AFFECTING CUE SELECTION THROUGH CONTEXTUAL INTEGRATION

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ABSTRACT

This dissertation presents research examining the role of contextual patterns, salience, and individual differences in the determination of how much is incidentally remembered from a cognitive task performed during the exploration of a naturalistic outdoor environment. Previous empirical findings suggest that the human mind often selects cues for the storage and retrieval of information based upon a rigid, pre-determined hierarchy, frequently disregarding useful contextual cues in favor of features most directly relevant to the information itself. Drawing from environmental psychological principles, factors are outlined that contribute to the salience of contextual cues, the most important of which is the cognitive integration of the context with the observer and the integration of both with the task or mental operation at hand. Such integration is referred to as "contextual integration" and may represent an over-arching schema that serves as a cognitive or affective indicator of personal significance. The first of two reported experiments demonstrated superior memory for contextually integrated stimuli over those given more rudimentary consideration. The second experiment found changes in memory resulting from an interaction between the type of task performed and the mediating role of a cognitive style known as field-independence. This interaction supports the notion that there are predictable patterns to the cognitive management of contextual information. The effects of these patterns are better accommodated by contextual integration than any single construct such as personal relevance or depth of processing. Furthermore, arousal states and affective ratings of the environment, in Experiments 1 and 2, respectively, showed differential changes in reaction to more or less integrated situations. Conducted almost entirely in a natural environment, the research presented attempts to more closely merge the empirical ideals of the environmental and cognitive areas in psychology.

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INTRODUCTION

Both individual and species survival are in large part determined by the ability to successfully, and selectively, process the highly complex and changeable stimulation comprising the typical environmental context. Evolutionary and sociobiological theorists talk about environmental pressures (Wilson, 1975), many perceptual and environmental psychologists inspired by the work of Gibson (1979) refer to "affordances," but it does not take any special knowledge or perspective to understand that there is an inescapable influence of environments upon everything that occurs within them. Despite its ubiquity and irrefutable role in human activity and development, the influence of the environment upon human cognition and behavior is difficult to isolate and quantify. That is why most psychology research is conducted in controlled laboratory settings and customarily does not consider the role of environmental or other contextual factors. There are notable exceptions, including but not limited to the entire field of environmental psychology and some perspectives in cognitive psychology. In fact, researchers from nearly every field of psychology make at least occasional attempts to incorporate their findings into a broader applicable context, and greater generalizability is an implicit goal of all psychology research. The present analysis focuses upon research approaches that make regular use of explicit manipulations and measurements of contextual factors and their interrelations in attempts to determine those qualities that render an environment, or other contextual element, more or less salient, meaningful, or personally relevant.

The principal idea behind the present analysis is that one of the most important qualities of real environments is their potential to satisfy the human need to perceive relations among the elements of any situation. That is, humans have an innate need to integrate their surroundings into a meaningful internal representation (Kaplan & Kaplan, 1983) and it should be possible to predict reactions resulting from the success or failure of that integration process. For instance, new or unusual elements introduced into a familiar environment will attract increased attention to that environment (Nadel & Willner, 1980; Jacobs, Thomas, Laurance, & Nadel, 1998) as the new element is integrated into the schemata representing the entire contextual milieu. Depending upon the perceived importance of integrating the new element, the inability to do so can lead to increased arousal and eventual frustration or even stress (Stokols, 1979), or the diversion of attention away from the anomalous information if it is deemed unimportant or unmanageable. This is the first sense of the term "contextual integration" that will be used throughout this thesis, the degree to which elements of a situation work together to form an interrelated conceptual schema. Used as a verb, the term can also refer to the human tendency to cognitively restructure information in an effort to create such a state of affairs. The third, and most frequent, use of the term contextual integration in this analysis will be in reference to the application of that ideal to research investigating human-environment relations.

The general concept of integration is certainly not new and has re-emerged in psychology with increasing frequency over the last several decades, particularly in the areas of cognitive and environmental psychology. Addressing a conference on levels of processing in memory, Jenkins (1979) acknowledged an already rapidly growing trend by saying "Everyone now knows that memory phenomena are much more complicated and contextually determined than we used to think they were" (p. 430). In his arguments, it is clear that Jenkins uses the term "contextual" in a general sense to mean that a broad range of factors bear on memory and that as many as possible should be considered at a time. Physical context is just one subset of these possible sources of variation. Context-dependent memory research focuses almost exclusively on physical contexts (Godden & Baddeley, 1975; Smith, 1988; Smith & Vela, 2001), as well as internal contexts such as mood (Blaney, 1986; Bower, 1981; Eich & Metcalfe, 1989), in what is possibly the best example of a consistent integrative approach to research in cognitive psychology.

