a logical, predetermined fashion determines the analyzability of the task.

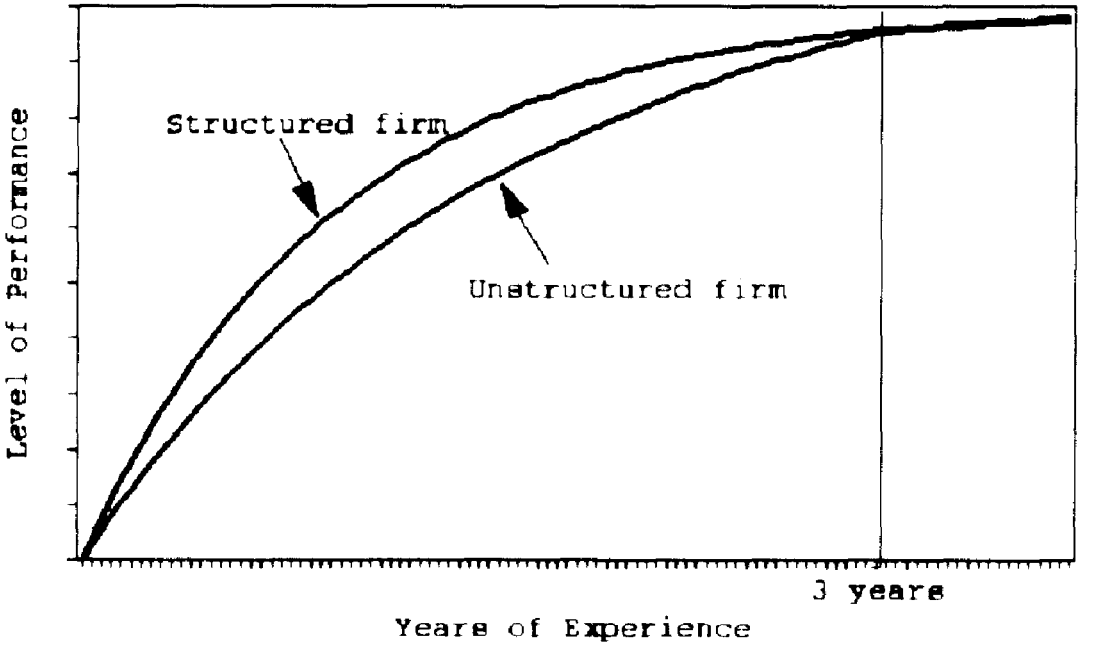
Routine audit tasks might include documenting internal controls and listing errors that result from internal control weaknesses. Non-routine audit tasks might include certain analytical procedures and footnote disclosure. Auditors will learn to perform more routine tasks before they learn to perform nonroutine tasks, because routine tasks have few exceptions so the task will become familiar to the auditor. Structured audit methodology should be particularly conducive to the performance of routine tasks, because the level of structure inherent in the work plan of a structured auditing firm matches the structured nature of a routine task.

Nonroutine tasks are learned more slowly than routine tasks. Nonroutine tasks have many exceptions so the task seems unfamiliar to the auditor. Auditors in firms with unstructured audit methodology should have an advantage in learning nonroutine tasks. The lack of a predetermined-consistent audit approach that is a normal part of their

working environment is consistent with the nonroutine nature of the task.

Due to the repetitive nature of routine tasks, performance differences are not hypothesized between auditors in firms with structured and unstructured audit methodology. Unstructured auditors may learn to perform routine tasks more slowly, but the routine task should become familiar to both groups of auditors. Figure 1 depicts the hypothesized learning curve for routine tasks.

Figure 1
Routine Tasks



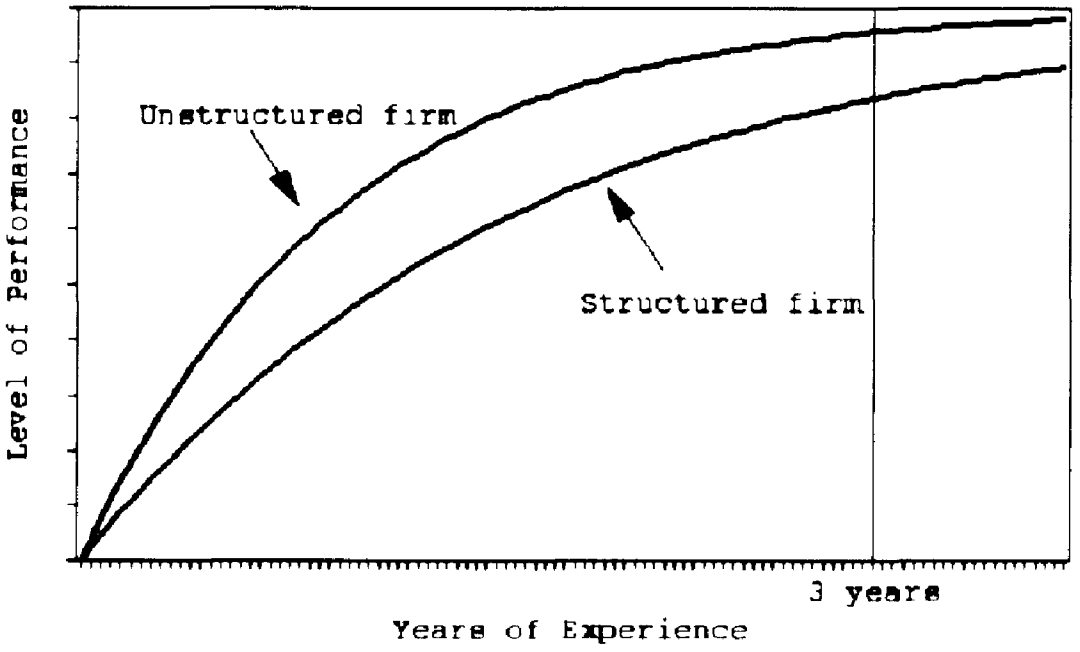
Given the assumptions of this learning curve, differences in performance for routine tasks should be small for auditors in firms with structured and unstructured audit methodology with three years of experience.

Nonroutine tasks are more difficult for an auditor to learn due to the number of exceptions encountered and the difficulty of analyzing task characteristics in a predetermined way. Structured audit methodology does not appear to offer the same advantage for nonroutine tasks that it does for routine tasks.

Structured audit methodology attempts to standardize audit judgment. However, nonroutine tasks are not amenable to standardization, so a structured audit approach will not be an advantage for nonroutine, more difficult, tasks. Unstructured audit methodology requires individual auditor judgment. Since nonroutine tasks require auditor judgment (because the performance of these tasks cannot be standardized) unstructured audit methodology should be more conducive for learning nonroutine tasks. Auditors with less experience making individual judgments (auditors in firms with structured audit methodology) may be less proficient at nonroutine tasks. Figure 2 depicts a hypothesized learning curve for nonroutine tasks. Given the assumptions of this learning curve, differences in performance for nonroutine

tasks should be greater than differences in performance for routine tasks between auditors, with three years

Figure 2
Nonroutine Tasks



of experience, in firms with structured and unstructured audit methodology.

Table 1 summarizes the above discussion, describing the relationship **hypothesized** between audit methodology and task routineness for audit performance.

The role of experience and knowledge

Each firm strives to increase proficiency by focusing attention on the level of expertise in the firm. That is,

one of the firm's goals for instructing new auditors is the increase in the knowledge base of the individual and

Table 1
Predicted Performance Differences
Structured and Unstructured Audit Methodology

Routineness of Task	Audit Methodology: Structured	Audit Methodology: Unstructured
Routine	I Smaller differences in performance expected between the two groups.	II
Nonroutine	III Larger differences in performance expected between the two groups.	IV

enhancement of the decision maker's ability to use the newly acquired knowledge to complete audit tasks which will be faced. As we have mentioned, experience, rather than instruction alone, allows the knowledge base to become sufficiently developed to constitute expertise; that is knowledge that might be appropriately used to complete audit tasks.

Virtually all experts report the supreme importance of practice for developing expertise. All testify to the extreme difficulty of gaining expertise through study of texts in isolation from practical application in the experience of decision making. (Gibbins, 1988, p. 60-61).

The consensus in the expertise literature is that practice is key for the development of expertise. This project surmises that different methods of practice in structured and unstructured firms may lead to different levels of proficiency for individual auditors.

The importance of practice suggests that the performance may be quite different for auditors from structured and unstructured audit firms on routine and nonroutine tasks. This leads to two general hypotheses which are the focus of this dissertation.

General Hypothesis 1: Performance on routine tasks will be comparable between auditors with at least three years of experience in firms with structured and unstructured audit methodology. Due to the repetitive nature of routine tasks, no performance differences are expected between the two firms.

General Hypothesis 2: Performance on nonroutine tasks will not be comparable between auditors with at least three years of experience in firms with structured and unstructured audit methodology. Auditors in firms with unstructured audit methodology will outperform auditors in firms with structured audit methodology, because unstructured audit methodology is more conducive to the development of professional expertise.

More specific experimental hypotheses will be constructed from these general hypotheses in the introduction to the results section. More detailed information regarding the role of knowledge in audit judgment is found in Appendix A. A review of the knowledge-based audit literature is found in Appendix B.

CHAPTER V

EXPERIMENTAL DESIGN

As indicated in Chapter I, and discussed in subsequent chapters, the performance of auditors is hypothesized to be a function of four factors: (1) audit firm methodology, (2) years of experience, (3) individual differences of intelligence and conscientiousness, and (4) the routine/nonroutine nature of the task. These factors are manipulated and/or controlled in the following experimental design in order to investigate the two general hypotheses presented at the end of chapter IV. This leads to the hypothesized predictions discussed in this section. The experimental measures of the four factors are discussed in more detail in the next section.

General approach

The study investigates the premise that work experience in a particular environment (an environment with either structured or unstructured audit methodology) is a major factor in the level of performance that involves nonroutine audit tasks. In contrast, with routine audit tasks, the level of performance of experienced auditors should not be influenced by the presence or absence of a structured work

environment. Thus task type (routine/nonroutine) and firm type (structured/ nonstructured) are the factors of primary interest to the study.

Tasks and firm structure

Five tasks were used in the experiment; two routine tasks concerned with internal control weaknesses and three nonroutine tasks concerned with analytical procedures. An in-depth discussion of these tasks is subsequently provided in Chapter VI. Table 2 summarizes the predictions from the five audit tasks and the evaluation criteria used to measure the auditors' performance on the tasks. These predictions follow from the general hypotheses presented at the end of Chapter IV.

Table 2
Routine and Nonroutine
Audit Tasks in Study

Task		Routine or Nonroutine	Evaluation	Prediction
1-2	Internal control weaknesses	Routine	Accuracy	Smaller differences in performance
3-5	Analytical procedures	Nonroutine	Accuracy	Larger differences in performance

Individual measures of conscientiousness and general mental ability

The study is based on the premise that the auditor's work experience in a particular audit environment (an environment with either structured or unstructured audit methodology) is a major factor in the performance of an audit task. Given this premise, it would be useful to determine that performance differences are related to the ways that different audit methodologies shape the performance of every auditor in the group and are not attributable to individual differences among the auditors in the firms. For this reason, two important individual differences previously used by researchers (Barrick and Mount, 1991) for predicting job performance are measured in this study to determine that the performance differences reported are not due to individual differences in auditors. A positive relationship between the individual factors--conscientiousness and general mental ability--and job performance is hypothesized. The expectation is that the level of conscientiousness and general mental ability will not vary between the two firms. Mean differences between the level of conscientiousness and general mental ability for each firm will be examined to determine if differences exist between the two firms for these specific characteristics. The correlation between job performance

and conscientiousness and general mental ability will be examined to evaluate the relationship between these factors.

Years of experience

Previous audit research has used years of experience as a way of distinguishing expert from novice auditors (Frederick, 1991; Biggs et al., 1988; Bedard & Biggs, 1991; Frederick & Libby, 1986; Butt, 1988; Marchant, 1989; Libby & Frederick, 1990). Using years of experience as a classification scheme, it is postulated in such studies that an auditor with eight years of experience, for example, has more expertise than an auditor with six years of experience. However, evidence regarding the effects of experience on audit judgment is somewhat mixed (see Wright, 1988 or Bedard, 1989 for reviews). Although experienced auditors outperform inexperienced auditors in many tasks, years of experience in itself may not be a good predictor of performance on specific tasks (Bonner and Lewis, 1990).

Why is years of experience a poor predictor for expert performance? Experts have more knowledge than novices, but this does not imply that all experts with the same number of years of experience have accumulated the same knowledge. In addition to the differences in work experience, these audit experts have different innate abilities which affect knowledge acquisition and performance. Differences in experience and abilities among the experts make years of

experience an unreliable predictor of expert performance. Even auditors with similar lengths of tenure (who also differ in their native ability) are likely to accumulate different work experiences and types of training through which they acquire different knowledge.

As discussed in Chapter IV, in this study a non-linear relationship between years of experience and level of performance is postulated, with different relationships for different types of tasks and types of firms. Consequently, the experimental goal of the study is to avoid any confounding of the primary conclusions with respect to years of experience. These considerations are discussed in more depth in Chapter VI. In addition, statistical procedures are discussed in Chapter VII for compensating for unavoidable differences in the years of experience of the subjects.

Discretion measure

Based on the previous discussion of structured and unstructured audit methodology, auditors in firms with unstructured methodology should perceive their work environment as being less structured, allowing for more discretion in the way their jobs are performed than auditors in firms with structured audit methodology.

An individual measure of discretion will be calculated for each auditor based on several components from the list

of role dimensions presented in Appendix F. The following items will be included in the discretion measure: (1) role formalization, the extent to which the manager's role is formally prescribed in official documents; (2) role definition, the extent to which managers perceive their jobs and authority to be constrained; (3) role routine, the extent to which managers perceive their work to involve familiar problems; (4) everyday routine, the extent to which managers perceive their work to be highly programmed; (5) long-term stability, the extent to which managers anticipate little year to year change in the content of their job; and (6) perceived authority, the scope of authority that managers perceive they possess. The expectation is that auditors in firms with unstructured audit methodology will report higher levels of discretion in their jobs than auditors in firms with structured audit methodology.

Questionnaire

The audit tasks were administered by means of a questionnaire. The subjects were from one structured firm and one unstructured firm. The subjects received the questionnaire from an office coordinator, recorded their answers on the questionnaire and returned the material directly to the author of the research project.[2] The

[2] The author contacted partners at various locations of the two firms and determined if they were willing to participate in an audit survey. If they agreed to participate in the

overall response rate for the questionnaire was 47% (43% for the unstructured auditors and 51% for the structured auditors).

In addition to the professional auditors, to measure the effect of experience on task performance, twenty-two undergraduate auditing students with no public accounting experience also participated in this study. The purpose of using a control group was to demonstrate that the routine tasks were non-trivial tasks requiring audit experience in structured or unstructured work environments.[3]

As elaborated upon in Chapter VI, the questionnaire (presented in Appendix G) contained sections pertaining to internal control tasks, analytical procedures tasks, and questions measuring the individual's conscientiousness level and general mental ability.

The five audit tasks were presented to auditors in the context of a continuing audit of a medium-sized, publicly

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survey, questionnaires were mailed to an office coordinator designated by the partner for distribution. Questionnaires were mailed to 12 locations of the unstructured firm and 11 locations of the structured firm. To increase compliance, a postcard was provided so the auditor could notify the office coordinator when the survey was returned.

[3] Student scores averaged 1.80 for routine tasks and 0.38 for nonroutine tasks out of 5 possible. Comparable scores for expert subjects were 4.85 and 3.12, respectively. Based on these results, the tasks used in this study appear to be non-trivial tasks. Auditors learn to perform these tasks based on work experience. Such tasks are appropriate to investigate the influence of structured and unstructured audit methodology on task performance.

traded manufacturing company.[4] Background information included a description of the company and comparative financial statements for two years. Each task required the auditor to assume that he or she was supervising the work of an assistant.

The subjects were told that this study was part of an experiment to determine how auditors perform certain audit tasks. They were asked to assume the role of an audit supervisor taking part in the continuing audit of a manufacturing company during the preliminary planning stage of the audit. Subjects were given one page of background information on the company, the prior year's audited balance sheet and income statement, and the current year's projected financial statements **as prepared by the auditor**. The experimental tasks displayed additional information as needed to complete the task. Specifically, for tasks 3-5, subjects were given unaudited financial statements and financial ratios **prepared by the client**.

The tasks were presented to the subjects in two random orders, one group received the routine tasks first and the second group received the nonroutine tasks first to avoid fatigue effects in evaluating the responses. After completing the tasks, all subjects answered a debriefing

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[4] Eight audit tasks were pilot tested. The five tasks with the highest discriminatory power were selected for this study.

questionnaire. This questionnaire included items of interest relating to their background and work experience. Also included were measures of intelligence, conscientiousness and individual perceptions of the amount of discretion in their job.

Scoring

Scoring of the open-ended questions was performed independently by the author (who had three years of auditing experience) and a doctoral student (with one year of auditing experience). There were few differences in scoring and all differences were resolved into a common scoring rule which was used in the analysis.

Scoring of Task 1 and 2 (Internal control weaknesses)

To evaluate the auditors' knowledge of the relationship between internal control weaknesses and financial statement errors, auditors were given a documented internal control weakness. They were asked to list three important financial statement errors that could occur given the identified weakness in internal controls and to suggest two substantive audit procedures that would be useful in detecting such errors.

Accuracy criteria for this task were developed by reference to standard lists of internal control weaknesses in auditing textbooks. If the financial statement error

listed by the auditor might have been caused by the internal control weakness, it was evaluated as a correct answer. If the error could not result from the internal control weakness, it was an incorrect answer. The substantive audit procedures were evaluated in a similar fashion. If the procedure would be useful in detecting the error, it was evaluated as a correct procedure. If the procedure would not be useful in detecting the error, it was evaluated as an incorrect procedure. Auditors were given a score of 0-5 points on this task, receiving one point for each correct answer.

