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SUMMARY

This paper reviews and assesses recent behavioral research in auditing and auditor expertise and makes suggestions for a change in paradigm and focus for the future. As a result of an interest in developing expert systems and the current availability of information processing models, appropriate technology, and methodologies needed to conduct cognitively based research, current expertise research in auditing is heavily biased toward judgment and decision making. This condition delimits a *de facto* cognitive focus for behavioral research in auditing and auditor expertise. In view of the variety of behaviors auditors are capable of exhibiting during performance of tasks in the field, such a narrow focus is problematic.

There are indications in the literature that judgment/decision making research is now so extensive that it has reached a mature stage. At the same time, much of the behavior of auditors during performance of tasks in the field has been, and continues to be, ignored. Compared with the range of behavioral phenomena researched in psychology, little behavioral research has actually been done in auditing, and if the current cognitive focus continues, little more is likely to be done in the future.

This paper urges researchers studying auditor behavior and expertise to adopt the broader notions of neobehavioral philosophy in psychology, in which observable behaviors are the primary foci of study, allowing for consideration of unobservable and covert processes as explanatory devices. Several attributes of methodology, audit tasks, environments, and auditor problem solving behaviors are discussed which lead to suggestions for broadening the focus of research in this direction. Among the specific recommendations discussed are (1) a redefinition of expertise and expertise research in auditing and (2) adoption of a negative research paradigm.

BEHAVIORAL RESEARCH AND AUDITOR EXPERTISE: TIME TO BROADEN THE FOCUS

Over the past decade, researchers have discussed the nature of expertise in auditing, reviewed research examining its underlying attributes and determinants, and rendered critical perspectives on its current state. However, in searching this literature, I find no overall assessment of what is being studied relative to the totality of behaviors auditors exhibit during performance of a task, or whether the direction this research appears to be taking is likely to be a productive one to take at this time. What I do find is much to suggest that the time may be right for a change in both paradigm and focus. With these observations in mind, this paper is a review of reviews, with personal commentary, evaluations, and suggestions for the future. It is offered in the hope that discussion and, perhaps, debate will be stimulated concerning an area of inquiry which I feel has evolved a form of tunnel vision and which can benefit from a fresh point of view.

The major conclusion I draw from this meta-review is that the current cognitively dominated view of expertise, while having been very productive thus far in raising the level of understanding about auditor judgment and decision making, is too narrow a focus to take for productive *expertise* research in the future. Significant opportunities for enhanced understanding of the phenomenon of expertise in auditing can be opened up if researchers adopt a broad conceptualization of what constitute audit tasks and environments and auditor task behavior. Suggestions for moving expertise research in that direction are presented and discussed.

I. THE CURRENT FOCUS OF EXPERTISE RESEARCH IN AUDITING

The many extant reviews of the literature on auditor expertise provide an overview of what has been accomplished to date in this area. Hence, there is no need for this work to be repeated here except in summary form. However, where necessary to document a point, I also discuss specific papers and cite research from domains other than accounting and auditing.

Emphasis on Judgment and Decision Making

Although the difficulties in precisely defining expertise have been explicated by a number of researchers (e.g., Bedard 1989, Bedard & Chi 1992), all seem to be in agreement that judgment and decision making are important aspects of any such definition. Dopuch (1989), in tracing the history of accounting research, documents judgment/decision making as the fastest growing area of study during the 1980's. Bamber (1993), in a compilation of recently published research in auditing, reports that during 1990 and 1991, forty-nine of fifty-three papers were concerned with judgment and decision making research. Literature reviews abound which attest to the ever finer scrutiny of the dimensions of auditor judgment and decision making. For example, Libby (1989) reviews human information processing and the unique features of accounting environments, Colbert (1989) summarizes studies relating experience and auditor judgment, Choo (1989) examines expert vs. novice research, and Bonner and Pennington (1991) report research on the cognitive determinants of expertise.

The productivity of judgment/decision making research can be gauged not only by the volume of papers that have been produced, but also by the new interpretations and investigative directions suggested by evaluations of findings, methodology, and scope. For example, some of the research covered above has yielded contradictory findings (Trotman & Wood 1991). In an attempt to reconcile some of these conflicts, Trotman & Wood showed that differences in levels of consensus reported in past internal control judgment studies could be accounted for entirely by sampling error. Hence, none of the variables examined in their meta-analysis has a significant effect.[1] In challenging the use of experience as a proxy for expertise, Davis & Solomon (1989) argue that expertise should be operationalized using performance-based rather than experienced-based notions. Where there is

not an available or timely measure of decision quality, then conformity with procedures which would be followed by other experts in the circumstances should be used as the concept of expert performance, regardless of outcome. Citing another concern, Shanteau (1992) argues that findings regarding expert judgment/decision making in psychology and physics, to which audit researchers often refer, may not be applicable to auditing because of differences across the respective domains. For example, compared with auditing, the environment of physical science is more stable and passive, and the problem situations studied by psychologists are relatively simple. Finally, Solomon (1987) points out that since auditing is generally carried on as a team effort, a serious limitation of extant research is its neglect of group judgment/decision making.

Reasons for the Emphasis on Judgment/Decision Making

In terms of the volume of output reviewed above, it can be seen that judgment/decision making research has been highly productive, though with mixed results. However, it seems reasonable to ask why it is that this area of inquiry continues to be pursued to the apparent exclusion of other aspects of behavioral research in auditor expertise? The reasons seem to involve an interaction of two circumstances: Interest, arising principally out of the promise of expert systems, and Possibility, because, given interest, we tend to study that which it is possible to study given the technology and methodologies available at the time.

Interest in expert systems. The very significant interest in building expert systems provides an incentive to attain a greater understanding of how human experts organize, access, and process information in making judgments and decisions. Consider some recent examples. Meservy et al. (1986) extensively studied the reasoning processes of six audit managers who reviewed workpapers and made compliance testing decisions as a basis for constructing and validating a computational model of their judgment and decision making processes. Similarly motivated studies have been conducted by Peters (1990) for the purpose of validating a model that would identify risky accounts, and Shpilberg & Graham (1986) for a model to assist in evaluating tax accruals and tax planning. It is believed that perfection of systems such as these will substantially increase the efficiency of audits and improve the consensus and consistency of auditor judgments. Under Einhorn's (1974) criteria for expertise, the judgments of experts should display high consensus and consistency. Since it is almost axiomatic that any mechanical system given the same inputs will yield the same output, use of such systems, *ipso facto*, increases the apparent expertise of those using them.