The relation between a person and his or her environment is merely the starting point for research in environmental psychology, which takes an holistic approach to psychology wherein complex experimental integration involves multiple interacting elements. For example, environmental psychologists interested in the cognitive effects of a stressor in a particular environment (e.g., noise in a school setting, Ward & Suedfeld, 1973) will make every effort to analyze a situation very much like the one in question (preferably in the actual setting, as in the Ward and Suedfeld study) rather than simply relying upon standards for the stressor obtained in controlled laboratory situations. This situational realism is also applied to the tasks performed during an experiment. Environmental psychologists try to have subjects perform tasks that are normal for an environment, using variations in performance on those tasks as broader indicators of the effects of environmental factors, rather than using only physiological or simple yes-no response indicators of a reaction. As would be expected, the greater resulting generalizability is often accomplished at the expense of such experimental hallmarks as internal validity and replicability (Stokols, 1987), but the reactions of subjects in such studies are less likely to involve demand characteristics or response biases than those of subjects in laboratory settings. Reactions can also be more pronounced, as in the case of a frustrated subject in the Ward and Suedfeld (1973) study who used a fire axe to chop the cable supplying recorded highway noise outside his classroom.

This dissertation describes theory and research that support a cognitive approach to environmental psychology. A principal concern of such an approach is the maintenance of experimental rigor and replicability in real or realistic environments without losing the qualities of those environments that determine important factors such as their affective significance or personal meaning. Existing research will be reviewed that has already defined some of the more important determinants of such environmental qualities, and issues related to their measurement. Relevant findings and assumptions in cognitive psychology are presented to establish the concept of task-relevant cue selection and its relevance to the process of mentally structuring the environment, the importance of which is reviewed through the literature on environmental interaction and preference. To help bring these issues together, contextual integration is presented as a means of characterizing situations in terms of the degree to which they represent an optimal combination of elements that might satisfy the human need for an ordered context. Research is presented that uses changes in memory performance and mood to examine the role of contextual integration in the day-to-day process of organizing and acting upon environmental information.

> From an evolutionary perspective it is reasonable to assume that not all stimuli are equal, that some stimuli that are of functional importance to the organism will have special affective properties associated with them (Kaplan, 1987, pp. 4-5).

Perspectives on the Selection of task-Relevant and Environmental Cues

If certain patterns of contextual information can acquire more meaning and significance than others, with related changes in attention and other cognitive functions, then a better understanding of the patterns might provide a template for more narrowly focused analyses of the functions both antecedent and consequent to such affective responses. As the preceding quote from Kaplan (1987) suggests, there may be patterns of stimulation to which the human perceptual system is particularly sensitive, to which it allocates greater cognitive resources. The quote does not mention patterns explicitly, but as an environmental psychologist, Kaplan typically writes about complex stimuli such as landscapes and no doubt would agree with the present argument that patterned stimuli are most relevant to discussions of cognitive and affective processes. It is unlikely that any single stimulus would develop and later re-establish anything like a significant affective response without a corresponding interpretive context. A rock on its own may simply be a rock, but if holding it, feeling it, and seeing familiar streaks through its color draw forth from memory an earlier experience wherein the rock was found and became the center of a stimulating conversation on a significant day, then that rock is elevated in meaning to the status of a personal keepsake, a treasure. Its simple features call forth the entire pattern of stimulation of which it was a part when it was first encountered, a remembered pattern that lends the rock special meaning and significance.

This is by no means a new idea. The entire souvenir trade in tourist locations throughout the world capitalizes on this type of contextual meaning and place association. Jacoby and Craik (1979) discuss the same relativity and context-dependence of an item's significance in their discussion of distinctiveness and its contribution to the depth of stimulus encoding. According to them, "meaning is a set of contrasts resulting from distinctions required when interpreting the item in the context of some task" (Jacoby & Craik, 1979, p. 3). What is of particular interest in the present analysis is the effect of this meaning ascription upon later processes such as attention and selection, in addition to the aforementioned concern with the underlying organizational nature of the ascription process itself.

In a description of the role of complex contextual patterns in emotional reactions and their consequent effects upon cognitive activity, Russell (2003) includes "all the information possessed about the external cause" (p. 148) in a long list of factors contributing to "Core affect [which] is part of the information used to estimate affective quality and thus is implicated in incidental acquisition of preferences and attitudes" (p. 149). He also mentions mood-congruent memory, the idea that what is remembered from a stimulus array may depend upon the correspondence of its emotional valence with the mood of the individual. Similarly, in what is widely accepted as the best explanation of a long, complicated history of context-dependent memory results, Eich (1995) provides evidence that affective states associated with reinstated learning environments mediate the beneficial effects upon memory for material learned in those environments. Given these strong, complex associations among personal significance, cognition, and the environment, the contextual integration approach provides a framework for research that considers all three. That framework allows a more narrowly focused delineation of the patterns of contextual information that elicit significant affective responses of the type likely to influence cognitive processes.

Eich's (1995) manipulation of mood, independent from changes in the environment, can be seen as a contextually integrated approach. Not only did it provide a broader, more multi-faceted perspective on the factors contributing to context-dependent memory effects, and did so using a natural environment, but at a more basic level it also demonstrated the empirical ability to systematically vary a naturally occurring person-environment relation. In the area of environmental psychology, the research conducted by Ward, Snodgrass, Chew, and Russell (1988) also embodies what can be interpreted as a contextually integrative perspective. Their experiment manipulated complex relations among contextual elements using meaningful tasks that entailed distinct "plans," and measured their effects upon both environmental affective ratings and memory tests. The distinctiveness of the different task plans created meaningful associative relations among the person, the task, and the experimental situation, which is interpreted under the present scheme as a fairly high degree of contextual integration. Further analysis of these examples, their relation to personal relevance and its role in cue selection, and the possible mechanisms involved will follow more logically after a review of other existing integrative approaches to the organization of human thought and its relation to patterns of contextual information.