Scoring of Tasks 3, 4 and 5 (Analytical procedures)

To evaluate the auditors' ability to perform analytical procedures, the subjects were given differences between projected and unaudited financial ratios and were asked to propose an explanation to account for the observable facts. They were given five ratios: the current ratio, quick ratio, gross margin percentage, inventory turnover ratio, and accounts receivable turnover ratio and were asked to identify the accounting error that would account for all the unexpected changes in the ratios. Accuracy criteria were used to evaluate the hypotheses generated by the auditors. Auditors were given points according to the number of changes which their hypotheses explained. For example, if

their explanation would account for the changes in all five ratios, they received 5 points. Auditors were given a score of 0-5 points on this task, receiving one point for each ratio change correctly identified by their explanation.

CHAPTER VI

PERFORMANCE MEASURES

As indicated in the introduction and discussed in subsequent chapters, the performance of auditors is hypothesized to be a function of four factors: (1) audit firm methodology, (2) years of experience, (3) individual differences of intelligence and conscientiousness, and (4) the routine/nonroutine nature of the task. The experimental manipulation of these four factors is now discussed.

Audit firm methodology

Subjects from two Big Six accounting firms were used in the study. According to the structure classification scheme developed by Cushing and Loebbecke (1986) and Kinney (1986) (see Chapter II), one firm uses structured audit methodology and the second firm employs unstructured audit methodology. Subjects were initially classified into two groups based on their firm affiliation. Although accounting firms as a whole have been classified as structured or unstructured based on the Cushing and Loebbecke (1986) and Kinney (1986) classification scheme, an individual office of any given firm may operate at a level of structure that differs from the overall classification. Given the possibility of

individual variation within each firm and to supplement the classification that is based on the firms' generally employed audit methodology, a self perception measure of auditor discretion was also used to determine whether the subjects work environment was structured or unstructured.

During the debriefing process, auditors answered a series of questions related to their perceived discretion in performing their daily audit tasks. The answers to these questions were evaluated on a discretion continuum. A positive relationship between discretion and performance is hypothesized. Higher levels of discretion should lead to better performance (that is, more accurate answers) for nonroutine tasks.

The measure of discretion was based on previous work by Child and Kieser (1981) and Hickson (1966). Child and Kieser (1981) used a measure of role prescriptions to study managerial discretion in organizations. The questionnaire was originally formulated by Hickson (1966). Hickson concluded from a review of organizational theory literature that role prescription was a major focus of research because it was at the heart of the distinctions between the mechanistic and organic models of organizations. This study used a questionnaire that is similar to Hickson's to determine whether differences exist between the amount of discretion given to auditors in structured and unstructured

accounting firms. Such an inquiry presupposes that auditors in firms with unstructured audit methodology not only possess more discretion by job definition, but also that they respond to the questionnaire in a manner consistent with their job description. Appendix F lists the role dimensions examined in the questionnaire.

Years of experience

Participants in this study were audit seniors and supervising seniors with a mean and standard deviation of 43 and 13 months of experience respectively, (47 and 16 months for unstructured auditors and 40 and 11 months for structured auditors). Evidence provided by Abdolmohammadi and Wright (1987) indicates that audit seniors with an average experience of three years may be considered "experts" in the use of analytical procedures (the subsequently discussed nonroutine tasks). The seniors were employed by various offices of the two Big Six accounting firms.

The selection of participants was designed to avoid wide variations in the years of experience of the auditors. This is reflective of the goal of the study: after controlling for the confounding effect of years of experience, is there a difference (or uniformity) in the level of performance between auditors from firms with dissimilar methodologies with respect to nonroutine (or

routine) tasks. That is, is there a firm effect for nonroutine tasks? Further steps that were taken to guard against such confounding are discussed in a later section.

Individual differences--Conscientiousness and general mental ability

Five personality factors have been found to affect job performance: extraversion, emotional stability, agreeableness, conscientiousness and openness to experience. Although, the labels assigned to these five personality factors differ somewhat across researchers, the following names and descriptions of the variables are representative: (1) extraversion (sociable, talkative, assertive, ambitious, active); (2) emotional stability (calm, secure, not nervous); (3) agreeableness (good-natured, cooperative, trusting); (4) conscientiousness (responsible, dependable, planful, organized, persistent); and (5) openness to experience (imaginative, artistically sensitive, intellectual) (Barrick and Mount, 1992). The claim that these five factors represent the basic components of personality is based on four lines of evidence: (1) consistent results have been shown from longitudinal and cross-observer studies; (2) traits related to each factor are found in most personality systems; (3) the five factors are robust across different age, sex, race and language groups; and (4) prior research indicates that all

personality traits have some biological basis (Barrick and Mount, 1992).

Conscientiousness

Results from a meta-analysis of the personality dimension literature indicate that one factor--conscientiousness--is a good predictor of job performance (Barrick and Mount, 1991). Based on past research, conscientiousness has been found to be a valid predictor for all occupational groups and all job-related criterion studies. Based on the preponderance of evidence showing that conscientiousness is an important determinant of job performance, any model seeking to explain job performance should consider this important determinant of performance (Barrick et al., in press). Conscientiousness is related to job performance because it reflects personal characteristics such as dependability; or being careful, thorough, responsible, organized, hardworking, and achievement-oriented (Barrick and Mount, 1991, p. 4).

A subset of the Personality Characteristic Inventory developed by Barrick et al. (in press) was used in this study to measure conscientiousness. For a more thorough description of the item content and development methods see Barrick et al. (in press). This personality inventory was developed by taking items representing each of the five constructs from existing inventories to assess the primary

traits associated with each construct. Their final inventory contains 132 items on the questionnaire.

Barrick and Mount's Personality Characteristic Inventory has been administered to over 2,000 individuals including students, managers, sales representatives, retail clerks, and production workers. The data gathered from the questionnaire have been analyzed using factor analysis, using the principal components method and varimax rotation. The items relating to the five constructs had relatively high factor loadings on a priori factors and did not load on other factors. Coefficient alpha reliability estimates are .85 (extraversion), .67 (agreeableness), .89 (conscientiousness), .85 (emotional stability), and .86 (openness to experience) for the five factors. Values for test-retest reliability data for 63 salespeople over a 9 month period are .73, .70, .84, .73, and .79, respectively. In addition, in one study 205 students completed the Personality Characteristic Inventory and the NEO-PI Inventory (Costa and McCrae, 1985), another measure of the Big Five personality characteristics, and correlations among similar personality constructs were .68, .56, .71, .67, and .63, respectively. Correlations with dissimilar constructs were much lower, ranging from .04 to .39. These results provide evidence of the construct validity of the five

factors measured by the Barrick and Mount Personality Characteristics Inventory.

A subset of the original 132 item inventory was used in this study. Twenty-five questions were selected to measure conscientiousness. Three questions were selected from each of the remaining constructs as distractors. This led to a total of thirty-seven questions.

General mental ability

A second factor, general mental ability, was also included in this study to investigate audit task performance. Bamber (1993) discusses the importance of considering the role of general mental ability in the decision making process. He notes that there are only a few auditing studies that have examined the role of this variable on auditor performance (Marchant, 1989; Bonner & Lewis, 1990; Bonner et al., 1993). The current research project uses a measure of general mental ability previously developed and tested by Bonner and Lewis (1990).

Past research suggests that knowledge and problem solving ability are important determinants of performance for tasks that are poorly defined (e.g. Lesgold, 1984; Simon, 1979; and Voss & Post, 1988). Researchers in a number of different domains have found that knowledge contributes to performance. Several studies have shown that performance in ill-structured tasks is related to technical

knowledge in the domain. (Technical knowledge includes the facts, rules, and relationships relevant to the problem at hand.) In auditing, technical knowledge has been found to be related to performance in tasks such as hypothesizing financial statement errors (Bonner & Lewis, 1990).

Researchers have also demonstrated that general mental ability may be related to performance in ill-structured tasks. Because ill-structured tasks provide little information to decision makers about the issues involved, the means of solving the problem, or the alternatives available for the solution, reasoning may also be an important determinant of performance in poorly defined tasks (Hunter, 1986; Lesgold, 1984; and Simon, 1979). This would be particularly true in nonroutine audit tasks where there are no standard rules for solving the problem.

Hunter (1983) examined the effect of job experience and general mental ability on job knowledge. Hunter's analysis revealed that general mental ability has a causal impact on the acquisition of knowledge, which in turn has a major impact on performance. This finding was supported by other researchers (Borman, White, Pulakow, and Oppler, 1991; Schmidt, Hunter, and Outerbridge, 1986). Based on these results, it is reasonable to propose the following relationship between general mental ability and performance:

general mental ability affects the individual's job **knowledge** which affects the individual's job **performance**. Because there is no explicit job knowledge measure in this study, it is assumed that mental ability will be directly related to job performance. The extent of general mental ability possessed by the auditor will be positively related to task performance. Higher levels of mental ability will be associated with higher levels of job performance.

General mental ability was measured by a scale used in Bonner and Lewis (1990) and Bonner, Davis & Jackson (1993). The scale consists of a subset of questions from the 1987-4 Graduate Record Exam. See Bonner and Lewis (1990) for additional details regarding the ability measure.

Tasks

The two routine and three nonroutine tasks of the study are now discussed. These tasks were selected to test the postulated relationships presented in Table 2. (The specific research hypotheses are presented in chapter VII).

Routine tasks

Task 1 (Internal control weakness-purchase cycle)

Given a specific weakness in the internal controls over accounts payable, auditors were asked to list three financial statement errors that could occur and not be detected by the control system and to list two substantive

audit procedures that would be useful in detecting such errors.

Task 2 (Internal control weakness-revenue cycle)

Given a specific weakness in the internal controls over accounts receivable, auditors were asked to list three financial statement errors that could occur and not be detected by the control system and two substantive audit procedures that would be useful in detecting such errors.

Tasks 1 and 2 for hypothesizing errors based on internal control weaknesses, are **hypothesis generation** tasks. Although few studies have considered this component of internal control evaluation, recent results from Bonner and Lewis (1990) indicate that auditors perform quite well at this task, probably because there are well-established rules and procedures for linking internal control weaknesses to financial statement errors.

Research has shown that expert auditors have good knowledge of common financial statement errors (Ashton, A., 1991; Libby, 1985; Libby & Frederick, 1990; and Tubbs, 1992). Further, there are differences related to the level of expertise evident in this knowledge (Frederick & Libby, 1986; Libby & Frederick, 1990; Tubbs, 1992).

Both groups of subjects have had sufficient experience to learn the task, so significant performance differences

are not hypothesized between groups. This should be a routine task for both groups of auditors.

Nonroutine tasks

Task 3 (Preliminary analytical procedures-inventory cutoff problem)

Auditors were given differences in projected and unaudited financial ratios and were asked to propose an explanation to account for the observable facts. The first nonroutine error presented to the subjects was an inventory cutoff problem (the target explanation). The client failed to record a year-end inventory purchase, so inventory and accounts payable were understated on the unaudited financial ratios. In this case, there are five discrepancies to resolve: (1) a decrease in the current ratio; (2) an increase in the quick ratio; (3) an increase in the inventory turnover ratio; (4) no change in the gross margin percentage; and (5) no change in the accounts receivable ratio.

Task 4 (Preliminary analytical procedures-unrecorded sales)

Task 4 involved an understatement of year-end sales (the target explanation). In this case, there are five discrepancies to resolve: (1) a decrease in the current ratio; (2) a decrease in the quick ratio; (3) a decrease in the inventory turnover ratio; (4) an increase in the

accounts receivable turnover ratio; and (5) no change in the gross margin percentage.

Task 5 (Preliminary analytical procedures-S,G, and A expense capitalized to inventory)

The third nonroutine error is a situation where selling, general and administrative (S G & A) expense is capitalized to inventory rather than expensed (the target explanation). This error, adapted from Bedard and Biggs (1991), requires the auditor to identify the error that caused the discrepancies by considering the pattern of the discrepancies. There are five discrepancies to be resolved: (1) an increase in the current ratio; (2) no change in the quick ratio; (3) a decrease in gross margin; (4) a decrease in the inventory turnover ratio; and (5) no change in the accounts receivable turnover ratio. If these discrepancies are considered as one pattern to be explained, the conclusion is that some part of SG&A expense was capitalized to inventory.

Hypothesizing errors in financial statements based on ratio analysis is a **hypothesis generation** task. In these tasks, auditors use frequency knowledge to generate the hypothesized errors. Past research has shown that expert auditors can generate many correct hypotheses for frequent errors, (Biggs et al, 1988; Libby, 1985; Marchant, 1989) but have more difficulty generating correct hypotheses for

infrequent errors (Bedard & Biggs, 1991; Blocher & Cooper, 1988; Bonner & Lewis, 1990).

Tasks 3-5 are nonroutine for both groups of auditors. In each case the successful completion of the task requires the auditor to link the discrepancies of the task to arrive at the target explanation. Larger differences in performance between the two groups are hypothesized for these tasks.

Accuracy criteria will be used to evaluate the hypotheses generated by the auditors. The hypothesis will be evaluated on a scale of 0-5 based on the number of discrepancies explained by the explanation. For example, arriving at the target explanation in each case will explain all the discrepancies in the ratios and result in a score of 5 on the case.

Validation of the routine and nonroutine tasks

The routine and the nonroutine tasks of the study were developed based on a review of past audit research and on discussions with audit researchers and audit managers from two Big Six accounting firms. The audit tasks were refined during a pilot test with twelve experienced auditors. The auditors found the tasks to be appropriate for the experience level of the subjects. Third and fourth year auditors perform the various audit tasks in the study as

part of their normal daily work experience. The auditors believed the tasks were both realistic and challenging.

Coakley and Loebbecke (1985) describe auditors' expectations of accounting errors in manufacturing firms. The routine and the nonroutine analytical procedure tasks used in this study are consistent with the Coakley and Loebbecke descriptions of errors found in manufacturing clients.

The task of error identification based on internal control weaknesses is classified as a routine task because it is frequently performed by accountants in the auditing process. Discussions with audit managers confirmed the validity of classifying this task as routine.

Further characteristics of the audit tasks

Bonner and Pennington (1991) have classified, according to a number of characteristics, twenty-eight tasks that are customarily performed during an audit. It is helpful to consider the assigned characteristics of Bonner and Pennington (1991) for the five tasks considered in this study, for the purpose of determining whether they are correctly classified as routine and nonroutine tasks. As will be seen, Bonner and Pennington's classification of the tasks used in this experiment is completely consistent with

and reinforces the postulated relationships discussed in the previous section of the paper.

Bonner and Pennington (1991) characterize audit tasks in several ways, including the cognitive processes involved, the type of reasoning used, the quality of knowledge available, the professional guidance given for performing the task, and the performance of auditors on each of those tasks based on past audit research.

Performance

The results of prior audit research are summarized for each audit task included in this study.

Process type

Audit tasks employ two types of cognitive processing. The construction form of processing is relevant when task performance involves generating ideas and constructing interpretations. In contrast to this, reduction processes involve reducing information to get an evaluation of an hypothesis, estimate or choice. Based on prior research, experts perform better at construction processes than reduction processes, probably because experts are good at generating choices, but not so good at selecting one of their choices (Bonner and Pennington, 1991, p. 23).

Type of reasoning

Two types of reasoning are apparent in the audit tasks. The performance of some tasks is based on reasoning which is guided by theory and causal relations. This is theory-driven reasoning. The performance of other tasks is based on statistical reasoning, for example relative frequencies. Experts perform better at tasks which require causal reasoning, probably because most individuals prefer verbal explanations to statistical explanations (Bonner and Pennington, 1991, p. 27).

Quality of knowledge

The quality of knowledge available to guide task performance also differs among the tasks. The quality of knowledge may be structured or impoverished. Structured knowledge is well-organized, but not necessarily extensive. Impoverished knowledge lacks either organization or depth. Past research indicates that performance is better on tasks with well-structured knowledge bases. According to Bonner and Pennington, this result is consistent with past research demonstrating the importance of knowledge for expert performance (Bonner and Pennington, 1991, p. 27). Table 3 describes the knowledge requirements of each task.

Table 3
Knowledge Requirements of Tasks

	Routine	Nonroutine
GAAP Knowledge	Knowledge of the effect of specific internal control errors on financial statements.	Knowledge about the relationship between specific errors and financial statements. Knowledge of more complex error patterns and relationships.
GAAS Knowledge	Knowledge of errors created by poor or missing controls.	Knowledge of error frequencies. Knowledge of analytical procedures.
Client Knowledge	Knowledge of the client's accounting system.	Knowledge about the client's business. Knowledge of the economic environment. Industry knowledge.
Quality of Knowledge	Structured	Impoverished.

Professional guidance

The quality of the auditor's learning environment differs among the tasks. The results of the Bonner and Pennington survey indicate that professional guidance is more extensive for the good performance groups and less extensive for the poor performance groups (Bonner and Pennington, 1991, p. 32).

The assigned characteristics for the tasks in this research project are presented in Table 4. For additional information regarding these characteristics, see Bonner and Pennington (1991).

What can the reader conclude from a review of Table 4? Based on this table, previous research suggests that the routine tasks used in this research study should result in good performance on the part of auditors. These tasks fall into categories that lead to better performance on the part of auditors: they involve the construction process type and the quality of knowledge available to solve the tasks is structured. The nonroutine tasks included in this research study are more difficult to perform. These tasks involve the reduction form of cognitive processing, they are based on theory-driven reasoning and the quality of knowledge available to solve these tasks is unstructured.

Table 4
Task Characteristics

Panel A - Performance and Process Type

Task	Performance	Process Type: Construction	Process Type: Reduction
Routine	Good Bonner & Lewis, 1990 Frederick & Libby, 1986	Hypothesis Generation	
Nonroutine	Mixed Bedard & Biggs, 1991 Blocher & Cooper, 1988 Bonner & Lewis, 1990 Blocher, et al., 1983 Heiman, 1990		Hypothesis Generation

Panel B - Type of Reasoning and Quality of Knowledge

Task	Type of Reasoning: Theory	Type of Reasoning: Statistical	Quality of Knowledge: Structured	Quality of Knowledge: Impoverished
Routine	x		x	
Nonroutine	x			x

Panel C - Professional Guidance

Task	Professional Guidance: Pages in Audit Standards
Routine	10.0
Nonroutine	0.5

CHAPTER VII

RESULTS

This section develops the experimental hypotheses examined in the research instrument and describes the experimental results. H1 elaborates general hypotheses 1 and 2 developed in chapter IV of the paper. General hypothesis 1 predicts that performance on routine tasks will be comparable between auditors in firms with structured and unstructured audit methodology. General hypothesis 2 predicts that performance on nonroutine tasks will <u>not</u> be comparable between auditors in firms with structured and unstructured audit methodology.