Availability of technology and methodology. What *is* studied is very often a function of what *can be* studied. The technology required to conduct cognitively oriented research (e.g., audio and video recording) is now widely available, and the models (e.g., Newell and Simon's (1972) standard model of human information processing) and methodologies needed (e.g., process tracing and behavior observation) are now well developed and generally accepted. The progress of non-cognitively focused behavioral research, on the other hand, has been retarded by lags in one or more

of these elements. For example, the writer is not aware of any widely accepted models of auditor task behavior other than those employed by the cognitive paradigm, and auditing researchers have been slow to adapt models available in other domains (e.g., Bandura's (1976) model of mutual determinism[2]) to audit tasks and environments.

The three developments mentioned are highly inter-related. Process-tracing attempts to capture the linked thoughts of auditors in arriving at specific judgments or decisions (e.g., Bedard & Biggs 1991; Biggs et al. 1988; Meservy et al. 1986; Biggs & Mock 1983). The dominant process-tracing methodology is the concurrent think-aloud verbal protocol, especially as employed in Newell and Simon's (1972) ground-breaking study of human problem solving and extensively researched and theoretically anchored by Ericsson and Simon (1993). This methodology is heavily influenced by the computer-based data-processing paradigm so characteristic of our times, and uses as its raw data the frequency of various cognitive operators reflected in the verbalized thoughts of experimental subjects during problem solving.

Behavior observation methodology, unlike verbal protocol methodology, has been rarely used in auditing research (see Russo 1994: 182-184 for a review). However, in education, psychology, and psychiatry, where behavior observation is a common modality, it has been implemented making extensive use of time sampling techniques. The development of relatively inexpensive and easy-to-use video recording technology has now made possible the more precise and complete behavior observation methodology required by the unique demands of behavioral research in auditing.[3] The writer believes that in the future, behavior observation will be instrumental in overcoming the previously mentioned lag in non-cognitively focused behavioral research.

II. ASSESSMENT OF THE CURRENT FOCUS OF EXPERTISE RESEARCH

Tasks and Environment Have Been Subordinated to Cognition

The tendency in current expertise research to minimize task and environment so as to focus on cognition is evident regardless of whether the research emphasizes the quality of judgment/decision outcomes or the judgment/decision making processes. In that segment of expertise research which examines the phenomenon of judgment/decision making from the standpoint of outcomes, laboratory tasks and environments are simple compared with those actually encountered in the field. Typically, such tasks provide subjects with cases or documents containing all the required instructions and data in a generally pre-digested and relatively organized form, and with clearly stated task objectives. That is, the experimenter rather than the subject has established the fact pattern, selected the data, organized the data presentation, and stated the task objective. Hence, opportunities for the subject to formulate the task objective, ascertain relevant information requirements and availabilities, or identify and approach the data sources -- demands which are typical of tasks in the field -- are minimized.

Because of the very nature of judgment and decision making, that segment of current expertise research which investigates the process by which auditors solve problems in the field necessarily examines only the cognitive portion of that process. Data collected in this research generally concerns the observed frequency of occurrence of various cognitive data processing operators. For example, Biggs & Mock (1983), Meservy et. al (1986), and Biggs et. al (1988) use variations of task structuring, information acquisition, analytical, and action/choice as operator classification categories. Other process researchers employ categories which reflect their particular research objectives. Peters (1990), for example, classifies cognitions in terms of hypotheses generated, support offered, and uncertainty strategy used, and Bedard & Biggs (1991) classify their subjects' cognitions in terms of several categories of performance, and errors in interpretation, pattern recognition, and hypothesis generation. In all of these examples, consistent with the cognitive focus discussed earlier, only that portion of task behavior and only those environmental influences which are evident through subjects' verbalized cognitions are treated as relevant. Other forms of behavior and other environmental factors which do not leave a cognitive trace, both of which may be of significance in understanding how auditors bring about task solutions, are by implication considered to be irrelevant.

Behavioral Research in Auditing Is Narrowly Defined

Interest and Possibility, which were discussed in Section I, in acting to focus attention on judgment and decision making, have produced a *de facto* purview for behavioral research in auditing. Compared with what is the case in psychology, in auditing, the focus of behavioral research is significantly narrower, and in distinguishing among phenomena that are considered within the focus of that research, it is somewhat less precise. I refer to these consequences as the definitional problem and the problem of hierarchical confusion, respectively.

The Definitional Problem. It is instructive to compare what two respected reviewers perceive as the objective of the kind of research being examined in this paper. Bedard (1989) assesses the objective of *cognitive* auditing research in this way:

> Cognitive studies of expertise in auditing have focused on the expert's knowledge and its role in professional judgment. (121).

By comparison, Bamber (1993) presents the objective of *behavioral* accounting research, which he abbreviates "BAR," as follows:

> ... in auditing BAR a primary objective is understanding auditors' cognitive processes. (7)

Since both definitions present a cognitive orientation, one might well ask: except for the label attached to the kind of research each describes, in what substantial ways do these objectives differ?

Surely, an understanding of cognitive processes cannot exist absent an understanding of the role of knowledge in arriving at judgments.

On careful reading of the quoted objectives, Bedard's cognitive conceptualization might be viewed as a refinement or qualification of Bamber's behavioral. To develop this interpretation further, consider that Bamber (1993: 2) includes three major kinds of investigations in his conceptualization of behavioral research: (1) judgment and decision making; (2) the influence of the accounting and auditing function on the behavior of others (employees, managers, taxpayers, and investors); and (3) the influence of the product of these functions on the judgments and decisions of its users. The first and third of these investigative areas are clearly cognitively focused. Only one, the second, is potentially consistent with the less radical and widely accepted psychological (i.e., neobehavioral) sense of the term "behavioral research." Neobehavioral psychology comprehends behavioral research as the examination of the *observable* actions of organisms, allowing for the use of unobservable and covert processes as explanatory devices (Reber 1985: 467). However, even allowing for the fact that Bamber's second category of behavioral investigation includes neither the influence of others on an auditor's task behaviors nor the effects of an auditor's behaviors on his/her own subsequent behaviors, the sense that one comes away with after reading his development of this point is that the behavior of concern is individual information processing and decision making. Thus, although Bamber's conceptualization of behavioral research appears to be broader than Bedard's, in its intent it is just as narrowly focused. Therefore, if, as it appears, the same line of research can be described as being either "behavioral" or "cognitive," then only confusion can result.

An alternative interpretation of the two quoted objectives is that one, Bedard's, is concerned with discovering what an auditor knows and uses in making specific judgments or decisions in a particular task domain, while the other, Bamber's, with how that knowledge is processed. If indeed this is the distinction that is to be made, then perhaps better terminology to apply might be "knowledge content research" and "cognitive process research" rather than "cognitive research" and "behavioral research," respectively.