Cognitive Approaches to Integration

Order Out of Chaos: The Rational, Adaptive Mind. As mentioned earlier, Jenkins (1974, 1979) makes some important arguments for a "contextual" approach to research in psychology, which should entail the careful consideration of a comprehensive spectrum of variables influencing an experimental task. In particular, he proposes a "tetrahedron" of interrelated variables that converge upon ongoing cognitive activity. These are the "orienting task," the "materials," the "criterial tasks," and the "subject" variables (Jenkins, 1981, p. 233). At first, these appear to differ only slightly from the key factors proposed by the present analysis, those of the task, the environment, and the person. Splitting the task variable into subject- and task-related sub-components is a fairly minor theoretical divergence, but by limiting his "contextual" focus to the task-related materials and to subject variables such as expertise, Jenkins (1981) makes only passing reference to the tremendous pool of relevant information offered by the physical environment in which the task is performed. Although his model is not contextual in the sense most important to the present analysis, Jenkins (1981) does emphasize the importance of considering the interactions among the categories of variables, particularly in his earlier explanation of the model (1979), wherein he explicitly defined each interaction.

Anderson (1990; Anderson & Schooler, 1991) pays particular attention to the importance of environmental cues, suggesting that the selectivity of the human cognitive system may be the result of adaptive pressures throughout the evolution of the species. Cognitive systems are thereby attuned to the environments in which they develop so that resources are not wasted on attempts to incorporate unlikely events.

> The basic idea is that at any point in time, memories vary in how likely they are to be needed and the memory system tries to make available those memories that are most likely to be useful. The memory system can use the past history of use of a memory to estimate whether the memory is likely to be needed now (Anderson & Schooler, 1991, p. 400).

In other words, what the mind elaborates upon and eventually stores in long term memory is not only what it thinks it will need, but that which it can easily integrate into existing knowledge. Thus, Anderson introduces one particular ingredient which makes all the difference in attempts to understand human decision and cue selection strategies: the rational, adaptive nature of the human mind, which is uniquely capable of seeking out that which is familiar and understandable in an otherwise chaotic display of environmental and task-related stimuli. Schacter (1999) concludes a recent review of theories of memory and its limitations by supporting the Anderson and Schooler (1991) perspective, and by way of illustration prompts the reader to consider "what would be the consequences and costs of retaining the myriad of contextual details that define our numerous daily experiences?" (Schacter, 1999, p. 197). Clearly there is much to be gained in terms of processing efficiency if cognitive processes can be simplified as much as possible, and much to be gained in terms of predictive power if psychology can delineate systematic ways in which the mind accomplishes that simplification. An understanding of the hierarchy behind the cue selection process is an important step toward that delineation.

Associative Network Approaches. One of the most highly organizational approaches to cognitive psychology is the associative network theory of memory, for which the article by Collins and Loftus (1975) is probably the most often cited. The Collins and Loftus model describes a process by which a stimulus activates a number of "nodes" in a semantic knowledge network, which in turn activate related nodes and so on in parallel until enough of the proper connections are made to constitute a representational match to the original triggering stimulus. Once a matching pattern of internal representation is obtained, the target stimulus is recognized as having been encountered before. The aspects of the network approach that are most relevant to the present analysis are: (a) that relatively simple conceptual constructs that exist in the mind can associatively combine to form larger, more elaborate ideas, and (b) that an external stimulus can give rise to some sort of mental activation which in turn can trigger an infinite variety of thoughts and associations by traveling different paths through this network of differentially related concepts.

The applications for, variations upon, and extensions of the network theory are numerous and, due to their intuitive appeal, propagate swiftly (see Forgas, 1999, for a recent review and extension). In the approach most relevant to the present analysis, Bower (1981) discusses the way in which a mood or emotion can activate an entire network of related memories, concepts, and sensations, as well as the inhibitory effect an unrelated mood can have upon the attempt at activation. "The different emotion node will call up interfering associations that will compete with recall of the correct target items" (Bower, 1981, p. 136). By considering competing associations, Bower acknowledges the potential for associative connections to impede as readily as assist the activation of a target representation. He also used the network model to describe the influence of emotion upon several cognitive processes in addition to memory, including selective attention and social perception. In all of these instances, conceptual schemata in long term memory are considered the basis for determining the relative importance of incoming stimulation in order to prioritize the allocation of attention to those stimuli. "The contents of consciousness are the sensations, concepts, and propositions whose current activation level exceeds some threshold" (Bower, 1981, p. 134). Thus network theory supplies an explanatory basis for the present contextual integration approach wherein the key contextual factors of the person, the task, and the environment may represent primary nodes responsible for organizing basic associative patterns from which all further propositional analyses may proceed.