H2 examines the significance of four variables: audit firm methodology, years of experience, level of conscientiousness of the individual, and the general mental ability of the individual in measuring performance on routine and nonroutine tasks. H3 predicts that two of these variables, conscientiousness and general mental ability will not differ between firms.

H4 examines the validity of the Cushing and Loebbecke (1986) and Kinney (1986) classification of structured and

unstructured audit firms. This classification has been used by a number of accounting researchers (for example, Williams & Dirsmith, 1988), but it has not been validated as being an accurate description of firm methodology. A measure of perceived discretion is used to validate the classification scheme.

The research hypotheses are summarized briefly below. Results relating to the individual hypotheses are discussed in greater detail in the sections that follow.

Research hypotheses

H1: There will be an interaction between task and audit firm methodology in determining audit performance.

Audit performance will not be the same for auditors in structured and unstructured audit firms. Performance differences between structured and unstructured firms are expected to be particularly salient for nonroutine tasks. Auditors in firms with structured and unstructured audit methodology will perform routine tasks equally well. However, auditors in firms with unstructured audit methodology will perform nonroutine tasks more accurately than auditors in firms with structured audit methodology. This leads to the interaction specified by H1.

H2: Audit methodology will provide incremental explanatory power over years of experience and individual differences for performance on the audit tasks.

Hypothesis 2 investigates the relative influence of the factors considered in this experiment on auditor performance. This research project is based on the premise that the performance differences noted between the two firms are a function of firm differences, above and beyond any possible differences in either the experience level of the auditors in the firms or individual differences in the characteristics of the auditors between the two firms (not expected).

Hypothesis 2 investigates the validity of this premise. After controlling for the effects of years of experience and individual differences, audit firm methodology will be a significant variable in determining audit performance.

H3: The individual difference variables of conscientiousness and general mental ability will not vary between the two groups of auditors.

Given the similarity in hiring practices among the Big Six auditing firms, no differences in levels of conscientiousness or general mental ability are anticipated. Both factors have a positive relationship with performance, so higher levels of conscientiousness and general mental ability should be associated with better (more accurate) performance.

H4: Auditors in firms with structured audit methodology will report less discretion in their jobs than auditors in firms with unstructured audit methodology.

If the classification of structured and unstructured audit methodology is a valid description of actual firm practices, auditors in firms with unstructured audit methodology should report greater levels of discretion in their jobs than auditors in firms with structured audit methodology. Hypothesis 4 serves as a diagnostic check on the structure classification of the two accounting firms.

Results from each of these hypotheses are discussed in the sections that follow. The data analysis for hypotheses 1-3 was performed on a final sample of 81 supervising seniors and managers (45 structured and 36 unstructured), with experience ranging from 23 to 99 months (average = 43 months). The data analysis for hypothesis 4 used a data set of 96 auditors (52 structured and 44 unstructured).[5]

Hypothesis 1 - Audit task by firm methodology interaction

Hypothesis 1 predicts an interaction between task and firm. Auditor performance is expected to vary as a function of firm in the following manner: auditors in firms with structured and those with unstructured audit methodology will perform routine tasks equally well. Auditors in firms with unstructured audit methodology however, will perform

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[5] Ninety-six questionnaires were returned. Responses were incomplete for fifteen questionnaires (seven structured and eight unstructured) resulting in a final sample size of eighty-one for the task variables and ninety-six for the discretion measures.

nonroutine tasks more accurately than auditors in firms with structured audit methodology.

To test hypothesis 1, a multivariate manova analysis was estimated using task and task x firm as within-subject factors and firm as a between subject factor. Three covariates: months, conscientiousness, and intelligence were also considered in the analysis. The multivariate analysis uses five measures of performance on the audit tasks. Auditor performance on each task is measured as the number correct out of 5 possible points. Results of the analysis are reported in Table 5.

Table 5
Multivariate Manova Analysis of Auditor Performance

	F Statistic	Signif of F
Between Subject:		
Firm	1.01	.319
Regression	2.98	.037
	T Statistic	**Signif of T**
Covariates:		
Months	.448	.152
Conscien	.766	.446
Intell	2.564	.012
	F Statistic	**Signif of F**
Within Subject:		
Task	48.30	.000
Firm x Task	4.01	.003

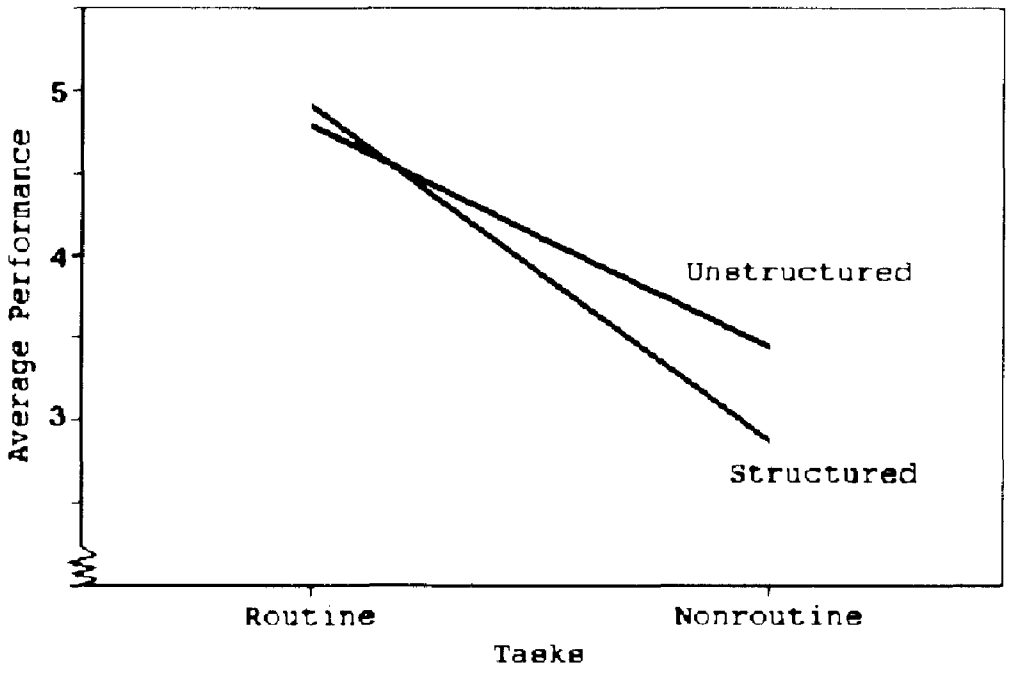
As shown in Table 5, hypothesis 1 is confirmed. The interaction between firm and task is significant at the .003 level (F=4.01). This interaction indicates that performance differences in the two types of tasks are not the same for structured and unstructured audit firms. Although auditors in structured firms perform as well as auditors in unstructured firms on routine tasks, they perform worse on nonroutine tasks. The significant interaction requires that the task variables be examined separately by firm categories. There are many combinations of the five scores that one could consider, however, the specific combination of these scores relevant to this study is the average score on tasks 1 and 2 (the routine tasks) and the average score on tasks 3, 4, and 5 (the nonroutine tasks). These two averages will be used to examine the task variables. Figure 3 depicts the interaction between task and firm, using average performance on routine and nonroutine tasks for the two groups as the performance measure.

Hypothesis 2 - Firm effect

Hypothesis 2 examines the effect of audit firm methodology on task performance. Specifically it suggests that audit firm methodology is a significant factor in determining task performance.

This study is based on the premise that performance differences between the two groups of auditors are a function of differences in audit firm methodology above and beyond any possible differences in either the experience level of the auditors or individual differences (not expected). Three models will be tested to investigate the relative influence of the individual factors and the firm

Figure 3
Task x Firm Interaction



variable on auditor performance: (1) a full model with audit performance as the dependent variable, firm as the independent variable, three covariate terms (months,

conscientiousness, and intelligence), and interaction terms for firm and the covariates; (2) a reduced model omitting the firm x covariate interaction terms that are insignificant in the previous model; and (3) a reduced model omitting all the interaction and the covariate terms that are insignificant in the previous model.

Auditor performance is hypothesized to be a function of four factors: audit methodology, months of experience, and individual differences of general mental ability and conscientiousness. Anova analysis is used to examine the importance of these four factors. Table 6 reports the results using the full model. In this model we are primarily interested in determining whether any of the between subject or within subject interactions are significant. The firm and covariate variables will be investigated subsequently.

The interactions between audit firm and the level of conscientiousness, months of experience, or general mental ability of the auditors in the two firms are not significant. This indicates that performance does not vary between the two groups of auditors as a function of the level of conscientiousness, months of experience or general mental ability of the auditors.

Two of the within subject interaction variables are significant--task x firm and task x intelligence. This

indicates that task performance differs by firm and intelligence level. Both of these variables will be examined in greater detail in future sections. A significant univariate task x firm interaction supports the multivariate task x firm interaction reported for hypothesis 1. Auditor performance is not the same for structured and unstructured audit firms.

Table 6
Anova Analysis
Full Model with
Covariate and Interaction Terms

	df	SS	F Stat	P-Value
Between Subject:				
Firm	1	.001	.002	.967
Months	1	.087	.206	.651
Conscien	1	.241	.574	.451
Intell	1	2.751	6.540	.013
Firm*Conscien	1	.012	.029	.866
Firm*Months	1	.356	.846	.361
Firm*Intell	1	.140	.334	.565
Error	73	30.701		
Within Subject:				
Task	1	2.741	4.754	.032
Task*Months	1	.616	1.069	.305
Task*Conscien	1	.009	.016	.899
Task*Intell	1	2.633	4.567	.036
Task*Firm	1	2.624	4.551	.036
Subject	80	63.925	1.386	.077
Error	76	43.824		

The variables of interest can now be examined in a more parsimonious model corresponding to the postulated

relationships, after determining that the covariates do not interact with firm.

Table 7 reports the results of a reduced model omitting the firm x covariate interactions that are not significant. In this model, the between subject factor of intelligence is significant at the .003 level (F=9.124). Auditor performance is a function of the level of intelligence of

Table 7
Anova Analysis
Reduced Model with
Covariate Terms

	df	SS	F Stat	P-Value
Between Subject:				
Firm	1	.259	.632	.429
Months	1	.858	2.088	.153
Conscien	1	.329	.802	.373
Intell	1	3.748	9.124	.003
Error	76	31.219		
Within Subject:				
Task	1	2.741	4.754	.032
Task*Months	1	.616	1.069	.305
Task*Conscien	1	.009	.016	.899
Task*Intell	1	2.633	4.567	.036
Task*Firm	1	2.624	4.551	.036
Subject	80	63.925	1.386	.077
Error	76	43.824		

the individual, but the study did not confirm that auditor performance varies as a function of the months of experience of the individual or the level of conscientiousness of the individual. This result supports the recent work in the

accounting literature suggesting that years of experience is a poor measure of audit expertise (Bonner & Lewis, 1990). Years of experience was included in this study to evaluate the significance of this variable on auditor performance given the conflicting results in the auditing literature. The significance levels for the within subject factors are the same as reported in the full model.

Table 8 reports the results of a further reduced model testing the significant variables in the model reported in Table 7, in addition to the firm variable. A reduced model/full model test[6] indicates that the reduced model fits the data better than the full model reported in Table 7 ($F=1.634$, $p=<.01$).

In the reduced model reported in Table 8, the between subject factor of intelligence is significant at the .004 level ($F=8.636$). All the within subject factors are significant (task is significant at .000 ($F=17.477$), task x intelligence is significant at .031 ($F=4.823$), and task x firm is significant at .013 ($F=6.499$)). The significant task x firm interaction supports the results of the

[6] A reduced model/full model test can be used to evaluate whether a full model fits the data better than a reduced model. In this test, the error sum of squares for the full model is compared to the error sum of squares for the reduced model. The difference in sum of squares is divided by the difference in the degrees of freedom between the two models to determine if the reduction in error sum of squares for the full model is significant given the change in degrees of freedom. This test is used to evaluate the fit of two models (Neter, Wasserman, & Kutner, 1985, p. 95-96).

multivariate analysis reported in Table 5. In the multivariate setting, the task x firm interaction was significant at the .003 level (F=4.01). This interaction indicates that performance differences in the two types of tasks are not the same for structured and unstructured audit firms. Although auditors in structured firms perform as well as auditors in unstructured firms on routine tasks, they perform worse on nonroutine tasks. The simple effects of this interaction will be reported in the following section.

Table 8
Anova Analysis
Reduced Model with
Significant Terms

	df	SS	F Stat	P-Value
Between Subject:				
Firm	1	.432	1.038	.312
Intell	1	3.595	8.636	.004
Error	78	32.466		
Within Subject:				
Task	1	9.958	17.477	.000
Task*Intell	1	2.748	4.823	.031
Task*Firm	1	3.703	6.499	.013
Subject	80	65.845	1.445	.052
Error	78	44.443		

Simple effect tests of
task x firm interaction

Table 9 presents the results of a series of anovas using performance on task 1, task 2, task 3, task 4, task 5,

average performance on routine tasks and average performance on nonroutine tasks. Performance on these tasks is examined to explain the significant task x firm interaction. One could ask: "Is the interaction significant due to performance differences on routine or nonroutine tasks?" In each anova, firm classification is the treatment variable.

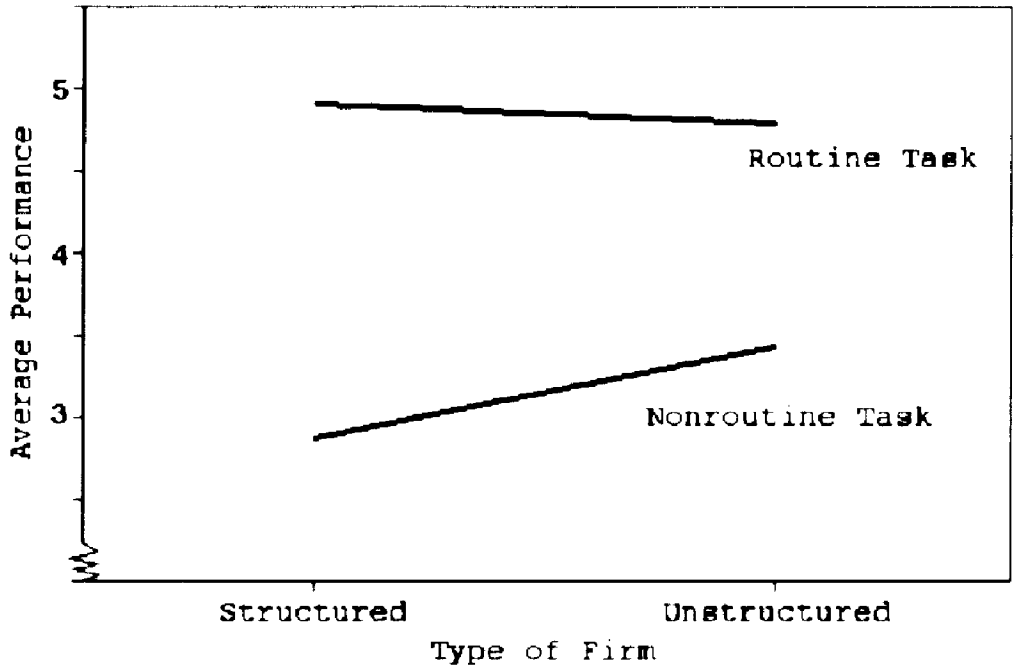
Table 9
Anova Comparison of Performance on Audit Tasks

Tasks	Total Possible Points	Audit Firm Classification		F Ratio	F Prob
		Structured	Unstructured		
Routine					
Task 1	5	4.91	4.89	.08	.772
Task 2	5	4.93	4.69	2.78	.099
Nonroutine					
Task 3	5	3.22	3.97	4.66	.034
Task 4	5	2.53	3.58	6.60	.012
Task 5	5	2.87	2.81	.02	.877
Average Routine	5	4.92	4.79	2.31	.133
Average Nonroutine	5	2.87	3.45	4.93	.029

The results from these anova analyses support the explanation for the firm x task interaction reported in hypothesis 1. Auditors in firms with structured and

unstructured audit methodology perform at similar levels on routine tasks (F=2.31, p=.133). However, auditors in firms with unstructured audit methodology outperform auditors in firms with structured audit methodology on nonroutine tasks (F=4.93, p=.029). Figure 4 graphically depicts the results reported in Table 9, using average routine and average nonroutine performance scores.

Figure 4
Performance on Audit Tasks



Another way to examine the interaction effect is to calculate the effect size (Cohen, 1977) for each task.[7]

[7] Cohen's d is calculated in the following manner: $d=2r/\text{squareroot}(1-r^2)$. For correlational studies, d=.20 is

Effect size calculations are used to evaluate the magnitude of the effect apart from the statistical significance of the effect. Unlike the p-value test of statistical significance, effect size is not dependent on sample size. Using Cohen's d (Wolf, 1986) as a measurement of effect size, we find as expected that the effect size for nonroutine tasks (D=.484) is twice as large as that for routine tasks (D=.281).

Anova analyses reported in Tables 10-12 consider the effect of the covariate and covariate x firm interactions on the simple effects tests for routine and nonroutine tasks.

Table 10 reports the results of an anova analysis using average performance on routine tasks as the dependent variable, firm as the independent variable, and months, conscientiousness and intelligence as the covariates. No variables in this model are significant at the .05 level. A reduced model using firm and intelligence, the two variables with the highest significance levels is also reported in Table 10. Neither the intelligence nor firm variable is significant at common significance levels. Auditor performance on routine tasks is not a function of the level of intelligence of the individual or the audit firm membership of the individual. The results of the anova analysis are consistent with the nature of the routine task.

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a small effect, d=.60 is considered to be a medium effect, and d=1.00 is a large effect (Wolf, 1986).