The Problem of Hierarchical Confusion. Setting aside the preceding definitional problem, Bedard dichotomizes *approaches* to studying auditor judgment and decision making as either behavioral or cognitive. According to Bedard, the behavioral approach focuses on the quality of judgments and decisions as measured by inter-judge consensus, intra-judge consistency, and degree of self-insight. The cognitive approach, on the other hand, focuses on knowledge organization, decision processes, and their inter-relationships. However, from the standpoint of *what* is being studied, as opposed to *how* it is being studied, there is only a single aspect of expertise -- judgment/decision making -- under examination.

The use of two different terms, "behavioral" and "cognitive," as labels for what is research on essentially the same aspect of expertise promotes an unclear distinction in the literature between "what" and "how." On the one hand, there are two labels for study of the same phenomenon,

judgment/decision making. On the other hand, there are two labels for two or more different methodologies for pursuing that study, i.e., outcome quality, and the cognitive processes and knowledge leading to outcomes.

"What" and "how" relate to, respectively, the phenomenon of interest and the instrumentation for studying it. Empirical phenomena can be conceptualized as hierarchically related.[4] In experimental research, phenomena of interest are studied through observation of other phenomena that are believed to be subordinate to or highly correlated with them. For example, it may be reasonably taken as given in the present discussion that the highest level phenomenon of interest is expert behavior. The phenomenon of expert behavior can be studied through observation of subordinate and correlated phenomena, among which are the quality of judgment/decision making, procedures followed, automaticity of behaviors during task performance, quality of task outcome, task duration, and others. Each of these, in turn, may be studied as phenomena in terms of still more basic subordinate and correlated phenomena,[5] and so on, the depth of hierarchical descent being limited only upon arrival at the lowest level which is both meaningful and methodologically feasible.[6]

How a phenomenon is studied concerns what subordinate and correlated phenomena are chosen for examination. Given its current prominence in auditing research, judgment/decision making has been targeted for study ostensibly because it is considered relevant to an auditor's exhibiting the quality of expert behavior. At the next lower level, the subordinated phenomenon chosen for how judgment/decision making is studied depends upon beliefs about how it is related to the qualities of judgment/decision making: consensus and consistency of judgments and decisions made are measured because they are believed to be highly correlated with the degree to which expert judgment, and by extension, expert behavior is present. At a lower level still, cognitive processes and knowledge used are studied because it is believed that process and knowledge differences are diagnostic as to why judgments and decisions lack consensus and consistency.[7]

Little Behavioral Research Has Been and Is Likely to Be Done

I wish to reemphasize what is central about the preceding discussion. In extant expertise research in auditing, both "behavioral" and "cognitive" are labels concerned with the study of a single phenomenon -- judgment and decision making. Hogarth (1991), in his review of cognitive research in auditing, does not distinguish judgment/decision making from cognitive research, and never refers to any of this research as "behavioral." As defined by Bamber and Bedard (see previous discussion), one, the cognitive approach, is a narrow subset of the other, the behavioral, and neither approach is, strictly speaking, synonymous with Behavioral research with a capital "B" to distinguish the broader neobehavioral sense previously given from the putative sense as currently practiced in behavioral auditing research. In terms of the focus of expertise research in auditing, which is the subject of this paper, use of the terms "behavioral" and "cognitive" appears to be a distinction

without a difference. From this perspective, therefore, while much judgment/decision making research has been reported, comparatively little Behavioral research has actually been done in auditing.

One of the signs that a line of inquiry may have reached maturity is a lack of significant new insights and an increasing preponderance of research primarily devoted to refining previous findings (see Losee 1993, Ch. 14, for a discussion of relevant work by Kuhn on this point). While recognizing the contributions of the cognitive approach, several reviews seem to indicate that this line of inquiry may have reached a point of diminishing returns. For example, Shanteau (1989) concludes that although heuristics and biases have been demonstrated to affect auditor judgment and decision processes, this line of research has not yielded much understanding of those processes. Bedard (1989) cites research showing that, from the standpoint of Einhorn's (1974) criterion of expert judgment and decision making (generally operationalized as intra-judge consistency and inter-judge consensus), experts behave essentially the same as novices. The same conclusion is expressed by Shanteau & Stewart (1992), although these researchers do point out that in certain circumstances, auditors generally fair better than do experts in other domains. One such circumstance, studied by Ashton (1985), shows that where factual answers are available, consensus was highly correlated with accuracy. On balance, however, it appears that at present, expertise research in auditing has reached a very mature stage and that further significant progress is not likely to be forthcoming from continued pursuit of the currently dominant cognitive paradigm.

In looking ahead, Bamber (1993) cites research by Tubbs (1992), Libby & Lipe (1991), and Moeckel (1990) as indicative of the future direction of expertise research in auditing. Consider for a moment that Tubbs examines experience and the organization of auditor knowledge, Libby & Lipe examine incentive effects and cognitive processes in judgment, and Moeckel studies memory errors and the opinion formation process. While all of these research efforts are important, in highlighting them as illustrative of the direction of future expertise research in auditing Bamber presents a view of the future which is a continuation of the present cognitive landscape. Further, Bamber is not alone in having this outlook. Even while calling for more emphasis on the contextual features of tasks and environments in auditing research, Hogarth (1991) still focused on "the different types of *judgmental tasks* auditors are required to perform" and "what contextual features might have the greatest impact on *audit judgment*" (288, emphasis added). If the preceding prognostications are correct, it appears unlikely that Behavioral research in auditor expertise will fare any better in the future than it has in the past.[8]

III. TOWARD A NEW PARADIGM AND BROADER FOCUS

Current judgment/decision making research fails to adequately consider the unique nature of field auditing tasks and environments. Consequently, generalization suffers in that current research is carried on with tasks and in environments not representative of those encountered in the field. Methodological considerations also require that researchers reorient themselves in terms of the application of their findings outside the laboratory. In the following sections, I discuss some issues of methodological orientation and some attributes of auditing tasks, environments, and auditor behavior which present aspects of auditor expertise beyond the reach of an exclusively cognitive paradigm. I also make several suggestions for expanding the focus of auditing research in the broader direction comprehended by neobehavioral psychology.