The hierarchical organization and high degree of interaction detailed by the models defining them not only make intuitive sense, they also serve well as explanatory constructs for a fair amount of data. In an early description of how associative theories account for cue effectiveness, Anderson and Bower (1973, pp. 341-343) report the results of a study done by a student of theirs (Wanner, 1968). In the experiment, single words were better sentence retrieval cues when the target sentence was one of a matched pair containing more ancillary associations to the cue word than if the target was the sentence with fewer associations. This is only one of many such experimental results Anderson and Bower (1973) explain with an associative network approach. Similarly, the works of Collins and Loftus (1975) and Bower (1981) are filled with such examples, most of which fall under the general category of research into "priming," which is a greater tendency for an item to be either recalled or otherwise produced if it, or material related to it, has been active in consciousness recently. With examples such as these, and much more empirical support across a wide variety of subtopics in psychology in the years since, the associative network theory of memory has proven its usefulness as a powerful predictive tool. Tryon (2002) suggests that the network approach is capable of integrating theories from numerous areas in psychology and related fields. The far-reaching applicability of network theories attests to the general usefulness of considering complex interactions among variables when studying cognitive and related phenomena.

Memory in Context. The study of memory in context has been the most active cognitive psychological approach to the investigation of how environmental and task variables interact to affect an individual's thought processes and performance. For this reason, and to more closely match Eich's (1995) study, the present experiments were designed to allow a context-dependent approach to the memory measures.

The term "contextual memory effects" will be used throughout this dissertation to refer to the general family of memory improvements, decrements, and congruencies attributable to the change or constancy of external and/or internal contextual cues present at the time a memory is encoded and again when it is retrieved. The prototypical example for this class of phenomena is the physical environment manipulation used by Godden and Baddeley (1975), wherein memory performance was lowest when the environment (in this case underwater or on land) during retrieval did not match the study environment and highest when the environments matched. This specific effect is referred to as place-dependent memory. Similar effects have been found for pharmacological-state contexts (Eich, Weingartner, Stillman, & Gillin, 1975; Eich & Birnbaum, 1982) as well as mood-state contexts (Bower, 1981; Eich, 1995; Eich & Metcalfe, 1989). These effects are referred to collectively as state-dependent memory. When referring generally to place- and state-dependent memory, it is customary to use the term context-dependent memory. The even broader term "contextual memory" is used here because this also can include mood-congruent memory, which was described earlier as the selective memory for material corresponding to one's current mood.

Almost from its earliest inception, contextual memory research has been more interested in the memory-related decision processes involved than in memory performance per se. At first, contextual memory researchers were preoccupied with the variety and kind of contextual cues available to the typical experimental subject. Smith, Glenberg, and Bjork (1978, p. 352) mention time of day, color of walls, and appearance of the experimenter as just a few examples of the many potentially important contextual features that a subject might use as memory cues. This perspective, which will be referred to as the cue-combination, or exact-sum, approach, considers any failure to replicate contextual memory effects a reflection of the inability to capture the exact combination of contextual features necessary to generate a useful or salient contextual cue. It quickly became apparent, however, that the mere presence or simple combination of memory cues does not guarantee their contribution to memory performance. A multiple-example failure to replicate the physical context-dependent memory effect was reported by Fernandez and Glenberg (1985) and similar contradictory results have appeared in the state-dependent literature (Bower & Mayer, 1989), all indicating the necessity for more complex explanations.

Acknowledging the role of person-related factors, Smith (1979, p. 464) refers to the "cuing" and "strategy" hypotheses to compare the general ability and the decision, respectively, of an experimental subject to utilize physical contextual cues to retrieve an associated memory or interrelated group of memories. By considering the decision processes of the individual, this emphasis upon cue selection contributes another piece to the overall puzzle of contextual memory, and comes closer to the present integrative ideal, but still ignores the importance of classifying the types of person-task interactions involved. Eich and his colleagues (Eich, 1980; Eich et al., 1975; Eich & Birnbaum, 1982) were among the first to use an implicitly hierarchical system to explain how inconsistent contextual memory effects might result from the differential relevance attributable to the various cues associated with a given task situation. From their perspective, failures to demonstrate the influence of context upon memory may reflect the presence and selection of more salient cues, such as related words or category exemplars (among the items referred to by Eich, 1980, p. 160, as "list" and "copy" cues). This emphasis upon the competition among task-relevant cues has been dubbed the "outshining hypothesis" (Smith, 1988, p. 19) and has been used most often to explain the consistent resistance of categorized list members and recognition memory to the influence of contextual cues.

Compared to the contextually integrative ideal advocated in the present analysis, the exact-sum approach places too much emphasis upon individual features of the context, of which there may be dozens. An experiment could precisely match every imaginable physical feature across times of study and test, but this would amount to a manipulation of only one key experimental factor: the environment. The cue selection and outshining hypotheses fare better in that they classify potential cues according to their salience, implying that factors such as meaningfulness and personal relevance may contribute to the cue selection process, an essentially integrative approach. That is to say that, by suggesting the role of organized self-referent decision factors in the process of cue selection, these approaches implicitly acknowledge the importance of considering complex person-environment relations in analyses of the ongoing control of cognitive activity.