Because routine tasks are easily learned by an individual, intelligence is not a factor in determining the performance of routine tasks. Auditors in both firms learn to perform routine tasks, so the association with a particular audit firm is not a significant factor in determining auditor performance on routine tasks.

Table 10
Anove Table for Average
Routine Tasks

Model tested: Average routine by firm with months conscien intell firmcon firmmon firmint.

Variable	df	SS	F	P-value
Firm	1	.453	3.284	.074
Months	1	.014	.105	.747
Conscien	1	.203	1.468	.230
Intell	1	.565	4.099	.047
Firmcon	1	.032	.233	.631
Firmmon	1	.055	.396	.531
Firmint	1	.061	.442	.508
Error	73	10.071		

Model tested: Average routine by firm with intell

Variable	df	SS	F	P-value
Firm	1	.492	3.445	.067
Intell	1	.373	2.614	.110
Error	78	11.141		

Table 11 reports the results of an anova analysis of average performance on nonroutine tasks (using tasks 3, 4,

and 5) with covariate and interaction terms. In this model, intelligence is significant at .020 (F=5.614). A reduced model with firm and intelligence is also examined to consider the importance of these two variables on average nonroutine performance. In this model, firm is significant

Table 11
Anova Table for Average
Nonroutine Tasks
Task 3, 4, & 5

Model tested: Average nonroutine by firm with months conscien intell firmcon firmmon firmint.

Variable	df	SS	F	P-value
Firm	1	.383	.297	.588
Months	1	.217	.168	.683
Conscien	1	.436	.338	.563
Intell	1	7.244	5.614	.020
Firmcon	1	.250	.194	.661
Firmmon	1	1.087	.843	.362
Firmint	1	.378	.293	.590
Error	73	94.183		

Model tested: Average nonroutine by firm with intell

Variable	df	SS	F	P-value
Firm	1	4.064	3.227	.076
Intell	1	12.065	9.579	.003
Error	78	98.244		

at .076 (F=3.227) and intelligence is significant at .003 (F=9.579). Auditor performance on nonroutine tasks is a

function of the audit firm and the level of intelligence of the individual, but this study did not confirm that performance varies as a function of months of experience or the level of conscientiousness of the individual.

Table 12 reports the results of an anova analysis using only two of the nonroutine tasks--tasks 3 and 4--to evaluate average nonroutine audit performance. Based on the averages reported in Table 9, task 5 differs from tasks 3 and 4. In tasks 3 and 4, unstructured auditors outperform structured auditors (3.97 vs 3.22, F=4.66, p=.03 for task 3; 3.58 vs 2.53, F=6.60, p=.01 for task 4). In task 5, there is no difference in performance between the two groups of auditors (2.81 vs 2.87, F=.02, p=.88). Due to these differences, average-based anova analyses of nonroutine tasks are reported for both tasks 3, 4, and 5 (Table 11) and tasks 3 and 4 (Table 12) for purposes of comparison. Perhaps task 5 was not characteristic of a nonroutine task for the group of auditors in this study.

Using average performance on nonroutine tasks (3 and 4) as the measure of performance, only one of the covariates, intelligence, is significant (F=6.156, p=.015). A reduced model omitting the nonsignificant covariates and interactions, considers the effect of firm and intelligence on average performance on nonroutine tasks. Intelligence is

Table 12
Anova Table for Average
Nonroutine Tasks
Task 3 & 4

Model tested: Average nonroutine by firm with months conscien intell firmcon firmmon firmint.

Variable	df	SS	F	P-value
Firm	1	.007	.004	.948
Months	1	.020	.012	.914
Conscien	1	.097	.057	.812
Intell	1	10.483	6.156	.015
Firmcon	1	1.100	.646	.424
Firmmon	1	2.323	1.364	.247
Firmint	1	.415	.244	.623
Error	73	124.314		

Model tested: Average nonroutine by firm with intell

Variable	df	SS	F	P-value
Firm	1	10.803	6.565	.012
Intell	1	20.352	12.369	.001
Error	78	128.345		

significant at .001 (F=12.369) and firm is now significant at .012 (F=6.565). Hypothesis 2 is confirmed. Audit firm methodology is a significant factor in determining auditor performance on nonroutine tasks. Audit performance on nonroutine tasks varies as a function of audit firm membership.

The results of this study are consistent with the learning curves presented in Chapter V of this paper. Auditors in both structured and unstructured firms learn to

perform routine tasks because of the repetitive nature of such tasks. One must implicitly recognize the limitations of our sample, however auditors in firms with structured audit methodology do not appear to develop the same level of expertise for nonroutine tasks as auditors in firms with unstructured audit methodology. Auditors in firms with structured audit methodology may fail to develop the ability to solve nonroutine tasks because the level of structure inherent in the work plan of the structured auditing firm is inconsistent with the nature of the unstructured task.

Sensitivity analysis - Audit tasks

How sensitive are the results previously reported to the specific combinations of the routine and nonroutine tasks used in this study? For example, since average performance is used, are the results driven by only one or two of the five tasks? Table 13 reports the results of a multivariate manova analysis using the five performance measures as the dependent variable and firm as the independent variable. Table 13 reports the results from specific combinations of the five tasks to evaluate the sensitivity of the firm effect to various combinations of the 5 variables.

Panel A of Table 13 reports the results of two combinations of tasks: task 1 and 2 compared to task 3, 4 , and 5 and task 1 and 2 compared to task 3 and 4. The second

combination is evaluated based on results reported in Table 9 results for task 5. As seen from Table 9, the

Table 13
Multivariate Manova Analysis Using Alternative Task Combinations

Tasks	F Statistic Firm Effect	Signif of F
Panel A		
Task 1&2 and Task 3,4&5	8.442	.005
Task 1&2 and Task 3&4	12.650	.001
Panel B		
Task 1 and Task 3	4.797	.031
Task 1 and Task 4	7.318	.008
Task 1 and Task 5	.010	.921
Task 2 and Task 3	9.395	.003
Task 2 and Task 4	8.917	.004
Task 2 and Task 5	.215	.644

difference in performance between auditors in firms with structured and unstructured audit methodology is not significant (F=.024,p=.877) for task 5. Table 13 now shows that the effect of firm increases from a significance level of .005 to .001 when the score on task 5 is deleted from the analysis.

Panel B of Table 13 reports the significance of the differences between all pairwise combinations of the two routine and the three nonroutine tasks. Consistent with the results reported in Panel A, all pairwise combinations of

routine and nonroutine tasks are significant at the .05 level, except the two pairs involving task 5.

The performance differences observed between the two firms in this study are quite stable to different combinations of the five tasks, with the exception of task 5.

Hypothesis 3 - Conscientiousness and general mental ability

Hypothesis 3 predicts that the individual difference variables of conscientiousness and general mental ability will not vary between the two firms. The hiring practices of the Big Six accounting firms are similar, so a priori there is no basis for predicting differences in conscientiousness or general mental ability between the two groups. A positive relationship between the individual factors (conscientiousness and general mental ability) and performance was hypothesized. The results generally support this relationship.[8]

Table 14 reports the average conscientiousness and general mental ability ratings for the two groups of auditors. The results reported in this table generally

[8] The correlation between average nonroutine performance and conscientiousness and intelligence is -.04 and .34, respectively. The correlation between average routine performance and conscientiousness and intelligence is .18 and .16, respectively. The correlation between average nonroutine performance and intelligence is significant at the .01 level (none of the remaining correlations are significant at standard levels of significance).

support the prediction that the level of conscientiousness and general mental ability of the two groups does not differ.

Table 14
Anova Analysis
Comparison of Conscientiousness and General Mental Ability Ratings Based on Cell Means

Measure	Total Score Possible	Audit Firm Classification		P-Value
		Structured	Unstructured	
Conscientiousness	3	2.59	2.48	.053
General Mental Ability	9	6.76	7.25	.119

Conscientiousness was measured by a subset of the Personality Characteristics Inventory developed by Barrick et al. (in press). The coefficient alpha reliability estimate for the subset of conscientiousness questions used in this study is .81 (compared to a reliability coefficient of .89 for the original scale).

General mental ability was measured by a scale developed by Bonner and Lewis (1990) and used in their 1990 paper and in subsequent research (Bonner, Davis & Jackson (1993). The scale consists of a subset of questions from the 1987-4 Graduate Record Exam. Although the questions come from a well-tested source, a reliability coefficient

was calculated because only a small subset (nine questions) of the original scale was used. The coefficient alpha reliability estimate for the general mental ability questions used in this study is .63 with one question deleted.[9] This indicates that 63 percent of the time, a second questionnaire would result in a similar score as the measure of general mental ability. The original questionnaire also had a .63 reliability coefficient.

Hypothesis 4 - Perceived discretion in firm

Hypothesis 4 examines the perceived discretion of auditors in structured and unstructured audit firms. If the classification of structured and unstructured audit methodology is a valid description of actual firm practice, auditors in firms with unstructured audit methodology should report higher levels of discretion than auditors in firms with structured audit methodology. The managerial role dimensions considered in the discretion index are described in Appendix F.[10]

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[9] A reliability measure can be calculated for any combination of the nine questions in the set. Since the subjects answered all questions, it is possible to report a reliability measure for all or a portion of the questionnaire. In effect, this allows you to select out the group of questions that would be the most reliable in measuring the construct of interest without pre-testing the questionnaire.

[10] Child & Kieser (1981) developed a measure of role prescriptions to study managerial discretion in organizations. From a review of the organizational theory

An individual measure of discretion was calculated for each auditor based on six components from the list of role dimensions (described in Appendix F): role formalization, role definition, role routine, everyday routine, long-term stability, and perceived authority. These six components can be identified as having a directional relationship with the level of discretion in the job. The reliability of the discretion measure is .18. Given the low reliability of the scale, it might be better to focus on the two measures of routineness, role routine and everyday routine to measure discretion. Table 15 reports the results for the six component variables and for the overall discretion measure for auditors in structured and unstructured audit firms. from the design of their jobs, but they also report less discretion in their jobs than auditors in firms with unstructured audit methodology. Based on the results from this study, the classification of audit methodology as structured and unstructured appears to be a valid description of actual firm practice. Auditors in firms with unstructured audit methodology report more discretion in the way in which they conduct their audits than auditors in firms with structured audit methodology.

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literature, they concluded that role prescriptions were at the heart of the distinctions between mechanistic and organic organizations. These role dimensions will be used to construct a discretion measure to evaluate the extent to which an individual auditor's job is prescribed by office policy.

Table 15
Anova Analysis
Auditor Discretion

Variable	Total Possible Score[a]	Firm Classification: Structured	Firm Classification: Unstructured	P-Value
Role formalization	9	6.65	7.00	.635
Role definition	9	4.36	4.75	.316
Role routine	9	4.37	5.50	.015
Everyday routine	9	5.45	6.21	.066
Long-term stability	9	5.90	6.03	.723
Perceived authority	9	3.06	3.13	.850
Discretion Measure	9	4.90	5.51	.018

[a] 1=less discretion, 9=more discretion

Classification of subjects by level of discretion

The previous section reported that the discretion measure is significantly different between the two firms, with auditors in firms with unstructured audit methodology reporting higher levels of discretion and auditors in firms with structured audit methodology reporting lower levels of discretion. The purpose of this section is to examine the

discretion measure in greater detail to consider its importance in determining auditor performance.

First, the individual measure of auditor discretion was used to divide the subjects into groups. Although accounting firms as a whole have been classified as structured or unstructured based on the methodology classification scheme developed by Cushing and Loebbecke (1986) and Kinney (1986), an individual office of any firm may operate at a level of structure that differs from the overall classification. Individual auditors within a firm may also perceive the discretion level in their job to be different from the methodological classification. The classification of subjects based on their perceived discretion is designed to evaluate how closely individual offices of firms correspond to the overall structure classification.

Data from the subject pool were examined in three ways: (1) the entire subject pool was split into two equal groups based on the mean level of discretion (one group with high discretion and a second group with low discretion); (2) the top third of the discretion continuum was compared to the bottom third; and (3) the top 15 discretion scores were compared to the bottom 15 discretion scores. Table 16 reports descriptive statistics from these three classifications. If the structure classification is a valid

Table 16
Auditor Classification by
Discretion Level

	Structured	Unstructured	Fisher Exact Test[a]
Top Half	23	25	
Bottom Half	29	19	.155
Top Third	11	17	
Bottom Third	20	8	.024
Top 15	4	11	
Bottom 15	11	4	.000

[a] The Fisher Exact Probability Test is a nonparametic test used when sample sizes are small. It is used to determine whether the two groups differ in the proportion in which they fall into the two classifications (Siegel, 1956, p. 97).

description of audit methodology, auditors in firms with unstructured audit methodology should be classified in the high discretion group and auditors in firms with structured audit methodology should be classified in the low discretion group. The results from Table 16 generally support this trend, especially for the top 15/bottom 15 discretion levels. The next sections of the paper examine the performance results for the top 15/bottom 15 discretion group in greater detail.

The relationship between discretion and performance should be positive for nonroutine tasks. More discretion should lead to better performance on nonroutine tasks, but should result in no improvement in performance on routine tasks due to the ease of learning routine tasks.

Table 17 reports the results from the discretion classification using auditors with the 15 highest and lowest discretion scores. The discretion measure is significantly different between the two groups (F=103.93, p=.000). The average performance on routine tasks is not significant (F=.09, p=.760), as predicted. The level of discretion does not affect the level of performance for routine tasks for this group of subjects. Due to the ease of learning routine tasks, even auditors with high discretion (and low structure) in their jobs learn to perform routine tasks. However, the amount of discretion in the auditors' job does affect their performance on nonroutine tasks. The average performance on nonroutine tasks is significantly different between the two groups (F=7.46, p=.011). The high discretion group outperformed the low discretion group for nonroutine tasks. The high discretion group correctly identified 3.56 of the 5 ratio changes, while the low discretion group only identified 2.44 of the 5 possible changes.[11]

The effect size for the average routine task performance is rather small, Cohen's D=.116, while that for

[11] The discretion measures were significantly different for the other two discretion groupings: (1) the top half/bottom half (F=90.31, p=.00) and (2) the top third/bottom third (F=92.77, p=.00). However, none of the performance measures on either routine (p=.969 and .658, respectively) or nonroutine (p=.863 and .856, respectively) tasks were significantly different for these two discretion classifications.

Table 17
Anova Analysis
Comparison of Performance on
Audit Tasks By Discretion Level
Top 15/Bottom 15

Tasks	Total Possible Points	Discretion Level High[a]	Low[a]	P-Value
Discretion Measure	9[b]	6.98	3.28	.000[d]
Average Routine	5[c]	4.70	4.77	.760[e]
Average Nonroutine	5[c]	3.56	2.44	.011[f]

[a] N=15 in each group. (High=11 unstructured, 4 structured; Low= 4 unstructured, 11 structured)

[b] 9=high discretion, 1=low discretion

[c] 5=most accurate, 0=least accurate

[d] Cohen's d=-3.854

[e] Cohen's d=.116

[f] Cohen's d=-1.034

nonroutine tasks is much larger, Cohen's D=.-1.034. This suggests that auditors with more discretion perform better on nonroutine tasks than auditors with less discretion.

Auditor performance on nonroutine tasks appears to be related to the amount of discretion permitted in the work place in the structuring of one's tasks. There is some evidence to suggest that higher levels of discretion are associated with better performance on nonroutine tasks.

Auditors learn to perform routine tasks regardless of the amount of discretion in their jobs.

Table 18 reports full and reduced anova analysis results for performance measures using the top 15/bottom 15 discretion scores (a task x discretion analysis) in the place of the firm variable. This analysis (with 29 df) is comparable to the task x firm analysis presented in Table 6 and 8 (with 80 df). The task x discretion variable in the only significant variable in either the full or reduced model. Auditor performance on tasks varies as a function of the level of discretion. This result supports the conclusion that the level of discretion in an audit firm affects the level of performance on audit tasks.

Cohen's d is -.755 for the discretion variable and .794 for the intelligence variable. Both of these variables have a medium size effect on auditor performance, even though the p-values of the variables are not significant at common levels of significance. This may suggest a problem with sample size and power for the top 15/bottom 15 sample of 30.

Table 18
Anova Analysis
Discretion Model for
Top 15/Bottom 15 Discretion Scores

Model = Perf by discr with months conscien intell discrcon discrintel discrmon

	df	SS	P-Value
Between Subject:			
Discretion level	1	.128	.634
Months	1	.000	.979
Conscien	1	.976	.197
Intell	1	1.178	.158
Discr*Conscien	1	.219	.536
Discr*Months	1	.066	.732
Discr*Intell	1	.160	.596
Error	22	12.149	
Within Subject:			
Task	1	1.121	.180
Task*Months	1	.005	.925
Task*Conscien	1	.014	.878
Task*Intell	1	1.208	.165
Task*Discr	1	3.441	.023
Subject	29	26.203	.141
Error	25	14.746	

Model = Perf by discr with months conscien intell

Between Subject:			
Discretion	1	1.834	.067[a]
Months	1	.052	.749
Conscien	1	.803	.217
Intell	1	1.448	.101[b]
Error	25	12.522	
Within Subject:			
Task	1	1.121	.180
Task*Months	1	.005	.925
Task*Conscien	1	.014	.878
Task*Intell	1	1.208	.165
Task*Discr	1	3.441	.023
Subject	29	26.203	.141
Error	25	14.746	

[a] Cohen's d=-.755

[b] Cohen's d=.794

CHAPTER VIII

DISCUSSION

This dissertation was designed to investigate the development of professional expertise in structured and unstructured auditing firms. Subjects were given five tasks to complete--two routine tasks identifying financial statement errors based on internal control weaknesses in the revenue and purchases cycle; and three nonroutine tasks using ratio analysis to identify financial statement errors during the preliminary planning stage of an audit. Auditor performance on these tasks was used as a measure of the level of professional expertise of auditors in the two types of firms.

If auditors in firms with both structured and with unstructured audit methodology perform equally well on the experimental tasks, then audit expertise would not appear to be affected by firm type. However, if one group of auditors outperforms the other group, audit methodology may be a significant factor contributing to performance differences.