Need For Methodological Reorientation

Serious questions arise regarding the ability to apply findings from current studies beyond the particular tasks used and the particular subjects participating. In process oriented studies, in particular, because of unique logistical difficulties and the labor intensity of the protocol methodologies employed, sample sizes are generally small and typically range from four to six subjects. Rather than being randomly selected from the population of auditors, subjects in these experiments are often volunteers who participate on an availability basis. Edgington (1967: 195) observed that where small, non-random samples are used, extensions of findings beyond the specific task and participating subjects must be made based on logical rather than statistical grounds.[9] The ability to make this type of argument in auditing expertise research deserves further attention.

To elaborate on this last point, from an overall perspective, two extreme research approaches can be identified. The first of these is the standard experimental procedure of random sampling from a population. The second is intense study of a single individual or situation, an approach exemplified by the case method. If behavioral research is to have any tangible value, it will ultimately be necessary to apply findings obtained by either of these approaches to either populations or specific individuals. These alternatives produce the cross-break shown in Table 1.

TABLE 1

CROSS-BREAK OF EXPERIMENTAL DESIGN AND APPLICATION POSSIBILITIES

	Target of application	
Design Feature	Groups (Populations)	Single cases (Individuals)
Groups (Samples)	A	B
Single cases (Individuals)	C	D

Note: Populations includes aggregations of auditors, tasks, and environments. Individuals includes a specific auditor performing a specific task in a specific environment.

Common experimental methodologies generally fall into box A. Process oriented research generally falls into box C, but could potentially fall into box D as well. Common statistical arguments are not valid for applications of findings in boxes B, C, or D. Such extensions must be based on logical rather than statistical arguments.

The methodology of current experimental research, particularly that of outcomes oriented research, is located primarily in the upper left-hand quadrant of this cross-break (labeled box A in Table 1.) That is, most current experimental research is based on random samples from populations to which findings are, in turn, extended. However, for the reasons mentioned above, the bulk of current process oriented research is actually located not in box A, but in one of the remaining boxes, particularly box C. It is in attempting to utilize experimental findings in the manner represented by boxes B, C, and D in Table 1 that Edgington's argument is most applicable. Unfortunately, the appropriate response to this methodological challenge is not as simple as prescribing proper sampling from an appropriately specified population. Even experiments located in box A are not without problems. For example, it is highly unlikely that any "random sample" of auditing tasks, or any meta-analysis of studies of such tasks, could be considered meaningful for purposes of generalizing about the problem solving behavior of auditors in the *population* of auditing tasks. If the findings of behavioral research in auditing expertise are to be extended beyond the confines of a narrow cognitive focus and the permissible extensions of findings obtained by means of current methodologies, then features of audit tasks, task environments, and auditor task behavior which transcend experimental particulars will have to be identified. Once identified, these features become

the logical tools for addressing questions concerning the behaviors of specific auditors performing specific tasks in specific environments.

The Unique Nature of Field Tasks and Solutions

While in the laboratory, a subject deals with a problem, in the field, an auditor deals with a task. A field task may be reasonably conceptualized as an ongoing sequence of problems; it does not terminate with the making of a judgment or decision. Rather, a field task tends to exhibit a continuity that is best described as a sequence of conditionally dependant sub-tasks in which the arrival at a judgment or decision is only a starting point for a series of cognitive and empirical[10] behaviors which ultimately produce a report, or a set of workpapers or other form of communication, including, possibly, a face-to-face conference. To cite one particularly clear example of such a sequential process, Biggs et al. (1988) used a laboratory task in which a series of judgments and decisions was required. The task consisted of two phases. In Phase I, subjects were given extensive case materials to read. They were then to request analytical information for their use during Phase II as a basis for revising audit programs. In a subsequent session, Phase II, each subject was provided with the analytical information requested. They then completed their task and rendered their decisions.

To understand problem solving behavior in its most general terms, and hence, as Edgington suggests, to be able to generalize based on logical rather than statistical arguments, it is necessary to distinguish among tasks, not by their substantive content (e.g., internal control, analytical review, accounts receivable, etc.) but rather in terms of the nature of the behaviors that take place within an auditor's task environment as that environment is perceived at each moment. In the field, auditors are constrained by their task environments, react to them, and by their very own information acquisition and solution execution behaviors, they alter them. I use the term "empirically intense" to distinguish such tasks from the cognitively focused tasks typically employed in the laboratory. Empirically intense tasks are characterized by requirements for significant information input from the task environment, significant domain and task knowledge, and solutions which require significant *interaction* with and *transformation* of the task environment.[11] The last characteristics mentioned have been largely overlooked in extant research. Libby (1989), for example, in reviewing auditing research and the unique nature of auditing environments does not even mention these unique features of auditing tasks and solutions.[12]

Task Context and Environment

In the judgment/decision making purview, when the audit environment is explicitly considered, group decision making (e.g., Solomon 1987), the review process (e.g., Trotman 1985, Trotman & Yetten 1985, Bamber 1983), audit structure (e.g. Bamber & Snowball 1988), and time

and peer pressure (e.g., McDaniel 1990, Ponemon 1991) are those aspects most frequently studied. Exceptions to the cognitive orientation are few and far between. Among this group are Watson's (1975) study of the relationship between uncertainty in the task environment and audit team structure, and Pratt & Jiambalvo's (1982) study of leader behavior in audit teams.

To comprehend in the most general way the interaction between environment and behavior, it is necessary to deal with the codeterminancy of environment and behavior at a more abstract level than that employed in the studies cited above. Environment, the ultimate source of all cues, defines the context of behavior. At its most fundamental level, a context can be conceptualized as a set of subconscious cues which increase the probability that consciously received cues will preferentially evoke certain responses. Context, therefore, and by extension, environment, delimits what knowledge will be preferentially accessible during performance of a task, and thereby proscribes the range of permissible task behaviors. The following paragraphs discuss some of the mechanisms by which environment influences behavior and suggest their possible significance for behavioral research in auditing.

Encoding specificity. Tulving (1992) reviews extensive psychological research by both himself and others suggesting that both the environment in which a task is learned and that in which the task is performed have significant effects on an individual's abilities to access information in memory. One particularly clear and often cited example of this phenomenon, called "encoding specificity," is Godden & Baddeley's (1975) experiment in which divers studied lists of words under two different environmental conditions: on land, and underwater. They were then asked to recall the lists in both the same and opposite environments from those in which the lists were originally learned. The results show that recall was higher in the same, and lower in the opposite environment. The writer is not aware of any formal studies of this phenomenon as it relates to auditing environments (e.g., classroom vs. field, across clients, laboratory vs. field, etc.) but logical extension, personal experience, and anecdotal evidence all seem to point to its being operative in all knowledge-driven situations, including auditing.