Person-environment relations signify the interaction between only two of three key factors that interact to determine the three important relations that a fully integrated approach must consider. The third key factor is the task to be performed, and it interacts with the other factors to create the other two primary relations, between the task and the person and between the task and the environment. An analysis is not fully contextually integrated unless it considers the complex interrelations among the three key factors that interact to determine the overall context of any cognitive activity. For instance, an experiment that independently manipulates only one or two of these factors or relations at a time is likely to produce inconsistent results. From this broader perspective, the ability of a familiar category to "outshine" an environmental cue in a place-dependent memory experiment can be explained as a person-task relation (the association of list members with familiar categories) outshining a single environmental cue, as opposed to the less informative explanation of a task-related cue drawing more attention than an environment-related cue.

As an example of the importance of the interrelations among the key contextual factors, consider that in the Godden and Baddeley (1975) context-dependent memory experiment all the participants were experienced SCUBA divers, a fact necessitated by the use of an underwater environment. This implies a close relation between the person and the environment that has not been replicated in most subsequent research. A more precise definition of "close relation" will emerge later in this argument, but in the most basic sense, what is meant is the familiarity or personal relevance that comes from repeated interaction with an environment (as with SCUBA diving or other place-specific behaviors) or through learned or constructed place attachment (as with religious homelands or imagined locations). This personal relevance is the same type of affective response discussed earlier in relation to Russell's (2003) analysis of "core affect." The existence of such a relation will increase or decrease the subject's use of the environment as a contextual cue, depending upon the nature of the other relations. A close relation between any number of person and environment factors may increase the usefulness of reinstating the study context at the time of test, but a co-occurring strong relation between the person and the task (e.g., a familiar, demanding, or internally focused task) could counteract, override, or even magnify the resulting contextual memory effects. This is an important concept for the present analysis, and not without precedent, as illustrated by the earlier Kaplan (1987) quote and others to be presented and discussed later, including the following:

> Information that aids in making sense out of the environment is likely to be particularly salient. Information that allows an individual to make more accurate inferences about his whereabouts should be highly valued (Kaplan, 1975, p. 93).

Without straying from the contextual memory research, we see the importance of these relations described by Fernandez and Glenberg (1985, p. 344):

> We interpret and remember specific events as being embedded within a structure of more global (and more local) events interrelated by physical causes and psychological goals of the actors taking part in the events. Also, the environmental context is usually closely related to the events that occur within the environment. That is, the environment may be perceived as causing the event or enabling the event to occur. Thus, it is likely that relations between the environmental context and events are integral to the representation of naturally occurring events.

The key to understanding the significance of these relations and their interactions lies in treating the three basic contextual components as categories of activation, the interaction of which culminates into a contextually integrated, and thereby more memorable, experiential whole. The resulting affective response may, in fact, be the very type Eich (1995) posits as mediating context-dependent memory effects.

A Broader Reality: The Environmental Perspective

Environmental psychology has successfully adapted cognitive psychological principles to suit the broader reality it seeks to define. While the fully "contextual" ideal heralded by Jenkins (1979, 1981) remains the exception in cognitive psychology, such integrative approaches are not only central to environmental psychology, they are often superceded by those embracing "transactionalism," which adds the variable of passing time to the integrative approach (cf. Altman & Rogoff, 1987, for a thorough review of various world views in psychology). Most relevant to the present analysis, the environmental area takes a bi-directional perspective on person-environment relations that provides particularly fertile theoretical ground for further exposition of the contextually integrated approach to research in psychology.

Though he was technically a perceptual psychologist, the work of Berlyne (1960, 1963) established one of the first groups of explanatory variables destined to form the foundation of thought and practice in environmental psychology. He delineated four variables, novelty, uncertainty, conflict, and complexity, which he referred to as "collative variables" (Berlyne, 1960). These variables define classes of stimulus properties that exert varying attentional demands upon the human perceptual system. In 1963 Berlyne demonstrated the utility of a subset of these variables in the prediction of stimulus selection. Subjects presented with more and less irregularly patterned stimuli spent more time exploring the more irregular (MI) stimuli than the less irregular (LI) stimuli, but were more likely to rate LI stimuli as "pleasing". Berlyne explained these findings in terms of the processing demands of the stimuli and the arousal level experienced at various points during a typical stimulus exposure period. Typically, initial presentation is associated with an increase in arousal as the perceiver anticipates and then receives the previously unknown material. From that moment of initial exposure there is a gradual decrease in arousal, and any concomitant discomfort or unease, as the perceiver becomes more familiar with the particular stimulus array. Supposedly, during this time the mind of the perceiver is assimilating as much of the provided image as possible, breaking it into subsets of itself that are more likely to match existing conceptual representations in the long term memory network. Therefore, the more familiar or easily processed elements there are comprising the stimulus array, the less time the perceiver needs to process it and therefore the faster the recovery from the initial increase in arousal. "Characteristics such as orderly spatial arrangement, coherent grouping of elements, repetition, and redundancy, which distinguish our LI patterns, appear to curb the initial rise in arousal and to accelerate recovery from it." (Berlyne, 1963, p. 288) The increasing tendency to rate the LI patterns as "pleasing" is thus attributed to the perceivers' satisfaction at having met the processing demands quickly and relief at the swift reduction of arousal afforded by the patterns.