Previous research indicates that several additional factors may be important in determining performance. The factors are: months of experience, the conscientiousness level of the individual, the general mental ability of the

individual, and the routine/nonroutine nature of the task. These factors were also examined in the experiment.

Prior audit methodology research has examined the advantages and the disadvantage of structured audit methodology in nonperformance areas. Researchers, for example, have asked: "Do methods used to coordinate audit communication differ between structured and unstructured firms?" Previous research has seldom considered the relationship between audit methodology and auditor performance (for an exception, see Dirsmith and Haskins, 1991). Given the trend of the last twenty years toward a more structured audit approach, it is important to examine the performance implications of structured audit methodology.

Cushing and Loebbecke (1986) have listed several potential advantages of structured audit methodology. These advantages are: (1) more consistent audit documentation; (2) improved efficiency in the audit decision process; (3) standardized documentation facilitating compliance with auditing standards; and (4) standardization of audit activities. Given the competitive audit market, structured audit methodology may be appealing because it offers the potential advantages of efficiency and effectiveness. These advantages would be positive factors favoring structured

audit methodology unless the advantages of the approach are outweighed by the potential disadvantages.

Potential disadvantages of the structured audit methodology (Cushing & Loebbecke, 1986) include: (1) the inflexibility of the structured audit approach; (2) the potential inefficiencies of structured audit procedures in less complex environments; and (3) possible limitations of structured audit methodology for the development of the professional judgment of individual auditors.

The purpose of this dissertation was to examine the third potential disadvantage. It has asked: "Are there any performance differences among auditors of structured and unstructured audit firms that might be associated with differences in audit methodology?" The dissertation's experiment clearly shows that auditors in firms with unstructured audit methodology outperform auditors in firms with structured audit methodology for the nonroutine tasks in this study.

If structured audit methodology inhibits the development of expertise by auditors for dealing with nonroutine tasks, policy makers must carefully weigh both the advantages and the disadvantages of structured audit methodology: an audit approach that appears to have advantages in terms of improving the efficiency and effectiveness of audit engagements may also have a serious

long-term consequence, its adverse effect on the development of expertise.

Structured audit methodology has its uses. For example, the repetitive application of a structured approach to routine tasks promises efficiency and clarity. Indeed, no statistically significant differences were observed between structured and unstructured firms in the performance of their auditors with routine tasks. The danger lies in the tendency to make all audit decisions "structured decisions;" that is, to squeeze every particular case into a pre-set mold. Such reliance on structure may not do justice to the many nonroutine features of an audit.

For the analytical procedures investigated in this study, the results suggest that expertise for nonroutine tasks is greater for firms using an unstructured audit approach. Why is this the case? Previous research indicates that expertise develops through practice. Structured audit approaches fail to give auditors sufficient practice to develop the skills of their trade. The key to using structured audit methodology may be to use it for the routine tasks, and also to include opportunities for judgments which go beyond prescribed patterns. Experts do not develop the ability to make nonroutine decisions unless they actually participate in such decisions.

Expertise in analytical procedures is an important skill to develop. Consider the findings of this study: even if the structured auditors were later to find the error that is more quickly identified by unstructured auditors, it is more efficient to discover errors during the planning stages rather than later in the audit. The purpose of employing analytical procedures is to direct the audit testwork to the areas that need additional attention. Errors missed during planning result in an inefficient audit and cost money even when the errors are eventually discovered. Differences in audit expertise for the audit tasks in the study have serious consequences for the efficiency of the audit and potential consequences for the accuracy of the audit.

Previous accounting research has used years of experience as a way of distinguishing expert from novice auditors (Frederick, 1991; Biggs et al., 1988; Bedard & Biggs, 1991; Frederick & Libby, 1986; Butt, 1988; Marchant, 1989; Libby & Frederick, 1990). In these studies, however, evidence regarding the effects of experience on audit judgment is somewhat mixed (Wright, 1988; Bedard, 1989). Bonner and Lewis (1990) report that years of experience may not be a good predictor of performance. The current research study supports the belief that expertise is not measured solely by years of experience. In all models

examined in this paper, years of experience (assuming a minimum level of three years) was an insignificant factor in determining performance.

If three plus years of experience is not related to auditor performance, what factors are important in determining performance? In this study, general mental ability (or intelligence) is a significant factor in determining performance. Previous accounting research has ignored the effect of general mental ability on judgment (for exceptions, see Bonner and Lewis, 1990 and Bonner et al., 1993). Bamber (1993) suggests that this deficiency in behavioral accounting research should be corrected. Given the results of this study, additional research on the relationship between general mental ability and audit performance may be fruitful. As predicted, the average level of general mental ability is not significantly different between the two auditing firms in the study. A positive relationship between general mental ability and performance was hypothesized and supported by the results (the correlation between general mental ability and average nonroutine, average routine performance is .34 and .16, respectively). In all the models tested, general mental ability is a significant variable for determining auditor performance.

The level of conscientiousness of an individual is often associated with the performance outcome of the individual. In this study, the level of conscientiousness of the auditor is positively related to routine task performance, so working harder and/or having a higher level of general mental ability will improve performance on routine tasks. However, no relationship was identified between the level of conscientiousness of the auditor and performance on nonroutine tasks.

The level of discretion of auditors in the two types of firms was examined by constructing a measure of the auditors' perceived level of discretion in their jobs. The level of discretion of auditors was examined to validate Cushing and Loebbecke (1986) and Kinney's (1986) classification of structured and unstructured audit firms. If the Cushing and Loebbecke (1986) and Kinney (1986) classification of structured and unstructured audit methodology is a valid description of actual firm practices, auditors in firms with unstructured audit methodology should report higher levels of discretion than auditors in firms with structured audit methodology. The results of this study support this hypothesis.

The results of this study also indicate that there is an interaction between audit task and the level of discretion. This interaction indicates that performance

differences in the two types of tasks are not the same for high and low discretion groups. The level of discretion makes a difference for auditor performance on nonroutine tasks (but not on routine tasks).

In summary, the results of this study suggest that auditors in firms with unstructured audit methodology outperform auditors in firms with structured audit methodology at the task of identifying financial statement errors during the preliminary planning stage of the audit. However, structured audit firms may have other mechanisms that are built into their audit plans to compensate for their lack of expertise on the analytical tasks in this experiment. This study is limited in its ability to identify such compensating elements or to permit these elements to affect auditor performance. Within these limitations, auditors in firms with structured audit methodology demonstrated less depth in solving nonroutine tasks.

General mental ability and the level of discretion perceived by the auditor are promising variables in explaining auditor performance. Additional research is needed to determine how these factors can be used to improve performance.

APPENDIX A

THE ROLE OF KNOWLEDGE IN AUDIT JUDGMENT

What are the essential characteristics which define an expert? While there are many characteristics we associate with expertise (e.g. the ability to make confident judgments quickly under pressure, a reassuring manner, or an ability to see the unusual or rare variable) the characteristic of greatest importance is that experts make better, that is more accurate, judgments than do novices. In other words, expertise should provide **both** superior **decision processes and** superior **performance** in the judgment area of the expert decision maker (Johnson, 1988, p. 210).

Two bodies of research have evolved which consider the development of expertise. The behavioral decision making literature evaluates the performance of experts, while the cognitive science decision literature evaluates the decision process of the experts. Each area of research will be discussed briefly in the sections that follow.

Behavioral decision literature does not present a flattering view of expert judgment. Experts are often found to perform no better than novices in the tasks studied (see Bedard, 1989; Johnson, Jamal & Berryman, 1989; Wright, 1988 for a review of the relevant accounting papers). Studies

using the behavioral approach examine the effect of expertise on certain parameters of judgment such as consensus, stability, self-insight and cue-importance. Researchers who use the behavioral approach seek to establish the presence of expertise by documenting distinctive differences between decisions by experts and those made by novices (e.g. Libby 1981, Libby and Lewis 1982, Ashton 1982, Joyce and Libby 1982). These differences focus on the performance element of the decision making process. The processing element (how knowledge is brought to bear on the decision process) is largely ignored by behavioral judgment researchers (Choo, 1989, p. 206-207).

Even more devastating to the study of expert judgment in the behavioral decision literature are research studies comparing expert decisions to simple statistical models. Model predictions are often more accurate than those of the expert judge (for examples, see Dawes, 1979 or Libby, 1976).

Why have experts performed so badly in these tasks? Several reasons have been suggested by researchers. First, most behavioral decision research has examined well-structured tasks. However, many expert decision making tasks involve unstructured or semi-structured tasks. These tasks may make radically different demands on the expert's ability (e.g. Abdolmohammadi and Wright, 1987). A second reason involves the use of experience as a surrogate for

expertise. Many accounting studies use years of experience as a surrogate for expertise, without identifying the conditions where experience is an appropriate surrogate for expertise. Researchers need better, that is, more precise and more complex ways to operationalize experience. Recent studies have suggested that expertise is task specific and that expertise in one area does not imply expertise in all related areas as years of experience would suggest (e.g. Bonner, 1990 and A. Ashton, 1991). Behavioral decision research may fail to find expert-novice differences due to its inability to describe how experience should affect the decision.

The cognitive view of expertise is based on knowledge differences between experts and novices. Cognitive psychologists define expertise in terms of the knowledge of an expert rather than the decision behavior of an expert. The failure of behavioral decision research to consistently demonstrate that expert decision makers outperform novices has led to an interest in the role of knowledge in shaping audit decision making. Understanding the cause of performance differences requires specification of the nature of experience related knowledge differences and the mechanisms through which they affect judgment. Many auditing decisions rely heavily on the task-related knowledge (for example, knowledge about accounting systems

or internal control) that the experienced auditor brings to the job. Given this reliance on information retrieved from memory, a complete picture of the audit decision making process must place substantial weight on the accumulated knowledge of the expert and how it is brought to bear on the decision.

Cognitive science has documented clear differences in experts' and novices' behavior in domains outside the audit area. It is clear that experts often have better and more complete representations of the task domain (Chi, Feltovich, and Glaser, 1982). These representations, in turn, allow experts to encode new information more quickly and completely (Chase and Simon, 1973). Experts apparently also have a richer repertory of strategies and appropriate mechanisms for accessing and applying these strategies (Larkin, McDermott, Simon and Simon, 1980). These strategies and the appropriate organization of knowledge often allow experts to perform tasks more quickly than novices (Johnson, 1988, p. 210-212).

Appendix B examines the knowledge-based expert judgment literature in auditing from 1980 to the present. The starting point is Weber's (1980) study of computer controls and EDP auditors. In the eleven years following Weber's research, approximately fifteen auditing papers were published related to the role of knowledge in the audit

judgment area. The papers represent several research methods and a variety of viewpoints concerning the appropriate method for studying audit expert judgment. While the papers present substantial contributions to the body of knowledge concerning expert judgment, a great deal of work remains to be done.

The role of knowledge in the audit decision making process

Learning and knowledge have been studied for a long time by psychologists and others interested in the decision making process. Questions of interest include: How is knowledge stored in the brain? How is it accessed during the decision making process? What difference does the method of storage and access of memory make in the decision making process? An answer to such questions is that the brain organizes its knowledge, creating memory and memory access structures that can be used to work effectively with what the individual knows. These structures and the mechanisms that are thought to go with them have been referred to by an assortment of names (e.g. images, schemata, templates, frames, category structure) (Gibbins, 1988, p. 52). In this paper, the terms "knowledge structure", "memory structure", and "auditor's knowledge" are used interchangeably. A knowledge or memory structure

is an abstract representation of where knowledge is stored in a person's head (Choo, 1989, p. 106).

One difference between an expert and a novice is that the expert has more knowledge stored in memory. Simply having more knowledge, however, is not the major factor that separates expert from novice judgment. Recent research in cognitive psychology suggests that the key difference between expert and novice decision makers is the manner in which that knowledge is **organised** and **accessed** so it can be brought to bear on decision problems. For this reason, understanding the role of knowledge appears to be crucial to understanding expert judgment.

The concept of knowledge structures is appealing, but empirically it has proven to be very complicated. Such structures are not directly observable, so they must be inferred from observations of behavior. Clearly, people do learn and remember and it seems sensible to propose that knowledge would be organized in some manner and not just randomly deposited in the brain. It also seems sensible to propose that the organization of memory could provide a guide to action. For example, if the brain remembers what to do, it would not have to reason through the decision a second time. It could use the response that worked last time (Gibbons, 1988, p. 52-53).

A knowledge structure seems to fit as an explanation for several observations. First, retrieval from memory is very fast. Because what is retrieved can be quite detailed, there does not seem to be time to have searched through random memories. Second, people can report quickly what they think should be done in a given situation, with confidence and great detail. Unless they are making it up, they appear to be drawing on an organized memory. Third, retrieval from memory seems to be cue-driven. This suggests some type of mapping process from the cues to the set of memories, implying that memory is structured in some way. Fourth, medical, neurological and psychological studies indicate that certain memories and cognitive skills have a physical location in the brain. An injury may destroy certain memories or impair the ability to learn some things, suggesting knowledge locations in the brain. Fifth, evidence of perceptual and cognitive biases has become common (e.g. Tversky and Kahneman, 1974; Ashton, 1976). Such evidence supports the existence of knowledge structure, for without the knowledge structure, the bias may not exist (Gibbins, 1988, p. 53).

Two papers, Gibbins (1984) and Waller and Felix (1984) describe the role of knowledge in the audit judgment setting. Gibbins' paper, "Propositions About the Psychology of Professional Judgment in Public Accounting" discusses

propositions, corollaries and hypotheses for the purpose of producing an empirical theory of the everyday process of professional judgment in public accounting. Gibbins writes within the general paradigm of cognitive psychology and learning research and uses that paradigm to develop testable hypotheses about professional judgment in public accounting. The proposals relate broadly to the professional judgment of accountants, not particularly to audit judgment. (Gibbins, 1988 provides additional detail about the propositions developed in the 1984 paper.) The Waller and Felix paper "The Auditor and Learning From Experience: Some Conjectures," is specific to the audit setting. This paper discusses a cognitive process which might be used to describe how auditors learn from experience. Both papers will be discussed briefly in the sections that follow. The purpose of this review is to develop a theoretical basis to examine the empirical literature in this area. It is difficult to consider the knowledge structure literature without an understanding of how the auditor learns from his work experience.

Gibbins' (1984) paper uses a simple cognitive process model of judgment to examine the professional judgments of accountants. This model contains five components: (1) the decision maker's accumulated learning (the pre-existing structural knowledge); (2) the triggering event (the

stimulus); (3) the decision making environment; (4) the judgment process (thinking, all mental activity); (5) the response. Propositions and hypotheses are written to correspond to four areas in the model in the context of the decision making environment. Appendix C summarizes information contained in these proposals and provides testable propositions that arise from the judgment model.

Gibbins' (1984) proposals about professional judgment in public accounting add up to several broad suggestions. First, audit judgment is a process of responding to the environment. Judgment is guided by memory templates which are shaped by the past experience of the decision maker. Second, audit judgment is largely unconscious. It becomes more conscious when the unconscious response doesn't fit the circumstance. Third, the judgment templates of auditors are stable. They reflect day-to-day experience more than they do formal education. Fourth, retrieval from memory and memory maintenance becomes more efficient with experience. This efficiency leads to more automated responses for routine judgment situations. Fifth, the audit judgment process is a causal rather than probabilistic matching of current perceptions to memory templates. Sixth, audit judgment is an incremental process of fitting cues to templates to generate a response. Neither a normatively complete view of the situation nor a normatively correct

combining of cues is needed to make a decision. Seventh, auditors are always prepared to respond to routine situations, because the judgment process includes continuous perception, updating of templates and generation of responses, whether or not acted upon. Eighth, the environment of the auditor requires justification of the decision and tends to emphasize negative outcomes more than positive ones (Gibbins, 1988, p. 56-57).

The Waller and Felix paper is similar to Gibbins, but it applies specifically to the audit decision making process. Waller and Felix (1984) describe a general model of how auditors learn from experience. Understanding how new knowledge is acquired requires an understanding of how old knowledge is stored and used. The authors present three distinct ways in which memory is commonly thought to be structured: short-term versus long-term memory; episodic versus semantic memory; and declarative versus procedural memory.

Short-term memory is the active or working memory containing the knowledge currently in use. The capacity of short-term memory is limited to only a few "chunks" of information at a given time (probably four to seven chunks). Long-term memory refers to the capacity to store knowledge for use in the future. Long-term memory has no practical capacity limit. The organization of long-term memory is of

interest to judgment researchers, as is the retrieval process of transferring information from long-term to short-term memory.

Long-term memory can be divided into episodic and semantic memory. Episodic memory refers to the storage and retrieval of autobiographic experiences. Semantic memory refers to the storage of general knowledge of concepts and meanings. An understanding of learning from experience requires an explanation of the organization of semantic memory and the interaction between semantic and episodic memory.

Long-term memory is said to contain declarative and procedural knowledge. Declarative knowledge consists of the facts one has in memory, while procedural knowledge consists of the skills one knows how to perform. Declarative and procedural knowledge partition the knowledge system into a part that is process and a part that is data (Waller and Felix, 1984, p. 385-386).

Waller and Felix describe a model of learning from experience. The central thesis of the model is that learning from experience involves the formation and development of cognitive structures to organize declarative and procedural knowledge in long-term memory. The authors refer to the cognitive structures that organize declarative knowledge as categories and schemata and the cognitive

structures that organize procedural knowledge as production systems.

Learning from experience requires the interaction of new information with knowledge structures previously created and stored in long-term memory. The retrieved knowledge both clarifies and is clarified by the new experience. The pre-existing cognitive structures are used to understand the new information and are modified in order to accommodate the unique elements of the new information (Waller and Felix, 1984, p. 386).

Waller and Felix suggest that the auditor use three types of knowledge in the audit judgment process: knowledge of generally accepted accounting principles (GAAP), knowledge of generally accepted auditing standards (GAAS), and knowledge of the client's environment. The auditor's objective in the decision making process is to render an opinion with respect to the audit report that the probability of material departures from the information disclosed is small. Bonner and Lewis (1990) develop the relationship between these three types of knowledge and audit expertise. Their results support the hypothesis that knowledge is a better determinant of auditor expertise than years of experience.