Passive environmental cues. While findings supporting encoding specificity relate to the availability of deliberately learned information, other studies show that perceptions of the task environment, even though passive, affect task behavior. Hartmann (1984: 112-116) cites extensive research in the behavior observation literature supporting the significant effects of passive environmental cues on behavior. Although the effects of these cues on task behavior have not been specifically studied in auditing research, they have been important factors in some studies. For example, Meixner & Welker (1988) show that prolonged tenure under the same supervisor increases the consensus of subordinates' judgments, but that this effect does not extend to prolonged tenure with the same organization. The environmental features which are most effective in changing behavior are those with which an auditor most frequently interacts. And in Ponemon's (1991) study of peer pressure, the circumstance having most influence on subjects' underreporting of time was their perceptions, based on casual observations of when their colleagues left the room, of the

"normal" time required to complete the task. Given these findings, the possibility that in the laboratory a subject's physical surroundings may influence task behaviors and outcomes cannot be discounted.

Subconscious beliefs. Subjects' subconscious belief that the interactive and personal consequences of judgments or decisions need not be faced can affect behavior. This belief is often based on covert perceptions of laboratory environments. Differential behaviors can be expected when subjects know that laboratory judgment/decision making research tasks terminate with arrival at the required judgment or decision choices. Thus, because decisions will not be implemented, decision maker-subjects behave as if there will be no personally felt "cost" accruing as a consequence of their decisions. Findings from several studies suggest that conscious and subconscious perceptions of the consequences of decisions do alter auditor behavior. For example, Peecher (1996) found that perceptions of justifiees' preferences affect auditors' assessments of client non-error explanations and their search for alternative explanations. Ashton (1990) found that the presence of incentives, decision aids, and a demand for justification affect the accuracy of auditors' judgments. Although in both these studies, the environmental manipulations were salient, might the same not also be said of passive and non-salient features of an auditor's environment?[13] For example, Ashton suggests that the introduction of decision aids into an auditor's task environment may change task perceptions, so affected decision makers now believe that new choice strategies are expected for successful performance.[14]

The Unique Nature of Auditor Task Behavior

Task Behavior Is a "Meander." Nothing ever precedes exactly as planned. The poet Robert Burns, in a well-known line, observed that "The best laid schemes of mice and men/ go often astray." Depending on the degree of uncertainty about the task environment, different methods of specification prevail, and even where there are procedural specifications, invariably some measure of *ad hoc* adaptation is necessary.[15] Watson (1975) showed that the more uncertain an environment, the less structured are audit programs because, in the face of uncertainty, one is forced to specify objectives rather than procedures. Similar consequences arise in other domains. Consider, for example, that in engineering, a floor can be specified either in terms of its required load-bearing characteristics (i.e., an objective, leaving materials and construction to be determined by field conditions) or in terms of its construction (e.g., type of structural members, placement, materials to be used, etc.) While there is a need for more empirical research on this kind of circumstance and response in auditing, even in fairly certain and familiar situations, behavior during performance of a task is to some extent a meander over the landscape of the task environment.

"Meander" is a word that conjures up images of the winding, snake-like patterns etched out by the flow of rivers and streams as they seek their common objective of minimum potential energy. It is aptly applied here, for in the field, what an auditor does, when it is done, and how it is done, is

constrained by what the task environment offers in terms of resources, and what it proscribes in terms of constraints. As the slopes, granites, and sands of the landscape shape the path of rivers and streams, so too do the potentialities and limitations present in an auditor's task environment act to shape task behaviors as that auditor winds his or her way toward minimization of the demand he or she perceives is being made for professional performance.

Reflecting the meandering characteristic of task behavior, the approach to auditor problem solving research advocated in this paper studies that behavior as an *interactive* activity; as something more than the purely cognitive process that is examined in the judgment/decision making literature. The focus of study is on both the process by which an auditor's perceived demand for performance is satisfied and its dynamics. This is not to say that either the cognitive processes of judgment/decision making or the quality of outcomes produced are not valid subjects of inquiry. However, neither judgment/decision making nor quality of outcome research represent the answer if the question posed concerns the dynamics of the transformation process by which a solution to a task in the field evolves.

The Importance of Considering Automatic Behavior. By intensely studying the process by which expert auditors form judgments and make decisions, researchers hope that insight will be gained into how this process and its outcomes can be improved and the skills of experts transferred to novices. It is the belief that the benefits of such improvements and transfers can be realized relatively soon following any advance in understanding that may account for the intensity with which this line of research is pursued. Unfortunately, the almost exclusive cognitive focus of current research can easily be interpreted as reflecting an implicit assumption that all behavior is necessarily the product of cognitive processing of information in memory. However, it should be clear to anyone who has survived ten minutes driving an automobile, achieved fluency in a foreign language, or hit a pitched baseball, that such an assumption is simply not true. While the term "cognitive" appears to be used as if it were synonymous with all forms of mental processing, it is only in unfamiliar situations that cognition enters into judgment and decision making; most of the time, people function on "automatic pilot."

Alba and Hutchinson (1987) cite extensive research attesting to the common observation that as one gains familiarity and expertise in a task, one's behaviors become more automatic. That is, with growing expertise, tasks are performed with diminishing effort and *without conscious control*. The increasing automaticity of behavior with experience is a central concept in artificial intelligence and learning theory (e.g., Anderson 1982, 1987; Mayer 1992: 305). Davis & Solomon (1989) employ the term "expert" to describe one whose behavior during performance of a task displays a high degree of automaticity. Bedard (1989) notes that experts exhibit little self-insight into how their decisions are made because most are made subconsciously. If the acquisition of expertise is manifested by an increasing automaticity of task behaviors, then a cognitive approach to studying expert behavior becomes increasingly less useful the more auditor-subjects approach the level of performance which is the objective of this line of inquiry.

Broadening the Focus for Behavioral Research in Auditor Expertise

The following paragraphs present some relevant considerations of how the focus of expertise research in auditing can be broadened to better reflect the neobehavioral sense discussed previously.

Redefine Expertise and Expertise Research. The prominence of judgment/decision making research described above can lead to the false perception that in auditing, this type of research is synonymous with expertise research in particular and with Behavioral research in general. Judgment/decision making is only one aspect of a phenomenon called expertise.[16] The difficulties in defining expertise have been noted earlier in this paper. However, here I wish to point out that expertise is as much a perception formed by what one observes about the behavior of another as it is about what that observer expects of the other in a given task situation. That is, *expertise is a judgment made by people about the behavior of others who are presented with a demand for expert performance.*[17] Consequently, I define the study of expertise as the comparative study of problem solving behavior observed during performance of a specific task. Implicit in this definition is the notion that expertise is a relative rather than absolute quality of observed behavior, contingent on (1) the subject of the attribution of expertise and the characteristics of (2) the task and (3) the observer.