By defining and measuring the influence of stimulus properties upon human information processing and preference, Berlyne (1960, 1963) set the precedent for future analyses of the cognitive significance of environmental features. From the environmental psychology perspective, the role of cognition in person-environment interaction has been examined most extensively by Stephen and Rachel Kaplan. Following a similar attempt by Wohlwill (1968), Kaplan, Kaplan, and Wendt (1972) conducted an experiment in which subjects provided preference and complexity ratings for slides of environmental scenes. To improve upon the Wohlwill (1968) study, Kaplan et al. (1972) made an effort to create and pre-divide their slides such that they depicted distinctively "natural" contrasted with "urban" visual scenes. Their results indicated that complexity predicted preference for the scenes within, but not across, the natural and urban categories. Subjects greatly preferred the natural scenes, but apparently not for any reason directly related to complexity, despite the role of complexity in preference ratings within the categories. The hierarchical nature of decision making processes, discussed earlier in the context of cognitive psychology, begins to show itself here. Although complexity is a powerful predictor of environmental preference, its inability to account for the distinction between environments independently rated as natural and urban suggests that there are more salient features exerting greater influence upon the decision processes responsible for preference.

In a review of several approaches to environmental preference, Kaplan (1987) proposes four predictive variables: complexity, mystery, coherence, and legibility of a given visual scene. He classifies these variables in terms of two dimensions, the first being their contribution to one or the other of "two affectively important informational outcomes", which he defines as "'Understanding' (comprehending or making sense of a scene) and 'Exploration' (being held by the setting, being attracted by or pulled toward sources of additional information)" (Kaplan, 1987, pp. 10-11). The other classification dimension Kaplan uses is the difference between information that is "immediately available" and that which is "predicted or promised" (Kaplan, 1987, p. 11). In more recent work (Kaplan, Kaplan, & Ryan, 1998), this latter dimension has been further clarified as the difference between "2D," immediately perceptible features, and "3D," features that would require movement through the scene to be fully appreciated. Particularly noteworthy is Kaplan's (1987) explanation of the predictive variables in terms of adaptive pressures and the evolutionary advantage of a natural inclination to extract as much information as possible from the environment. These themes, and a cognitive psychological perspective, also guide the book by Kaplan and Kaplan (1983) in which they provide a thorough analysis of the human endeavor to better understand and function in the physical environment.

The evolutionary and information-processing perspectives introduced by the Kaplans have continued to influence environmental preference research and theory. Herzog and his colleagues have produced numerous recent articles (e.g., Herzog & Flynn-Smith, 2001; Herzog & Kutzli, 2002; Herzog & Miller, 1998; Herzog & Shier, 2000) covering a large array of environmental scene types and perspectives. Throughout these studies, factors such as complexity and mystery continue to demonstrate strong effects upon judgments and classifications of the scenes. There have been some refinements, such as the incorporation of factors from comparable theories (e.g., Appleton's, 1984, "refuge" factor) and the definition of additional predictors, such as "Visibility" and "Locomotor Access" (Herzog & Kutzli, 2002), but all within the same general theoretical purview. Peron, Purcell, and their colleagues consider the work of the Kaplans, but also include factors such as representational schemata and changes in frames of reference to clarify otherwise inexplicable changes in preference within and between scene types (Peron, Purcell, Staats, Falchero, & Lamb, 1998; Purcell, Lamb, Mainardi Peron, & Falchero, 1994; Purcell, Peron, & Berto, 2001). Their use of frames of reference bears some resemblance to the use of plans in the Ward et al. (1988) study, with similar effects upon the outcomes, and therefore represents another example of a fairly integrative approach to contextual relations.

Further discussion of the relevance of the environmental perspective on psychological processes must await the more detailed description of contextual integration in the next sub-section. In general, as part of its empirical standard of multi-level analyses, environmental psychology offers a framework for predicting cognitive reactions to particular classes of environmental stimulation that might fruitfully be applied to the analysis of cue selection strategies. Using the known extent of human processing capabilities as a guide, Anderson (1990; Anderson & Schooler, 1991), the Kaplans (Kaplan, 1975, 1987; Kaplan & Kaplan, 1983; Kaplan, Kaplan, & Ryan, 1998), and environmental psychologists since have demonstrated that it is possible to carefully examine the pattern of a stimulus array and assess whether its component features will influence approach, avoidance, selection, or any of a host of other behavioral and cognitive outcomes. The most valuable aspect of environmental psychology is not its attention to the role of environmental features in human activity, it is the field's careful attention to the entire milieu of person-environment interdependencies that makes it a promising field of scientific inquiry. Emphasizing the importance of empirical attention to relations more than elements, Suedfeld (1991) reminds us that we must examine "experiences within environments" rather than just people or environments in isolation.

The transactional approach of environmental psychology has made for some attractive theories, but has proven difficult to implement. Attempting to account for and control so many variables and all their potential interactions is typically not practical. That is why it is so important to have a means of determining what components of an overall experience contribute most to its overall meaning for an individual. With its classification of contextual relations into three primary categories, the proper activation of which defines an elaborate personal event, a fully integrated lasting schema in an associative network, the contextual integration approach may significantly increase the practicality of transactional analyses.