Initially the auditor's knowledge of accounting rules is exclusively in declarative form. An accounting student

is exposed to a vast set of accounting measurement rules in the education setting. Gradually, through repeated use of the accounting rules (experience), the declarative representation is transferred into a procedural representation. Work experience both clarifies and elaborates the set of conditions and actions appropriate in given situations. Ultimately, the result for the professional auditor is an intricate system of accounting knowledge where the technical procedural knowledge is bonded with and tempered by the declarative knowledge (Waller and Felix, 1984, p. 397-398).

The auditor's knowledge of auditing is largely the product of experience and observation, not education. Declarative knowledge regarding GAAS will be obtained in an Auditing course, but formal instruction will do little more than establish a framework which will be greatly modified and filled-in by work experience (Waller and Felix, 1984, p. 398).

The auditor's knowledge of the client environment is predominantly declarative. Similar to the acquisition of auditing knowledge, the cognitive structures that organize the auditor's knowledge of the client environment are primarily the result of work experience rather than formal education (Waller and Felix, 1984, p. 400).

Given the role of experience in shaping knowledge structures, differences in knowledge structures should be apparent in expert and novice decision makers. Studies that fail to find expert-novice differences may do so as a result of a lack of understanding of the role of knowledge in the expert judgment process. Bonner (1990) develops this idea in greater detail.

The process of becoming an expert involves both instruction (education) and practice (experience). Anderson (1982) suggests that the first stage in acquiring a skill is the learning of declarative knowledge. Declarative knowledge comes from instruction and textbook material, provided mainly through formal education, but also available in on-the-job experience. (On-the-job declarative knowledge in the audit context might be in the form of audit programs or instruction manuals.) When an individual reads procedural material from a text, the brain rapidly compares it to prior knowledge, modifies it and makes generalizations. To advance beyond this stage, practice is necessary. Practice comes from textbook problems and on-the-job experience. The facts learned in instruction are "tried out" and a solution is generated through procedures such as analogy. Analogy involves a search for a similar solved problem. The template for the previously problem is mapped onto the current problem to aid in the solution of

the new problem (Gibbins, 1988, p. 59). Marchant (1989) explores the use of analogy in the audit judgment process.

Knowledge is compiled by production rules that identify the conditions when a specific cognitive act should occur. The next time the same problem is encountered, the production rules will be activated automatically to generate a solution. The procedural knowledge contained in the production rules is **specific to the task**, therefore it is often said that experts possess task specific knowledge which is lacking in novices. Gaining an understanding of expertise will require an assessment of the task specific knowledge the expert decision maker brings to the decision.

A sequence of rules may be combined into one rule, after repeated use has shown that these steps go together. This speeds up the decision process because fewer "chunks" of information will be accessed to make a decision. (Short-term memory still contains only four-seven chunks, but the chunks for expert decision makers are larger and they contain more information.) The more often a set of production rules is used successfully, the stronger they become. This allows for more rapid access in the future (Gibbins, 1988, p. 59-60).

One of the goals of instruction should be to create new knowledge structures and the ability to use them. However, it is experience, not instruction, that allows the

production rules to become sufficiently developed for expertise to develop. It is extremely difficult to develop expertise through even a thorough review and study of the text. Almost universally experts report the extreme importance of practice (Gibbins, 1988, p. 60). Through practice knowledge of a single principle is replaced by a bundle of knowledge about how the principle is applied in a variety of circumstances. The importance of practice suggest that the **decision process** may be quite different for experts than for novices. Protocol analysis research (Gibbins, 1988; Johnson, Jamal & Berryman, 1989; Bouwman, 1984; and Biggs, Mock & Watkins, 1988) develops this idea further. The novice may make his decision based on declarative knowledge about the situation. The novice's solution may be deliberately and painstakingly generated. The expert, on the other hand, may categorize the problem as one of a certain type, activate the production rule to solve the problem, and generate a solution automatically and rapidly. Research indicates that expertise must be considered to be task or situation specific. The specific details of what is known and perceived about the problem determine the decision process (Gibbins, 1988, p. 60-61).

To facilitate the discussion of the development of expert judgment, it may be useful to draw a continuum of task-specific judgment expertise. This continuum

encompasses four levels of judgment (listed in order of ascending expertise) naive to the task, educated to the task, experienced to the task, expert to the task. Libby and Frederick (1990) investigate the idea of a continuum of audit experience.

Individuals who are naive to the task know nothing about the task. They have neither experienced the task or been taught anything about the task. These individuals move to the next stage as they gain either education or direct experience with the task.

An educated decision maker has developed a specific knowledge structure for the task. This structure has been built in response to the learning situation and is not based on practice performing the task after learning about the task. This person may understand the components of the decision making process, but his ability to use this information will relate to the learning environment and not to practice with the task (Gibbins, 1988, p. 61). The typical accounting student will be in this category.

An educated decision maker becomes an experienced decision maker through practice in performing the task. The experienced decision maker has specific task-related knowledge structures which have evolved from the educated stage. At this point, the knowledge structures are more detailed and they may be automatic in their functioning.

An expert decision maker is recognized by others as being an expert. The criteria may be descriptive; for example, consistency across judgments or consensus with other auditors, or the criteria may be normative; agreement with authoritative standards or compatibility with rational models of decision making. Perhaps people become experts by using judgment processes that are different from those used by ordinary people. There is evidence that experts in some fields (e.g. chess, computer programming, electronics and radiology) do process information differently than less expert individuals. Empirically therefore, expertise may be correlated with performance quality and judgment method (Gibbins, 1988, p. 61-63). Several research papers consider this possibility. Appendix B examines papers relating to the role of knowledge in the audit decision making process.

APPENDIX B

A REVIEW OF KNOWLEDGE-BASED AUDIT JUDGMENT LITERATURE FROM 1980-1991

Studies of the role of knowledge in audit judgment could be classified by the two main types of methodologies they employ, ANOVA analysis and protocol analysis. In ANOVA studies, the researcher constructs a set of cases that are systematically different from one another. By observing how judgments change from case to case, the researcher is able to estimate the importance of the cues used in the decision making process. In protocol studies, the researcher analyzes verbal data collected by having the decision maker think aloud into a tape recorder while making a decision. The tapes are transcribed and the phrases are classified into predetermined categories according to the researchers' hypotheses.

Audit judgment studies can be further classified into studies that deal specifically with the **knowledge** of the expert auditor and studies that evaluate the **judgment competence** of the auditor in light of the special knowledge possessed by expert auditors. The purpose of the knowledge-based research is to comment specifically on the knowledge structure or memory structure of the decision maker. This

literature is commonly referred to as cognitive science decision research. The purpose of the judgment competence research is to evaluate the judgment of the decision maker based on such measures as consensus, confidence, cue weighting, consistency, insight and accuracy (Choo, 1989, p. 106-107). This body of literature is most often referred to as behavioral decision research.

Table 19 provides a list of studies in the audit judgment area that **deal specifically with the role of knowledge** in the judgment process. While all audit judgment competence studies deal implicitly with the expert's knowledge, only those studies that explicitly recognize the role of knowledge in the judgment process have been included. The cognitive science research has both informed and been informed by the behavioral literature. Accordingly, I use the term "the role of knowledge" to include both the role of knowledge structures in determining expert judgment and the role of task-specific knowledge in influencing the decision of the expert auditor.

Classifications of this type are somewhat arbitrary. Several papers clearly belong in one category or the other, but some of the papers could be placed in either category depending on the orientation of the researcher. It may be helpful to keep in mind the orientation of the two research approaches. The point of knowledge structure research is to

comment on the knowledge or memory structure of the decision maker. The point of judgment competence research is to comment on the judgment of the decision maker. Differences in knowledge are inferred from differences in judgment.

Table 19
Audit Studies From 1980-1991
Relating to
the Role of Knowledge in the
Audit Decision Making Process

Cognitive Science Research (Expert Knowledge)	Behavioral Research (Judgment Competence)
Anova:	Anova:
Weber (1980) Libby (1985) Frederick & Libby (1986) Butt (1988) Marchant (1989) Libby & Frederick (1990) Frederick (1991)	Abdolmohammadi & Wright (1987) Bonner (1990) Bonner & Lewis (1990) A. Ashton (1991)
Protocol Analysis:	Protocol Analysis:
Bouwman (1984) Biggs, Mock, & Watkins (1988)	Biggs & Mock (1983)

Papers using ANOVA analysis will be discussed in the sections that follow. For additional information regarding protocol analysis, please see appendices D and E. Protocol researchers use a very different methodology in the

execution of their research and for this reason the specific papers will not be discussed at greater length.

Cognitive science research - ANOVA analysis

A summary of expert knowledge literature from 1980-1991 reveals two types of contributions. First, all cognitive science papers contribute to an understanding of the nature of experience related knowledge differences. Second, though all studies suggest increasing methodological sophistication as researchers study expert knowledge, several projects are particularly important for developing research methods appropriate to the study of such structures. In brief, this literature shows the development of a classification of experience-related knowledge differences. Within the literature of the period (following the cognitive process categories used by Gibbins [1984]) these knowledge structure differences can be categorized in the following way: (1) accumulated knowledge; (2) the thought process; and (3) the decision. Appendix D summarizes specific knowledge differences that are treated in this literature.

In the context of this general development of a classification for experience-related knowledge differences, from Weber (1980) through the 1980's, several projects show the increasing sophistication in developing methods for investigating the knowledge of experts, thus adding to our

understanding of knowledge and how it affects expert judgment. Appendix E summarizes research contributions concerning these methodological developments in this area.

Weber (1980) was the first auditing paper to relate differences in memory processes to judgment differences between expert and novice decision makers. This paper provides a major contribution to the audit literature because it suggests that expertise can be understood by examining differences in the memory structure of experts and novices. Previous researchers tried to understand expertise by documenting **judgment** differences between experts and novices. However, such researchers failed to document judgment differences consistently (for a review of this literature, see Wright, 1988; Bedard, 1989; or Johnson, Jamal, Berryman, 1989). Behavioral researchers were led to the conclusion that there were no differences between expert and novice decision makers based on the results of their experiments. Weber introduced a new research method from psychology, free recall, to determine whether EDP auditors exhibited consensus in the ways they organized computer controls during the recall process, speculating that perhaps the lack of consensus in judgment resulted from a lack of consensus in the organization of the expert's memory. The results of his experiment show some evidence of consensus among auditors in the way they organize computer controls.

EDP auditors recalled more cues and clustered cues by control categories better than the student subjects. This result supports the contention that the organization of memory is a relevant dimension of expert judgment.

Libby (1985) examines the auditor's use of stored knowledge (from past experience) to generate hypotheses that explain financial statement errors. The stated purpose of his research is to gain some understanding of the knowledge structure of the auditor. The ability to **diagnose** financial statement errors and provide hypotheses to explain them is a key element of audit expertise and may be one of the most important factors that distinguishes expert from novice decision making (Elstein & Bordage, 1978).

Previous auditing studies (e.g. Ashton, 1974) used highly structured tasks wherein the subject is given a small number of cues and asked to make a decision. In contrast with this work, Libby recognized that many accounting decisions involved unstructured decision tasks. Libby's more complex method presumed that in unstructured problem situations the decision maker takes an active role in the decision process-generating hypotheses and searching for information. The task structures as defined by earlier researchers did not take such decision making activity fully into account. In view of the complexity of unstructured problem situations (which more closely resemble actual audit

situations than do the structured problems examined by earlier research) Libby (1985) and subsequent research which is interested in the expert's knowledge find it important to delineate a research task that uses the knowledge stored in the expert's memory. Hypothesis generation is thought by Libby (1985) and his successors to be such a task because hypothesis generation is based on the past experiences of the decision maker. Several subsequent Libby research papers and their successors also use this particular mode of task definition. In addition to Libby's successors in this field, the unstructured nature of the audit process was also recognized by later judgment competence researchers. (See Abdolmohammadi and Wright (1987) for an example of judgment competence research dealing with this concept.)

The current research project is closely modelled after the Libby (1985) paper. The current project asks subjects to **diagnose** financial statement errors and to **provide hypotheses** to explain them. As noted by Libby, the ability to diagnose errors and to provide hypotheses to explain them is a key element of audit expertise. This ability may be one of the most important factors that distinguishes expert from novice decision making. Such a task should tap the **expertise** of the decision maker.

Libby (1985) in the effort to work within the complexity of unstructured problem situations, makes three

contributions to the knowledge structure literature. First, it provides information about the relationship between the knowledge structure of the expert auditor and the decision behavior of the auditor. Past knowledge concerning financial statement errors is used by the auditor in the decision making process to form hypotheses regarding current financial statement errors. Second, Libby presents evidence of the recency effect in the audit setting. (This recency effect has been also considered in subsequent audit research [e.g. Tubbs, Messier, & Kneckel, 1990; Ashton & Ashton, 1988]). Third, Libby provides additional support for Weber's finding regarding the organization of the expert's memory, indicating that memory organization is a relevant dimension of expertise.

Like Weber (1980) and Libby (1985), Frederick and Libby (1986) is an excellent example of a research methods paper. The authors are interested in how the auditor's memory store interacts with current audit evidence to produce a judgment. To investigate this issue, they considered the knowledge necessary to perform the task, the stage at which such knowledge is acquired, and how the knowledge is brought to bear on the decision task. Advance specification of these three elements using the conjunctive fallacy theory allows the authors to make directional predictions about the decisions of experts and novices.

Frederick and Libby construct an experimental design varying the target stimuli, the context of the task, and the experience level of the participants. They use a simple prediction task where experienced auditors and student subjects predict the financial statement error implications of internal control weaknesses. This task requires two types of knowledge: knowledge of the double-entry accounting system and knowledge of the relationship between internal control weaknesses and account errors. Experienced auditors have both types of knowledge, while students have only the former. This knowledge difference is the basis for predicting a difference in decisions between auditors and students.

The Frederick and Libby (1986) paper provides several incremental contributions to the search for more sophisticated methods of examining the knowledge of experts in the literature under consideration. The results of the study are secondary in importance to the method which Frederick and Libby employed. The design of the paper allowed for an unambiguous demonstration of the effects of knowledge. The authors developed advance hypotheses about the effects of knowledge on the decision. They described how knowledge should affect the decision by making specific directional predictions about the effects of knowledge. They established a rivalry between different elements of

knowledge by manipulating the target stimuli, the context and the level of experience of the decision maker. The method employed by the researchers illustrates how consideration of the task-specific knowledge needed to complete the task and the process by which that knowledge is brought to bear on the task can lead to testable predictions concerning the role of knowledge in audit judgment. This paper illustrates an efficient method of some sophistication for use in demonstrating knowledge differences. (Several judgment competence papers followed this approach. See Bonner (1990) for an example.)

Butt (1988) builds upon Libby (1985). It examines whether the accuracy of frequency information for financial statement errors is influenced by how the frequency knowledge is acquired, either directly or indirectly, and whether expert and novice decision makers differ in the accuracy of their frequency estimates. By contrast, Libby (1985) had examined frequency judgments using only expert subjects, so expert-novice differences in this area had not previously been considered. Nor had Libby provided the subjects with frequency information, but rather elicited this information. Another interesting aspect of the Butt study, when compared with Libby (1985) is her use of a control group, comprised of auditors and students, to determine whether experts are better than novices at all

frequency estimation tasks, or only at tasks for which they have domain-specific knowledge.

Butt develops her research questions using a model of learning from experience suggested by Waller and Felix (1984) and Gibbins (1984). In particular she is interested in the question: does the presence of a preexisting mental structure of financial statement errors assist the decision maker in making frequency judgments? The experimental results suggest that auditors are more accurate in their judgments than students because they possess an organized knowledge structure where experimental information can be stored.

Employing these techniques, Butt (1988) makes several important contributions to the expert knowledge literature. Results indicate that frequency judgments based on direct experience were most accurate for both expert and novice decision makers and that frequency judgments based on indirect experience were least accurate for both classes of decision makers. Neither result is particularly surprising, although this had not been demonstrated previously in this unstructured audit setting. Another interesting result is the finding that indirect experience, when combined with direct experience, has a significant impact on judgment accuracy. This discovery has practical implications for designing training programs for CPA firms. Training

programs in CPA firms could be designed to include summary frequency information after the auditor has received the appropriate on-the-job experience, to increase the accuracy of frequency information on the part of the auditor. In this way, auditing firms have the opportunity to have some control over how auditors learn about the frequency of occurrence of errors. Given the results of A. Ashton (1991), training programs on error frequency information may be particularly useful given that auditors fail to receive sufficient direct experience in many areas to develop accurate estimates of any but the most frequently occurring errors.

Further results suggest that auditors performed slightly better than students in the auditing task, but there were no signs of expert-novice differences in the generic task. This indicates that experts are not superior to novices at all tasks, but only those in their domain of expertise. Research in other areas has suggested this fact, but there was little evidence in the audit area to confirm or disconfirm this hypothesis.

Marchant (1989) adds yet another increment to this literature's treatment of methods for examining knowledge structure. He examines the role of analogy and experience in a hypothesis generation task. To understand the role of experience and professional judgment, Marchant assumes that

both the characteristics of the expert's specialized knowledge and the mechanisms for its use must be determined. Marchant presents analogy as one mechanism that expert auditors use to access their specialized knowledge structure.

The results of Marchant's study indicate that experts used analogous reasoning in one of the treatment conditions (the performance condition), but not in the other (the timing condition). Marchant hypothesizes that the difference in the two conditions might best be explained by the results of Libby (1985). Libby had demonstrated that experts form probability estimates for errors that are based on their beliefs about the frequency of errors from past experience. They tend to select the errors they believe occur more frequently over errors they believe occur less frequently. In the Marchant study, experts estimated the timing error to be more likely than did novices, but believed the performance error was less likely than novices. Novices estimated the error frequencies to be about the same. Experts who believed the timing error to occur more frequently than the performance error did not need to rely on analogy to generate the timing error. Instead they based their estimate on domain specific knowledge.

The results of Marchant's experiment confirm the hypothesis that auditors will use analogical reasoning to

generate a potential hypothesis in an unusual situation. When the situation is more familiar, expert strategies are based on domain specific knowledge rather than analogy and a difference in performance between experts and novices is apparent. In other words, the main contribution of this paper to the expert knowledge literature is the support it provides for the domain specific error frequencies reported in Libby 1985. The finding that auditors rely on analogy to generate error hypotheses in certain unfamiliar situations is not as interesting as the fact that they abandon the analogy strategy and switch to a task-specific knowledge strategy in situations that are familiar to them.