Briefly considering each of these contingencies, the *subject of the attribution of expertise* refers to where expertness is to be attributed in the comparative behavior of individual auditors, groups of auditors (e.g., first-year auditors vs. audit managers), or of auditors as experts vs. other experts, (e.g., the relative expertise of, say, third-year auditors compared with that of third-year surgical residents.) *Characteristics of the task* refers to the degree to which a task is empirically intense. For example, judgment/decision making tasks typically lack the interactive continuity and environmental transformation characteristics of empirically intense tasks. While specific auditing tasks obviously differ both in subject matter and environment from other tasks both within auditing (e.g., financial audit vs. special purpose examinations) and in other expert domains (e.g., financial audit vs. surgery), tasks in different domains may nevertheless be comparable in terms of the characteristics of empirically intense tasks. Finally, since expertise is an observer's perception about the behavior of another, the *characteristics of the observer* bearing on the formation of such perceptions are relevant. These characteristics include at least the following: the observer's perceptions of the task and his/her own expertise in the task (e.g., what kinds of behaviors to observe), the observer's skill in observation (e.g., behavior capture and recollection), and the observer's expectations regarding patterns of behaviors to be or actually observed (e.g., extent of automaticity, relationship of absent to present knowledge, knowledge availability, etc.).[18] Space does not permit a full development of how each of the preceding contributes to the perception of expertise. These matters are left to future papers.

Adopt a Negative Research Paradigm. A paradigm identifies and limits what will be studied and how that study is to be conducted. Past behavioral research in auditing has on balance

taken a positive approach in that it has sought to examine a multitude of individual factors, each contributing, according to some theory, toward expert behavior. However, the key question, regardless of whether the focus is on cognitive or non-cognitive task behavior, is not how many different aspects of that behavior have been studied, but rather when will enough different aspects of that behavior have been studied so that meaningful *general* statements may be made about interactions between auditor, environment, and expert behavior? Unfortunately, short of an exhaustive examination, which is clearly impossible, no enumeration of facts or experience is ever sufficient to support a positive statement about predicted behavior. The latency of knowledge and the complexity of task behaviors, environments, and their interactions preclude any attempt to enumerate in a positive way either the knowledge of expert auditors or their task behaviors. On the other hand, given an observed failure to support a positive statement, it is generally a more tractable problem to demonstrate at least one factor which is sufficient to account for that failure.[19]

Consequently, in this paper, a negative approach to these issues is advocated which builds on the assumption that the sequence of observed problem solving behaviors of task experts is completely automatic. That is, it is assumed that task experts are so familiar with a task environment and so practiced with a task that their problem solving processes consist of an uninterrupted sequence of automatically chosen perception and execution behaviors.[20] We can expect, then, that the behavior of task experts will have a greater automatic content than that of task novices, and consequently, that their behaviors will be interpreted by an observer as more expert-like.[21] On the other hand, behavior sequences which evidence departures from completely automatic task behavior will be interpreted as departures from expert-like behavior.

The proposed paradigm also assumes that all problem solving behavior is (1) purposeful, meaning that auditors perform those behaviors they believe are appropriate to their objectives, and (2) intentional, meaning that the behaviors of auditors reflect their beliefs regarding the task and task environment. Because automatic behavior is carried out without cognitive involvement, these assumptions, along with the previously discussed assumption that the problem solving behavior of task experts is automatic, imply that all the knowledge required to instantiate each behavior is present within an auditor's knowledge base[22] and is available at the moment each behavior is performed.

On the other hand, a sequence of empirical behavior mediated by cognition is presumptive evidence of non-automatic access to procedural knowledge.[23] Cognitively mediated behavior sequences signal the perception of environmental or knowledge barriers that thwart behaviors which otherwise would have normally and automatically taken place. Physical, technological, or social circumstances present within a task environment may force use of less familiar behaviors and, therefore, less available knowledge. In addition, a lack of knowledge forces either a resort to behaviors whose objectives are to acquire the missing knowledge or a search for ways of doing without it. Here, then, are the origins of the "meandering" process referred to earlier in this paper.

An implication of the assumption that auditors are purposeful in their behaviors is that the mechanisms by which perception of environmental barriers affects behavior choices are revealed by the associations between the types of problem solving behaviors observed and the nature of the cognitions, if any, immediately preceding them. For example, a requesting behavior[24] preceded by an uncertainty cognition reveals a different knowledge state than would be revealed by the same behavior preceded by an analytical or planning cognition. In the case of automatically evoked behaviors, where preceding cognitions are absent, the relevant associations to examine are those between each observable behavior and that which immediately preceded it.

To cite one application of this paradigm, observed changes in the state of an auditor's knowledge during performance of a task represent the effects of experience in mitigating certain knowledge base attributes associated with a *lack* of expertise in performing that task.[25] Thus, Russo (1997a) was able to detect learning and determine its modality in four first-year auditors *during* performance of an empirically intense task, not by noting the development of expertise in a positive sense of that term, but by noting the degree to which their observed task behaviors approached or departed from being expert-like.

IV. CONCLUSIONS

The current approach to understanding problem solving processes during performance of audit tasks in the field is analogous to an attempt at understanding vehicle locomotion by intensely studying the firing of spark plugs or the effect of tire pressure on fuel efficiency. While both are important aspects of vehicle locomotion, a thorough understanding of either will not produce any understanding of how a vehicle moves under its own power. In like manner, a thorough understanding of cognitive processes, auditor knowledge, or auditor decision outcomes will not suffice to explain or predict auditor behavior during performance of an empirically intense task. If we are to understand the problem solving process, something we must ultimately do if audit research is to make any contribution to practice, then we must now broaden the focus of study to include more of the process itself, abstracted from specific tasks and task outcomes, and provided only that the types of tasks and environments used be appropriately representative of those encountered in the field.

Dopuch (1989) seems to feel that the present cognitive judgment/decision making line of research may have exhausted itself and argues that the next round of significant advances in understanding how auditors process information awaits some new direction. This paper does not propose a new direction, but it does point out a broader path. What is proposed is a process-based conceptualization of auditor task behavior that is closer to that of neobehavioral philosophy in psychology than is that of current judgment/decision making research in auditing. Under this conceptualization, the perception of an auditor's level of expertise while performing a task becomes a relative quality which is based upon the observed interaction of that auditor with the task

environment. Observed task behaviors are related to mental activity, both cognitive and subconscious, with the objective of detecting patterns of association between the two within the context of empirically intense tasks, the type of task typically encountered during the first two years of professional auditing experience.