Contextual Integration and the Present Empirical Approach

It was emphasized in the section on contextual memory that the concept of contextual integration involves more than the arbitrary combination of memory cues hypothesized in most network models. Such models suggest that, regardless what features are combined, as long as they are related in some way, there is some specific number or valence of cue combinations that will trigger memory retrieval. Figure 1 illustrates the complex interactive potential that emerges from just a small subset of person and environment features and the relations that may exist among them. For instance, the receptivity of the person to naturalistic stimuli, arising from a confluence

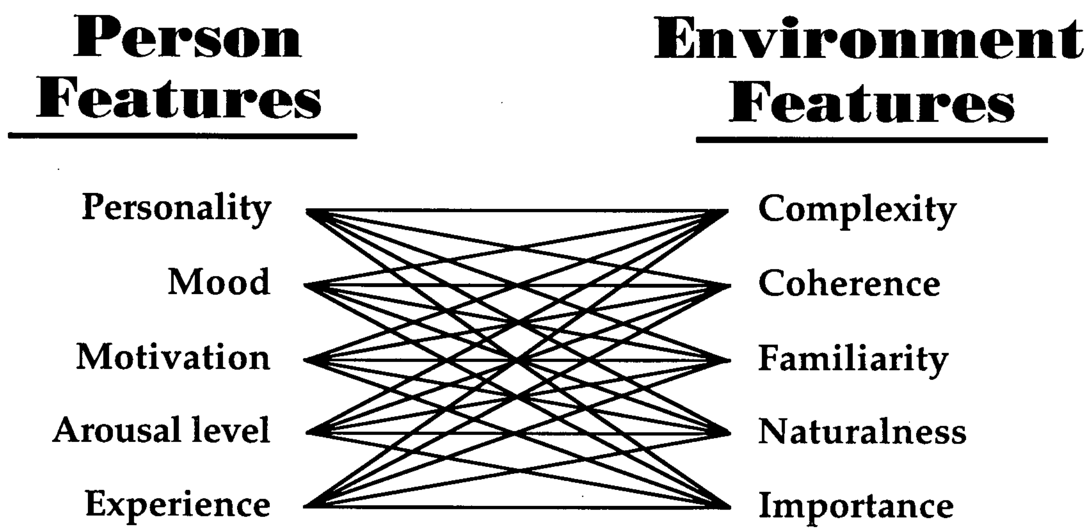

Figure 1. Illustration of potential first-order interactions.

of the person features listed in Figure 1, could interact with the more naturalistic features of an environment to render them more memorable or personally significant than any less naturalistic stimuli in the setting. This figure bears a strong resemblance to Metcalfe Eich's "illustration of the convolution of two items", a conceptualization of the way in which two items converge into "a higher order associative trace." (Metcalfe Eich, 1982, p. 631) The similarity between the figures highlights the similarity between the views, which focus on the network or pattern of activity stimulated by isolated combinations of cues and the power of past experience to enhance or impede that activation.

Contextual integration places less importance on specific cues and paths of activation, focusing instead upon the categories of activation to which cues belong and the division of those categories into the three key contextual factors of the person, his or her environment, and the current task, activity, or mental routine being performed. The central premise of the present analysis is that it is not just the activation of cues belonging to each of these categorical factors, but a measure of interaction among them, that is necessary to elevate an overall momentary experience to the status of a unique, distinctive event. That is, full contextual integration may be a necessary precursor to the attribution of affective properties to a given experiential milieu. Such full contextual integration represents the highest level in what is treated as a multi-level model of the process by which stimulus information is matched and integrated with existing knowledge. Figure 2 represents the interactive potential among the three key contextual factors. It is important to remember that the same complexity of interaction between the two key factors illustrated in Figure 1 (relation "a" in Figure 2) also exists between the person and the task and between the environment and the task (relations "b" and "c" in Figure 2). Although the empirical application of this model may at first appear overwhelmingly complex, it actually reduces complexity by grouping the interactive components into generalizable categories of activation. The remainder of this sub-section will elaborate the predictive potential of this approach.

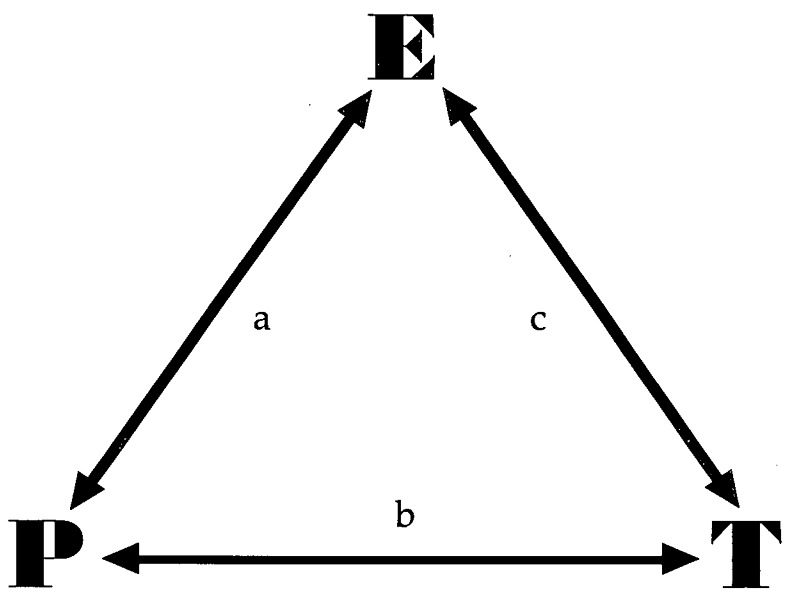

Figure 2. The relations between the person (P), his or her environment (E), and the task at hand (T).