Libby and Frederick (1990) investigate how experience-related differences in the content and structure of the auditors' knowledge of financial statement errors allow experienced auditors to direct their search activity so it is efficient and effective. The authors speculate that as auditors gain experience, certain changes in their knowledge content and structure occur. Learning they surmise, may add new financial statement errors to the knowledge structure, changing the way errors are categorized.

The incremental contributions of this paper are evident in both the method employed in the research design and the results of the study. The authors examined a less structured task where knowledge differences are more likely

to be found between experts and novices. They specified the expected knowledge differences in advance (making directional predictions) and the mechanisms through which they would affect judgment. The results provide evidence of expert-novice differences; evidence which previous decision making research had been unable to document consistently. Specific experience-related knowledge differences include: experienced auditors have more plausible errors in memory than less experienced auditors, experienced auditors are more accurate in their knowledge of error frequencies and are more likely to use this information to generate hypotheses, and experienced auditors have developed a transaction cycle dimension to their knowledge structure, allowing them to cluster cues and generate hypotheses more quickly. These experience-related knowledge differences are advantages that one might hope an expert would have, but had proven difficult to document in judgment competence research. (A. Ashton (1991) uses information reported in Libby (1985) and Libby and Frederick (1990) to investigate the auditors' knowledge of error frequencies in greater detail.)

Libby and Frederick (1990) also provide preliminary evidence of a continuum of audit experience. The subjects for this experiment included fifth year auditors, second year auditors and students. There were significant

performance differences between the second and fifth year auditors, but the largest and most consistent differences were between the experienced auditors and students.

Frederick (1991) examines the memory structures of experienced and inexperienced auditors. Two kinds of memory organization are considered: (1) a taxonomic organization, (e.g. internal control checklists; and (2) a schematic organization, (e.g. internal control flowcharts). This paper presents a continuation of the research agenda suggested by Weber (1980) and builds on the work presented in Libby and Frederick (1990).

Frederick (1991) uses a free recall task (e.g. Weber, 1980) to examine the memory structure of auditors and novices in the area of the organization of internal controls. In addition to examining how different organizations of memory affect free recall, this paper investigates how the organization of memory affects cued recall. Auditors and students are exposed to both a taxonomic and schematic organization of computer controls. The organizational principles of these methods of memory structures suggest that a greater number of cues will be recalled by the expert when retrieving internal control knowledge from a schematic memory structure rather than a taxonomic memory structure, but there will be no difference in recall for the student.

The results of this experiment provide the following information: (1) experts do not prefer one organization method over another; (2) subjects who chose the schematic method misclassify fewer internal controls than those who sort taxonomically; (3) experts recalled more cues from a schematic organization than a taxonomic organization; (4) novices retrieved internal controls equally from either organizational method; (5) auditors recalled more internal controls than novices; (6) subjects in the schematic condition clustered their output more than those in the taxonomic condition; (7) experts clustered their recall lists more than novices; (8) both experts and novices order their output to a greater extent in the schematic condition; and (9) experts and novices in both conditions were affected by output interference.

The incremental contribution of this paper lies in the way that this particular research method is used to demonstrate that the memory structure of individuals makes a difference in how knowledge is recalled. Auditors freely recalled more controls when the controls were organized by transaction flow. Novice subjects do not possess complete knowledge organizations (they lack experience which fills in the structure), so the type of representation does not affect their recall of controls.

Behavioral research - ANOVA analysis

Abdolmohammadi and Wright (1987) examined the effect of experience and task complexity on auditor judgment. This research study varied both the experience level of the auditors and the tasks performed. Abdolmohammadi and Wright compared the performance of experienced and inexperienced auditors on three types of tasks: structured, semi-structured, and unstructured audit tasks. The results show significant performance differences between experienced and inexperienced auditors for both unstructured and semi-structured tasks, but no differences for the structured task.

The incremental contribution of this paper lies in its use of task complexity to study expertise. Previous research projects used structured tasks to demonstrate expert performance. The Abdolmohammadi and Wright paper suggests that differences between experienced and inexperienced auditors are most apparent for unstructured audit tasks.

Bonner (1990) examines the role of task-specific knowledge for expert performance. This research project considers the role of task-specific knowledge in the selection and weighting of cues for two audit tasks, analytical risk assessment and control risk assessment. Unlike the Abdolmohammadi and Wright (1987) research

project, which varied the characteristics of the tasks in the structured and unstructured category, Bonner (1990) holds the task characteristics (other than knowledge differences) constant and varies the experience level. Bonner predicts large experience-related knowledge differences on the analytical risk task and small knowledge differences on the control risk task. Both inexperienced and experienced auditors have sufficient knowledge to perform the control risk assessment task, but only experienced auditors have sufficient knowledge to perform the analytical risk assessment task. The results of her experiment support the predictions.

The contribution of the Bonner (1990) paper lies in its emphasis on the importance of task-specific knowledge for demonstrating expert performance. Bonner suggests that to examine experience effects in auditing, it is important to consider the knowledge necessary to complete the task and when it is normally acquired. Failure to do so will make it more difficult to demonstrate expertise.

Bonner and Lewis (1990) consider the factors which determine auditor expertise. They view expertise as arising from knowledge created by **specific** experiences and training. This knowledge is combined with innate ability to perform specific audit tasks. Bonner and Lewis consider three types of knowledge (general domain knowledge, subspecialty

knowledge, and world knowledge) and one type of ability (problem-solving ability). Depending on the task, expert performance will require one or more of these types of knowledge and problem-solving ability. Because the different types of knowledge are acquired by the decision maker through different experiences and training, they predict that knowledge and ability will explain more of the variation in performance than years of experience. The results of their study indicate that experienced auditors outperform less experienced auditors, but knowledge and problem-solving ability provide a better explanation of variation in performance than years of experience.

The problem-solving ability measure developed in Bonner and Lewis (1990) will be used in the current research project.

A. Ashton (1991) considers three research questions: (1) how many audits in a particular industry does an auditor experience; (2) what do auditors know about the relative frequencies actually associated with the population of financial statement errors discovered during an audit; and (3) do more experienced auditors have more accurate error frequency knowledge than less experienced auditors? These questions are of interest to audit researchers because analyses of audit judgment have suggested that frequency

knowledge regarding accounting errors is acquired by experience and is an important component of audit expertise.

The results of her study show that even experienced auditors have limited experience with financial statement errors. Auditors seem to know only the most frequently occurring error effects and causes. The differences in auditors' knowledge of error effects can not be explained by years of experience, number of clients audited in an industry, or industry-specific audit experience.

These results suggest that audit experience should be viewed as being task-specific, rather than as an overall general level of experience and expertise.

Protocol research

Contributions from the protocol research are listed in Appendices D and E. Please refer to these exhibits for additional information regarding protocol analysis.

APPENDIX C

GIBBINS' PROPOSALS REGARDING PROFESSIONAL JUDGMENT

Accumulated learning

1. Experience produces structured judgment guides, referred to as templates. A specific memory structure exists which provides a guide to the judgment process and the appropriate response.

    a. These templates exist prior to the event triggering their use.

    b. Greater experience is associated with more efficient use of memory.

    c. The template guide is more complete for more frequently experienced tasks.

2. Templates are maintained in long-term memory.

3. The attributes of the template are shaped by the environment.

    a. Some templates can be accessed faster, with fewer retrieval cues.

Testable hypotheses

1. Public accountants will have a more immediate response to situations in which they have more experience.

2. A more-experienced public accountant will develop response preferences faster than will a less-experienced accountant, benefiting from the efficiencies of having more developed judgment guides.

3. Because they are generated by a structure which accumulates past experience, response preferences will display a conservative tendency.

4. The response preferences of experienced public accountants will reflect direct experience more than classroom or other indirect learning.

The stimulus

1. The environment is subjectively perceived.
    a. Factors which limit perception also limit judgment.
2. Templates are continuously updated.

Testable hypotheses

1. Because individual public accountants' experiences, learning, and perceptions differ, response consensus will not occur naturally.

2. Any preference changes due only to perceptual changes will be comparatively weaker and unstable.

The thought process

1. Judgment is a continuous process.

2. Judgment is an incremental process. Judgment proceeds incrementally rather than by gathering full information and integrating it all before making a judgment.

a. For routine judgments, immediate implications of the decision will determine the decision.

b. Routine judgments will be made to keep one's future options open.

3. Judgment is a conditional process. Each state in the incremental judgment process is conditional on the information received in the previous stage.

4. Judgment begins with a search for a template. When a decision is called for, the immediate mental response is to search long-term memory for an existing template.

a. The search-retrieval process is cue-driven and may appear to use little information.

5. Template selection depends on circumstantial fit. The selection of a template is made by matching current information to information experienced as the template was learned.

a. The template selection process depends on matching the present situation with past learning, so it is not a forward looking process.

b. Perception and search will continue until a template is found.

6. Routine judgment is not conscious. People do not have access to their own higher mental processes.

a. After a judgment is made, explaining the judgment will require developing plausible rationalizations.

b. After-the-fact explanations will correlate with the individual's frequently used templates.

7. The judgment environment is incompletely perceived.

8. Personal characteristics of the decision maker affect template selection.

Testable hypotheses

1. The judgment process is likely to lack a clear beginning or end.

2. The judgment process will typically be manifested by a series of relatively minor actions, each chosen in the expectation of receiving feedback before the next action is needed.

3. The judgment of an experienced public accountant will be more intuitive than that of a less-experienced accountant, because the former has more templates to rely on and less need to think consciously through a judgment.

<u>The response</u>

1. Templates specify conscious response preferences.

a. Decisions are subject to perceptual and cognitive imperfections of the judgment process.

b. Decisions are based on events the decision maker has experienced.

2. Preferences and actions are consciously bridged.

3. The bridging process is causally, not probabilistically determined.

a. Actions are connected to consequences in causal terms.

4. The decision must be justifiable.

a. Some of the information gathered is to justify the choice, not make it.

b. Explanations of decision involve rationalization.

5. Evaluations tend to emphasize the "worst-case". Risk of loss is more important than opportunity for gain.

Testable hypotheses

1. Because decisions are inputs to the risk evaluation, a public accountant confronted with a new rule or standard will tend to alter the action before altering the preference.

2. Because of the importance of justification and the presence of retrospective rationalization, public accountant's explanations of their own judgments will be biased toward their perceptions of acceptable ways of making judgments.

3. Public accountant's perceptions of probabilities associated with even very common judgment consequences will be vague and not naturally quantified.

4. Public accountants' perceptions of risk will involve such non-probabilistic factors as exposure, precedent, or consistency, or worst possible outcome.

APPENDIX D

A SUMMARY OF SPECIFIC KNOWLEDGE DIFFERENCES FROM THE KNOWLEDGE STRUCTURE LITERATURE

Accumulated knowledge of the decision maker

1. The memory of experienced auditors is organized into appropriate categories, based on experience (Weber, 1980; Libby, 1985; Frederick, 1991).
2. The accumulated knowledge of the auditor assists the auditor in making judgments, improving the accuracy of the judgment (Butt, 1988).
3. Experienced auditors have more plausible errors in memory than less experienced auditors (Libby & Frederick, 1990).
4. Experienced auditors are more accurate in their knowledge of error frequencies than less experienced auditors (Libby & Frederick, 1990).
5. More experienced auditors exhibit significant performance differences over less experienced auditors in a hypothesis generation task (Libby & Frederick, 1990).
6. Expert auditors organize their memory using both taxonomic and schematic organization (Frederick, 1991).

7. More experienced auditors seem to have more complete memory structures, which permits a more efficient processing of information relevant to the decision (Biggs, Mock, & Watkins, 1988).

Thought process of the decision maker

1. Experienced decision makers display recency effects (Libby, 1985).

2. Experienced decision makers use knowledge from past experience to form hypotheses that guide audit work (Libby, 1985).

a. Experienced decision makers do not generate subsequent hypotheses from the same transaction cycle when given prompts (Libby, 1985).

3. Experienced decision makers use analogy to generate hypotheses in unusual situations, but switch to domain-specific knowledge when the situation is more familiar (Marchant, 1989).

4. Experienced auditors are more likely to use their knowledge of error frequencies to generate hypotheses (Libby & Frederick, 1990).

5. Atypical prompts have greater affects than typical prompts on the cycle membership of errors generated by experienced subjects (Libby & Frederick, 1990) (This result modified the conclusion from 2a. The result reported for 2a is for typical prompts.)

6. Auditors recalled more internal controls than novices (Frederick, 1991).

7. Experts auditors using schematic organization of memory cluster their output according to categories more than subjects using taxonomic organization (Frederick, 1991).

8. Expert and novice subjects are affected by output interference (Frederick, 1991).

9. Experts rely on rules of thumb when evaluating data. They also examine more years of data than novices (Bouwman, 1984).

10. To determine what data to examine, experts rely on a structured checklist approach to guide their analysis. In contrast to this, novices employ a passive, sequential strategy, paying attention to only surface features of the data (Bouwman, 1984; Biggs, Mock, & Watkins, 1988).

11. Experts use a directed search strategy to examine data. They develop an overall understanding of the company. Novices fail to do either (Bouwman, 1984; Biggs, Mock, & Watkins, 1988).

12. Experts focus on potential contradictions when reviewing data. Novices "link together findings that explain each other". Information that doesn't fit is ignored by novices (Bouwman, 1984).

13. Experts summarize groups of related findings, formulate hypotheses and use a list of typical problems in their data

analysis. Novices fail to perform these tasks (Bouwman, 1984).

The decision

1. Experienced auditors recall more cues than inexperienced auditors and are more likely to cluster cues by categories (Weber, 1980; Frederick, 1991).

2. Audit judgments by expert auditors are more likely to suffer from the conjunctive fallacy than novice judgments (Frederick and Libby, 1986).

3. Auditors are more accurate in their judgment than students (Butt, 1988).

4. Frequency judgment based on direct experience of error frequencies are most accurate for experts and novices (Butt, 1988).

5. Frequency judgment based on indirect experience of error frequencies are least accurate for experts and novices (Butt, 1988).

6. Indirect experience has a significant impact on judgment accuracy when combined with direct experience (Butt, 1988).

7. Decisions made by auditors outside their area of expertise do not differ from decisions of novices (Butt, 1988).

8. Subjects using the schematic organization for memory misclassify fewer internal controls than those who use taxonomic organization (Frederick, 1991).

9. Experts recalled more cues from a schematic organization than a taxonomic organization, while novices recalled internal controls equally from both organizational methods (Frederick, 1991).

APPENDIX E

A SUMMARY OF RESEARCH METHOD CONTRIBUTIONS FROM THE COGNITIVE SCIENCE LITERATURE

1. Methods from psychology, such as free recall, may enable researchers to investigate questions of interest in audit judgment (Weber, 1980).
2. Using unstructured audit tasks to investigate expert-novice differences may improve the researcher's understanding of the expert decision process (Libby, 1985).
3. Advance specification of the knowledge necessary to complete the judgment task, when it is acquired, and how it is brought to bear on the judgment will improve the researcher's ability to examine expertise in problem solving (Frederick & Libby, 1986).
4. Analogy may be an appropriate method for investigating questions of interest in audit judgment (Marchant, 1989).

APPENDIX F

SUMMARY OF MEASURES FOR MANAGERIAL ROLE DIMENSIONS

Table 20
Managerial Role Dimensions

Name of Variable	Nature of Variable	Questionnaire Reference
1. Role history	(a) length of employment	p. 2 #1
	(b) number of different positions	p. 2 #2
	(c) length of time	p. 2 #3
	in current position	p. 2 #4
2. Role formalization	Extent to which manager's role is formalized by prescription in official documents.	p. 2 #5
3. Role definition	Extent to which managers perceive their jobs and authority to be constrained.	p. 10 #1
4. Role routine	Extent to which managers perceive their work to involve familiar problems.	p. 10 #4
5. Everyday routine	Extent to which managers perceive their work to be highly programmed.	p. 10 #5
6. Long-term stability	Extent to which managers anticipate little year to year change in the content of their job.	p. 10 #6
7. Perceived authority	The scope of authority managers perceive themselves as possessing.	p. 11 #7

Table 20 (continued)

Name of Variable	Nature of Variable	Questionnaire Reference
8. Role performance	(a) perceived job competence	p. 11 #8
	(b) job satisfaction	p. 11 #9
9. Conflict between managers	Extent to which a manager perceives his colleagues to find difficulty in problem solving.	p. 11 #10
10. Self-attributed influence	Relative degree of influence which an individual believes he has in the organization.	p. 12 #11

APPENDIX G

QUESTIONNAIRE

Preliminary Planning Audit Procedures

I am interested in studying the decision making process of auditors as they are involved in planning the audit.

As part of your job as an auditor, you are asked to perform many tasks. In this study you will be asked to review a set of financial statements for BCS, Inc. and to make a series of decisions in planning the audit of the company. The decisions you make will be typical of those made by an auditor during the preliminary planning stage of the audit. You should consider each problem separately in making your decision. For example, the decision you make on the first problem should not affect your decision on problem two.

For purposes of standardization, please work all questions in the order given. Please finish each problem before going on to the next problem. Do not refer to earlier pages after you have completed them. You should record all your answers in the space provided in the questionnaire. Your answers to the questions on page 14-18 should also be recorded on the computerized scoring sheet enclosed. Please transfer your answers to these questions to the computer scoring sheet to facilitate evaluation of the data.

Please work completely alone on this exercise. Do not compare answers with other auditors in your office who may be completing similar questionnaires. Completion of this questionnaire should take approximately 30 minutes.

All responses will be kept **strictly confidential**. When you have completed the questionnaire, please return it directly to me in the envelope provided. Return the green card to the office coordinator.

Thank you for your cooperation. I appreciate your assistance in completing this questionnaire. The information regarding your audit experience is very valuable to me.