Among the benefits to be gained from the broader perspective proposed in this paper are a more complete understanding of audit tasks, solutions, task environments, task behaviors, and the perception of auditor expertise. Specific suggestions for this type of research can be found throughout Section III of this paper and in the endnotes, and examples of research along the lines proposed herein have been reported by Russo (1995, 1996, 1997a.) I believe that findings of this kind and at this level of abstraction can tell us something about the sources of the less-than-expert problem solving behaviors of novices. Such findings can also point the way toward the development of a clinically useful model for diagnosing the nature of observed less-than-expert task behaviors, improving the level of auditors' task performances, developing and assessing the effects of training programs, and in personnel screening and selection.

ENDNOTES

1. Trotman & Wood's study included fourteen published and three unpublished papers covering the period 1974 through 1985 and involved auditor judgments regarding internal control. The variables covered were experience (measured in years) and time pressure, and tasks primarily involved payroll, accounts receivable, purchasing, and sales problems.

2. Bandura proposed a framework for studying human behavior in social situations which proposes a mutual interaction among the environment, the self, and behavior. Strict behavioral research (i.e., ala Skinner) considers only interactions between behavior and environment, omitting the self. Cognitive research emphasizes in a very limited way, the self (in the form of an individual's knowledge), and its interaction with the environment (in the form of information input to the self and the judgment/decision outcome.) The arrival at a judgment or decision is not considered "behavior" in Bandura's sense.

3. Russo (1994 210-211) discusses four unique features of auditing behavioral research that make standard behavior observation methodology unsuitable for use in this area. Briefly, these are: (1) the complexity and variability of auditing behavior requires very large time samples; (2) the present paucity of scientific knowledge about the empirical behaviors of auditors makes it extremely difficult to specify behaviors to be sampled, the size of sample intervals, and other aspects of a good sampling plan; (3) use of sampling destroys the thread of continuity in observations and analysis of the problem solving process because of the evolutionary nature of solution behavior, including the possibility of false starts, back tracking, sub-task discontinuity, etc.; and (4) sampling exacerbates some of the technological problems in synchronizing cognitive and observable behaviors. Russo concludes that continuous behavior observation is required in order to productively study auditing task behavior.

4. In this paper, a "trunk to roots" conceptualization of hierarchy is used. Hence, lower levels are the more detailed and subordinate tendrils of higher levels.

5. Infinite regress, though suggested here, does not arise because the depth of hierarchical regression is limited by its utility within the specific context of a discourse. For a discussion of the problem of infinite regress and its irrelevance within the context of specific discourse, see Batens (1992).

6. As one descends a hierarchy to more basic phenomena, one progressively excludes an increasing number of potentially significant features of the highest level phenomenon which is the primary focus of study. Consider the hierarchy discussed in the text. The primary focus of study, expert behavior, is studied through the phenomenon of judgment/decision making. In choosing this lower level phenomenon as the instrument of investigation, the potential for insight offered by other second tier phenomena (e.g., automaticity, task duration, etc.) is excluded. Use of investigative phenomena at successively lower levels of the hierarchy increases the exclusion, thus narrowing the

scope of the research and thereby rendering any findings increasingly less meaningful.

7. The hierarchical relationship discussed in the text is described by Reichenbach, the noted philosopher of science, as follows:

> Every factual statement, even the simplest one, contains more than an immediate perceptual experience; it is already an interpretation and therefore itself a theory...We shall have to make use of the scientific theory itself in order to interpret the indications of our measuring instruments. Thus we shall not say, "a pointer is moving," but "the electric current is increasing." (Reickenbach, quoted in Friedman 1992 86)

In the text discussion, experimental methods used to obtain and quantify consensus, consistency, knowledge organization, operator frequencies, and the other trappings of a particular methodology, are measurement instruments to behavioral researchers in precisely the same sense as a galvanometer (in its various incarnations) is the physicist's measurement instrument. The interpretation of changes in the measures obtained from these instruments reflect an application of theory whereby changes in an observed lower level phenomenon (e.g., a correlation coefficient or the deflection of a needle on a meter) is interpreted in terms of the higher level phenomenon which is the primary focus of interest (presence of expertise or the work done by an electric motor.)

8. In this respect, it is interesting to note that as this paper is being written (January, 1997), the ABO section of the American Accounting Association is scheduled to release a monograph entitled *Behavioral Accounting Research: Frontiers and Foundations* in early 1997 (*ABO Reporter*, Winter 1997). Based on an early table of contents, and acknowledging the danger in making generalizations prior to actually having read a publication, four of seven chapters in this monograph deal with judgment and decision making research, and one chapter each is devoted to accounting and organizational control, ethical behavior, setting accounting policy, and using sociology in accounting research. The bulk of the monograph, therefore, which in its title purports to delineate the frontier of behavioral research, appears to reflect the bias discussed in this paper and to confirm the outlook for the future of auditing expertise research expressed in this section.

9. Studies also differ in terms of the substantive content of the task and the mix of subjects. The substantive content of tasks in the studies cited include internal control, analytical review, and accounts receivable. Subjects included both senior auditors and audit managers.

10. In this paper, the term "empirical" is used to distinguish all behaviors normally observable of auditors under field conditions from those which are not. In this respect, cognition and other forms of mental processes are not "empirical" behaviors.

11. Biggs et. al (1983), which is cited earlier as an example of the sequential nature of auditing tasks, is a rather poor example of an "empirically intense task." In this experiment, the analyses were prepared by the researchers. Hence, the subjects did not interact in any way with the data, the information sources, or other aspects of the task environment which would normally be encountered during selection, compilation, and manipulation of the data. Anecdotal evidence

suggests that such interaction increases understanding and insight. Findings from experiments which minimize the interactive aspect of task behavior are difficult to generalize beyond the particular task and experimental setting. The interaction with data and its effect on judgment/decision making is a significant topic that is ideally suited to study via the cognitive paradigm. It would be interesting to replicate this experiment having the subjects prepare their own analyses and then compare the decision outcomes with those originally rendered. Other studies should address the effect of this kind of interaction on decision outcomes across related accounting areas (e.g., sales/accounts receivable, inventory/purchases/accounts payable, etc.)

12. Libby identified the following as unique attributes of accounting environments for purposes of information processing and decision making research: substantial task related knowledge, the existence of high stakes, differing market structures, unusual hierarchical group settings, time pressures, and decision aids.

13. What knowledge is brought to bear in performing a task is that which is induced by the task context. That different contexts can alter behavior is, I believe, a universally accepted proposition. Rather, the issues of relevance to the current paper are the manner in which a context is induced (i.e., explicitly or passively) and the generalizability of that form of induction to auditors performing empirically intense tasks. Both Peecher's and Ashton's experiments, cited in the text, are outcomes oriented studies in the judgment/decision making tradition. Peecher explicitly provided information about client integrity and the preferences for justification of the auditor-subjects' firms. Client integrity was manipulated by providing aggregated information from fifty of the firm's partners about where the client ranked in terms of integrity in the firm's client portfolio. The firm's preference for justification was manipulated by statements urging either healthy skepticism, full consideration of all the evidence, or full utilization of the client's insights into it's own business. In contrast to this outcomes orientation, the process oriented approach advocated in this paper would examine what behaviors and interactions, if any, take place to ascertain a justifiee's identity and preferences, to obtain justification of a particular kind, to assess client integrity, to develop alternative explanations, etc. Given that the objective of an experiment is an assessment of auditor expertise, explicit manipulation as described above would not take place because by doing so, it would no longer be possible to ascertain if the auditor-subjects would have normally considered such features of the task environment, or if they did, in what way and to what extent these considerations affected their task behaviors. In the previously cited studies by Meixner & Welker and Ponemon, the environmental features which contributed to the reported effects (i.e., tenure with the same supervisor and a "normal" time to complete the task) meet the requirements for passive induction of context since no explicit attempt was made to make these particular features salient. Yet features such as an auditor's personal history and the activity taking place in an auditor's immediate surroundings, and this form of induction (viz, covert perception) readily generalize to virtually all task situations encountered in the field.

14. It is a common classroom experience that students, when given a problem to solve that contains "distractor" information, feel compelled to find where in the solution that information belongs. When questioned about solution errors resulting from such attempts, student replies often reflect the assumption that, if the information is included in the problem, it, therefore, must be relevant.

15. Uncertainty is in the mind of the auditor, and can reflect a lack of information, inconsistent and ambiguous perceptions, or perceptions of environmental volatility. In all cases, the uncertainty prevents specification of specific procedures to be executed and forces concentration on accomplishing more or less broadly specified objectives with specific implementation procedures determined on an *ad hoc* basis in the light of the evolving task situation.

16. Bamber (1993: 2) quotes Hofstedt and Kinard's (1970: 43) definition of behavioral research in accounting as including the study of the behavior of accountants. Auditing, a subfield of accounting, is clearly included within the purview of this definition, yet the literature has been predominantly biased toward judgment/decision making, only one of many behaviors which auditors exhibit.

17. This definition can be applied to either outcomes or processes. In the text, the emphasis is on process, i.e., behavior in the performance of a task. Given this emphasis, two different perceptions of expertise must be distinguished: (1) the expectations of an observer regarding the anticipated behavior of another, and (2) the observer's assessment of another's expertise after having observed that person's behavior. Statements parallel to these may also be made regarding outcomes. A full discussion of the ramifications of the preceding comments are beyond the scope of this paper. However, this conception of expertise raises some interesting questions. Does it take expertise in an endeavor to recognize the expertise of another in that endeavor? For example, what can one who is completely unfamiliar with carpentry say about the observed behavior of another working with wood and tools? Will the unskilled and uninformed observer tend to focus on outcome while the skilled and informed on process? Will those that are skilled and informed focus on those aspects of task behavior that they themselves find most difficult? Are the perceptions of only the skilled and informed relevant? None of these questions has been given any definitive answer in the literature, yet all researchers, by their very own work, imply answers. I submit these issues for future research. However, for the moment, I am forced to assume that what a researcher studies is colored by that researcher's expertise in the task studied, and to acknowledge all that this assumption implies for focus and methodology.

18. The auditor's *intrinsic* knowledge and skill (if indeed such a concept can actually be defined) are irrelevant to the assessment of that auditor's expertise, since the observer's judgment of expert behavior (and this is the assessment which counts) is based on *apparent* or *manifest* knowledge and skill.

19. A formal exposition of the logic of the proposed paradigm is beyond the scope of this paper (see Russo 1997b.) Loosely put, however, a positive statement has the form "Smith read the file because it was displayed on the monitor screen, it was written in English, Smith reads and understands English, etc., ..." The number of necessary conditions in such a statement is indeterminate and potentially infinite. On the other hand, given a positive statement such as the preceding, failure to observe Smith reading the file when that behavior could have been expected can result in a negative statement of the form "Smith did not read the file because the disk on which it is saved was not available." To make such a statement, only a single sufficient condition is required.

20. Perception behaviors are all those observable behaviors by which stimuli are received from a task environment. In auditing, these behaviors typically are reading, listening, and observing. Execution behaviors are those whereby an auditor transforms a task environment. In auditing, these behaviors typically include requesting, writing, using mechanical devices such as calculators and telephones, searching, etc.

21. The assumption that the task behaviors of experts are automatic functions as an ideal standard for analytical purposes rather than as a realizable standard of expert performance. Since task outcome is not considered, task behavior approaching this standard can only be said to have become more *expert-like*. In tasks such as those in auditing, for which definitive determinations of the quality of outcomes are relatively rare (e.g., an outcome from auditor litigation), a process oriented criterion can only indicate expert-like behavior.

22. Given a set of cues related to a specific domain of performance, the term "knowledge base" is used to represent all the information accessible from memory to an individual performing in that domain.

23. All non-automatic empirical behavior is necessarily preceded by cognition. However, a finding that an empirical behavior was preceded by cognition does not necessarily imply any association between them. For example, in order to establish a causal relationship, the strongest form of association, it must be shown that a cognition was on the access path terminating with evocation of an observed procedure. However, automatic behavior may also be evoked by covert perceptions which occur during a cognitive episode (e.g., a sharp unexpected loud noise which evokes a learned or instinctive defensive response). In such instances, there would be no association whatever between the observed behavior (e.g., the defensive response in the preceding example) and the immediately preceding cognition. However, in the absence of evidence to the contrary, the presumption of an association between an observed behavior and the immediately preceding cognition is a reasonable one to make.

24. Requesting is an observable behavior during which an auditor initiates verbal communication with another person in the task environment. The communication may be either face-to-face or by means of a transmitting device such as a telephone or intercom.

25. The knowledge base attributes referred to in the text are information content and availability, both of which affect the ability of an auditor to put information to use during performance of a task.

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