Work Experience

1. How many months have you been employed as an auditor at your firm?

_____ months

2. How many different positions have you held since joining the organization? Please list the positions.

_____

_____

_____

3. What is the title of your current position?

_____

4. How long have you been in your most recent position?

_____ less than 1 year _____ 1-2 years
_____ 3-4 years _____ more than 4 years

5. Is there a written job description for your job?

_____ Yes _____ No

6. Have you previously worked for any other public accounting firms? _____ No _____Yes

If yes, please specify the firm, the nature of your employment and the length of your employment.

_____

_____

7. What percentage of your time have you spent working in the following industries during your employment as an auditor?

Industry	Estimated Percentage
Insurance and Banking	_____
Manufacturing	_____
Wholesale/Retail	_____
Not for Profit	_____
Other (Please specify)	_____
Total	100%

Instructions

In this questionnaire you will be asked to complete two types of problems: (1) identification of financial statement errors caused by internal control weaknesses; and (2) identification of errors in client prepared financial statements using ratio analysis. Directions for the internal control problems will be provided as needed. Instructions for ratio analysis follow.

Ratio Analysis:

Auditors often use ratio analysis in the preliminary planning stage of an audit to identify specific accounts that need additional attention during an audit. In the following cases using ratio analysis, you will be given three sets of financial ratios. The ratios in the first column are **prepared by the client** based on their current year unaudited statements. The ratios in the second column are **prepared by your audit firm** based on projections computed from BCS, Inc's current year financial statements. The ratios in the third column are based on prior year audited financial statements.

The two audit assistants assigned to work with you on this audit have some questions regarding the differences between the ratios in the first two columns. The auditor's projections are based on the results of the first three

quarters, past audited balances, and industry trends. You have previously reviewed the projections, and you are confident that they are based on sound assumptions and information. You have no reason to believe that conditions have changed to affect the projections.

Your task is to examine the ratios given in each situation and to help your assistants identify the cause of the discrepancy. Assume that any financial statement error is caused by a **single mistake or multiple occurrences** of the same mistake. You may assume that the errors are not in the calculation of the ratios. **All errors can be corrected by a balanced journal entry.** You will be asked to determine the most likely error in each case for differences between the ratios calculated by the client from their unaudited numbers and the ratios calculated by your audit firm based on projected numbers for 6/30/91.

Please review the financial statements and other relevant information relating to this company found on the last three pages of this document. When you are ready to proceed, please turn to the next page.

1. Internal Control Analysis.

During the preliminary planning stage of this audit, you discover a weakness in the internal control system. The current year documentation, review, and update of the internal control system has disclosed a weakness caused by heavy personnel attrition. Based on the fact that we know a weakness exists in internal controls, we will not perform compliance tests to test the internal control system, but will instead perform substantive procedures on the purchase cycle. Given the following weakness in the internal controls over accounts payable, list three <u>important</u> financial statement errors (including the accounts overstated or understated) that could occur and not be detected by the control system.

Internal control weakness: Checks are generated by BCS, Inc. based solely on the original invoice. There is no comparison made between the invoice, the purchase order or the receiving report.

Financial statement errors:

1. _____

_____

2. _____

_____

3. _____

_____

Next, list two substantive audit procedures that would be useful in detecting such errors.

1. _____

_____

2. _____

_____

Go on to the next page when you have completed all questions on the current page.

2. Internal Control Analysis.

During the preliminary planning stage of this audit, you discover a weakness in the internal control system. The current year documentation, review, and update of the internal control system has disclosed a weakness caused by heavy personnel attrition. Based on the fact that we know a weakness exists in internal controls, we will not perform compliance tests to test the internal control system, but will instead perform substantive procedures on the revenue cycle. Given the following weakness in the internal controls over accounts receivable, list three <u>important</u> financial statement errors (including the accounts overstated or understated) that could occur and not be detected by the control system.

Internal control weakness: Independent operation of sales, shipping, billing and accounts receivable departments could not be achieved.

Financial statement errors:

1. _____

_____

2. _____

_____

3. _____

_____

Next, list two substantive audit procedures that would be useful in detecting such errors.

1. _____

_____

2. _____

_____

Go on to the next page when you have completed all questions on the current page.

3. Ratio Analysis.

Ratio	6/30/91 (Unaudited) By Client	6/30/91 (Projected) By Auditor	6/30/90 (Audited)
Current ratio Current assets / Current liabilities	0.823	0.851	0.776
Quick ratio Cash + Receivables / Current liabilities	0.323	0.272	0.281
Gross Margin % Gross Profit / Sales	0.480	0.480	0.460
Inventory turnover Cost of goods sold / Ending inventory	12.677	7.541	8.836
Accounts receivable turnover Sales / Ending accounts receivable	23.354	23.354	24.926

a. List the accounting error that you believe would account for all the unexpected changes in the ratios.

b. Prepare the journal entry to correct the error assuming the books are not closed. You may list the accounts debited and credited without dollar amounts.

4. Ratio Analysis.

Ratio	6/30/91 (Unaudited) By Client	6/30/91 (Projected) By Auditor	6/30/90 (Audited)
Current ratio Current assets / Current liabilities	0.825	0.851	0.776
Quick ratio Cash + Receivables / Current liabilities	0.220	0.272	0.281
Gross Margin % Gross Profit / Sales	0.480	0.480	0.460
Inventory turnover Cost of goods sold / Ending inventory	6.980	7.541	8.836
Accounts receivable turnover Sales / Ending accounts receivable	29.572	23.354	24.926

a. List the accounting error that you believe would account for all the unexpected changes in the ratios.

b. Prepare the journal entry to correct the error assuming the books are not closed. You may list the accounts debited and credited without dollar amounts.

5. Ratio Analysis.

Ratio	6/30/91 (Unaudited) By Client	6/30/91 (Projected) By Auditor	6/30/90 (Audited)
Current ratio Current assets / Current liabilities	0.865	0.851	0.776
Quick ratio Cash + Receivables / Current liabilities	0.272	0.272	0.281
Gross Margin % Gross Profit / Sales	0.479	0.480	0.460
Inventory turnover Cost of goods sold / Ending inventory	7.277	7.541	8.836
Accounts receivable turnover Sales / Ending accounts receivable	23.354	23.354	24.926
Account Balances			
Inventory	$ 76,852,500	74,040,000	
Current assets	165,157,500	162,345,000	
Net Income	71,335,299	69,630,018	
Sales	1,072,980,000	1,072,980,000	

a. List the accounting error that you believe would account for all the unexpected changes in the ratios.

b. Prepare the journal entry to correct the error assuming the books are not closed. You may list the accounts debited and credited without dollar amounts.

Background Information

Please circle your response to the following questions.

1. How precisely are your responsibilities determined by the firm in performing analytical procedures?

1	2	3	4	5	6	7	8	9
Not Very Precisely								Very Precisely

2. How important a tool is analytic review for planning audit steps?

1	2	3	4	5	6	7	8	9
Not Very Important								Very Important

3. How confident are you about your use of analytical review?

1	2	3	4	5	6	7	8	9
Not Very Confident								Very Confident

4. How often do completely unforeseen things happen in your job?

1	2	3	4	5	6	7	8	9
Not Very Often								Very Often

5. How often do your working days follow a similar pattern to one another?

1	2	3	4	5	6	7	8	9
Not Very Often								Very Often

6. How much of the content of your current job has changed in the past year?

1	2	3	4	5	6	7	8	9
None								All

7. Please respond to the following question: I have complete authority on routine matters, but refer the majority of unusual items to my superior for approval.

1	2	3	4	5	6	7	8	9
Not Very Often								Very Often

8. How competent are you in the performance of your job?

1	2	3	4	5	6	7	8	9
Not Very Competent								Very Competent

9. How satisfied are you with your job?

1	2	3	4	5	6	7	8	9
Not Very Satisfied								Very Satisfied

10. How much difficulty do supervising seniors and managers in your organization have on reaching agreement on the resolution of an accounting issue which is open to interpretation?

1	2	3	4	5	6	7	8	9
No Difficulty								A Great Deal of Difficulty

11. Below are listed a number of people in your organization. How much actual say or influence does each of them have in determining what goes on in your organization with respect to making decisions relating to client matters?

Assistant/Staff

1	2	3	4	5	6	7	8	9
Not Very Great Influence								Very Great Influence

Senior or Supervising Senior

1	2	3	4	5	6	7	8	9
Not Very Great Influence								Very Great Influence

Manager

1	2	3	4	5	6	7	8	9
Not Very Great Influence							Great	Very Influence

Partner

1	2	3	4	5	6	7	8	9
Not Very Great Influence							Great	Very Influence

12. Given the financial statement errors that you have encountered in the audit process, what percentage of these would you estimate were initially detected by an analytical review procedure?

_____%

13. Based on your experience, in the audit of a manufacturing client, how recently have you encountered the following types of errors that result in an audit difference?

Use the following scale to record your responses. Be sure to consider all errors that would require adjustment in preparation of the financial statements.

1 - Most recent error.
2 - Next most recent error.
3 - Third most recent error.
4 - Error encountered, but not recently.
5 - Never encountered this error.

1. Bad debt expense and allowance either not recorded, or understated or overstated. _____
2. Goods returned by customer in current period either not recorded or recorded in incorrect time period. _____
3. Current period purchases on account not recorded or recorded in the next period. _____
4. Payments on account recorded but not made or overrecording of such payments. _____
5. Accrued expenses and payables either not recorded or underrecorded. _____
6. Purchase returns recorded but goods not returned or returned next period. _____
7. Current portion of long-term debt improperly classified as noncurrent. _____
8. Marketable securities not written down to lower of cost or market. _____
9. Expense payments made but not recorded or underrecorded. _____
10. Next period's credit sales recorded in the current period. _____
11. Expense items improperly classified as inventory. _____
12. Sales to valid customers are not recorded. _____

Circle the answer that best describes your agreement with each statement. You should use the middle column only when you cannot decide if you agree or disagree. Be sure to answer every question in terms of what you like and how you behave at the present time, and not in terms of what you think you should say or how you behave.

There are no right or wrong answers. The right answer is the answer that describes how you think or feel about the statement. Use your peers at work as your reference point in evaluating your characteristics and attitudes. Please record your answers for questions 1-46 on the computer sheet enclosed, using a No. 2 pencil.

		Agree	?	Disagree
1.	I always do my best at any job I undertake.	A	B	C
2.	I have been described by others as being lax on occasion.	A	B	C
3.	I tend to make decisions somewhat impulsively.	A	B	C
4.	At times I am a cold and aloof person.	A	B	C
5.	On occasion, I lack a sense of responsibility.	A	B	C
6.	I almost always plan things in advance at work.	A	B	C
7.	I tend to be calm and relaxed at work.	A	B	C
8.	I find it difficult to keep at routine tasks.	A	B	C
9.	I tend to get careless when I am trying to beat a fast-approaching deadline.	A	B	C
10.	I like to help others who are down on their luck.	A	B	C
11.	I tend to take a practical approach in any proposal I make.	A	B	C
12.	I almost always get more accomplished than other people.	A	B	C

	Agree	?	Disagree
13. I tend to have frequent ups and downs in mood.	A	B	C
14. I get distracted easily.	A	B	C
15. At work, I am very persistent.	A	B	C
16. I tend to be fairly even tempered.	A	B	C
17. I am very thorough in any work I do.	A	B	C
18. I tend to be characterized as an extremely hard-worker by others.	A	B	C
19. I like to take the traditional, conservative approach at work.	A	B	C
20. Before beginning my work, I like to plan and have it organized.	A	B	C
21. I often act carelessly when my time is limited.	A	B	C
22. I am a very agreeable person.	A	B	C
23. Even at the end of the day, I approach most tasks with vim and vigor.	A	B	C
24. I am generally thought of as being very sociable.	A	B	C
25. I often lose interest in things soon after starting them.	A	B	C
26. I can always be counted on to get the job done.	A	B	C
27. I like exciting and daring situations.	A	B	C
28. I am a very disciplined person.	A	B	C
29. I am very careful even when making a relatively unimportant decision.	A	B	C
30. I like to experiment with new and different ways of doing things.	A	B	C
31. I always strive to improve on my past performance, even if it means working long hours.	A	B	C

	Agree	?	Disagree
32. I am lazy at times.	A	B	C
33. I am not a very outspoken member in most groups I belong to.	A	B	C
34. I almost always end up doing more than I had planned to do.	A	B	C
35. It bothers me when I am not being very efficient at work.	A	B	C
36. I tend to enjoy art, music, or literature.	A	B	C
37. I like to do the best I can, even if it requires a lot of extra effort.	A	B	C

For each of the problems in this section, circle only one answer per question. Use the computer sheet to record your responses.

For questions 38 through 40, choose the analogous pair of words.

38. MITIGATE:SEVERE::

    a. compile:available

    b. restore:new

    c. contribute:charitable

    d. qualify:general

39. BABBLE:TALK::

    a. chisel:sculpt

    b. harmonize:sing

    c. scribble:write

    d. hint:imply

40. PITCH:SOUND::

    a. color:light

    b. mass:weight

    c. force:pressure

    d. energy:heat

Use the following information to answer questions 41 through 43:

LAST WEEK'S TOTAL HOURS WORKED AND HOURLY WAGES FOR THE CASHIERS AT MARKET X

Cashier	Hourly Wage	Total Hours Worked
P	$4.25	40
Q	4.75	32
R	5.00	26
S	5.50	25
T	5.50	22

Note: Last week no more than two cashiers worked at any one time, no cashier worked more than 12 hours on the same day, and on each day, each cashier worked continuously.

41. If Market X is open 96 hours per week, for how many hours last week were two cashiers working at the same time?

a. 49
b. 48
c. 36
d. 24

42. What was the average (arithmetic mean) number of hours that the five cashiers worked last week?

a. 25
b. 27
c. 29
d. 30

43. On Saturday of last week, Market X was open for 15 hours and exactly four cashiers worked. What was the greatest possible amount that the market could have paid in cashiers' wages for that day?

a. $132.00
b. $157.50
c. $161.25
d. $163.00

Use the following information to answer questions 44 through 46.

P, Q, R, S, and T are the computers in the five overseas offices of a large multinational corporation. The computers are linked in an unusual manner in order to provide increased security for the data in certain offices. Data can be directly requested only:

from P by Q	from S by Q
from P by T	from S by T
from Q by P	from T by R
from R by P	

44. If computers Q, R, S, and T are the only ones operating, which of the following requests for data can be made, either directly or through one or more of the other computers?

a. a request by Q for data from T.
b. a request by T for data from R.
c. a request by R for data from Q.
d. a request by R for data from S.

45. Which of the following computers CANNOT request data from any of the other four computers?

a. T
b. Q
c. R
d. S

46. Which of the following is a complete and accurate list of computers that can request data from S through exactly one other computer?

a. P and Q
b. P and R
c. Q and R
d. R and T

Financial Statements and Additional Information for BCS, Inc.

BCS, Inc. has engaged your office to perform the current year audit. This is the twelfth year that your office has performed the audit for BCS, but this is your first year on the engagement. You know from reviewing prior year workpapers that the system of internal control has been relied upon in past audits.

BCS, Inc., is a major manufacturer of consumer foods and an operator of two restaurant chains. Consumer food products include breakfast cereal and snack products. Restaurant operations consist of a chain of pizza restaurants and a separate chain of Mexican restaurants. The consumer food division accounts for 66% of sales and 75% of operating profits and the restaurant division accounts for 34% of sales and 25% of profits.

You may assume that:

1. All sales are made on credit, the credit policy has not changed from 1990 to 1991.
2. Prices have not changed significantly.
3. Sales and accounts receivable are recorded at gross, cash discounts are recorded when taken.
4. The allowance method is used to recognize losses from uncollectible accounts; bad debt expense is an operating expense.
5. Inventory is valued using the LIFO perpetual method; sales invoices are used to relieve perpetual inventory records.
6. Vendors' prices have not changed significantly.
7. Inventory purchases are all made on credit; the inventory policy has not changed.
8. Inventory purchases and accounts payable are recorded at gross; cash discounts are recorded when taken.

Financial Statements for BCS, Inc.

Balance Sheet

	June 30, 1991 (Projected)	June 30, 1990 (Audited)
Assets:		
Current Assets		
Cash	$ 5,970,000	10,620,000
Receivables	45,945,000	38,805,000
Inventories	74,040,000	59,160,000
Prepaid Expenses	14,775,000	11,235,000
Deferred income tax	21,615,000	16,695,000
Total Current assets	162,345,000	136,515,000
Land, Buildings & Equipment, at cost	336,195,000	290,175,000
Other Assets	86,730,000	66,735,000
Total Assets	$ 585,270,000	493,425,000
Liabilities and Stockholders' Equity:		
Current Liabilities:		
Accounts payable	86,805,000	77,730,000
Current portion of Long-term debt	19,350,000	12,045,000
Notes payable	3,510,000	15,495,000
Accrued taxes	23,880,000	19,305,000
Accrued payroll	23,205,000	20,415,000
Other current liabilities	34,110,000	30,990,000
Total Current Liabilities	190,860,000	175,980,000
Long-term debt	131,850,000	103,275,000
Deferred income taxes	68,280,000	64,140,000
Accrued postretirement benefits	16,425,000	16,380,000
Other Liabilities	10,830,000	12,195,000
Total Liabilities	418,245,000	371,970,000
Stockholders' Equity:		
Common stock	48,030,000	44,565,000
Retained earnings	235,605,000	198,795,000
Less common stock in treasury	(116,610,000)	(121,905,000)
Total Stockholders' Equity	167,025,000	121,455,000
Total Liabilities and Stockholders' Equity	$ 585,270,000	493,425,000

Financial Statements for BCS, Inc.

Income Statement

	For the Year Ended	
	June 30, 1991 (Projected)	June 30, 1990 (Audited)
Sales	$ 1,072,980,000	967,245,000
Costs and Expenses:		
Cost of sales	558,315,000	522,765,000
Selling, general and administrative	357,900,000	320,700,000
Depreciation & amortization	32,760,000	27,015,000
Interest	9,165,000	4,860,000
Total Costs and Expenses	958,140,000	875,340,000
Earnings from Operations before Taxes	114,840,000	91,905,000
Income taxes	45,210,000	35,850,000
Net Earnings	$ 69,630,000	56,055,000

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