The Factors

There is really no need to describe the key contextual factors at great length. Each is capable of infinite variety, but there is nothing mysterious about them and they are relatively self-explanatory. The only possible exception is the task factor which is interpreted rather broadly so as to include not just observable activities, but mental routines as well. There are two important points that need to be made about the role of the individual factors in the overall model. First, it is important to note that despite the complexity with which a single contextual factor may be dealt, whether it is considered across time, varied in appearance, or removed entirely, it is still just a single factor. For instance, the standard environmental match/mismatch procedure used in place-dependent memory studies represents the manipulation of the single factor of the environment. State-dependent memory studies are manipulating the person rather than the environment, but this is still just one independent factor, unless the environment is considered part of the mood manipulation. Second, there is no real place in the current model for solitary modifications of single contextual factors and the arbitrary combination of contextual features without regard for the primary factors to which they belong can yield unreliable results. The proposed key contextual factors may provide a structure for more precisely categorizing contextual influences, and yet their organizational strength is considered subsidiary to, and dependent upon, a consideration of their interrelations.

The one possible exception to the rule against the examination of single contextual factors is the person factor. Given that the person is the factor of greatest interest and complexity, it may be sensible to allow the consideration of individual components of the person regardless of whether or not they are part of a larger interrelated set of contextual factors. Sex and personality, for instance, are two person factors that can yield a great deal of information relative to the ease with which they can be incorporated into a psychology experiment.

The Relations

There are certain minimum relations among the key contextual factors that exist regardless the experimental manipulation or everyday situation. The person is always in some environment, the person is always performing some task (or at least cognitively processing, in a non-task-oriented situation), and the task is always present against the same environmental backdrop as the person. The integrative relations in the present model, however, are meant to indicate something more substantive than these basic co-occurrences. To use an analogy, simply tossing flour, butter, and milk into a pan and adding heat will not produce a smooth béchamel sauce. The correct proportion of ingredients must be combined at the proper time and with the appropriate amount of heat. In a similar fashion, full contextual integration can only be achieved if there is a specific pattern of interaction among contextual factors which exceeds the minimal level implied by mere co-existence. As for the "heat" that binds the contextual "ingredients," the affective response to a contextually integrated situation is the most likely candidate.

Returning to the cognitive psychology literature, person-environment relations ("a" in Figure 2) have received the most empirical attention, primarily from contextual memory research. Changing the environment from the time of study to the time of test does not really involve a "relation" between the person and the environment, but the multiple study room manipulation used by Smith (1979, 1984) came closer by drawing attention to the change. As mentioned earlier, the pre-existing person-environment relation in the Godden and Baddeley experiment (1975) also approaches more closely the level of integration implied by the present approach, but the relation received no special attention in that study. It was not until Eich's (1995) study that the relation between the person and the environment was given proper consideration in contextual memory research. Eich's (1995) experiments raise the level of contextual integration by independently manipulating mood and the presence of a pleasant natural environment. The result was a more comprehensive explanation for context-dependent memory effects than any that has been offered before or since.

There are also empirical examples of the other primary relations in the contextual memory literature. Eich and Metcalfe (1989) provided an example of the independent manipulation of the relation between a person and his or her task (represented by line "b" in Figure 2) when they had subjects either generate or read the to-be-remembered stimuli. Eich (1985) manipulated the relation between the task and the environment (relation "c" in Figure 2) when he instructed subjects to either mentally integrate the stimuli with environmental features or to simply form independent images of them. Both experiments found significant differences in recall depending on whether the study and test contexts were matched or mismatched, but only for the integrated stimuli in the case of the latter study. To explain the lack of context-dependent effects for non-integrated stimuli, Eich (1985) suggests that the independent imagery instructions may have diverted subjects' attention away from the environment, which might otherwise have contributed to what he suggests was an underlying "*experiential* context dependence" (p. 769) for material integrated with the environment. This argument anticipates Eich's (1995) later use of the more contextually integrative approach of independently manipulating mood and environment.

Working at the level of "higher-order, *composite concepts* (e.g., person-environment fit, place identity)" (Stokols, 1987, p. 51), environmental psychology "should attempt to discover the 'meanings' of the events to participants" (Altman & Rogoff, 1987, p. 34). After the person-environment relation, the most common relation considered in environmental psychology is that between the person and the task. A classic example is the independent manipulation of predictability and subject control over aversive stimuli in the determination of the stressful effects of noise (Glass & Singer, 1972). Similarly, Baum and Valins (1979) determined that degree of control, and learned helplessness resulting from little or no control, mediate the perception of crowding in a university dormitory environment. Summarizing the environmental perspective on general stress research and theory, Evans and Cohen (1987) name a variety of such factors that might mediate a person's reaction to an environment.

It is arguable that these factors can be interpreted as variations in the single contextually key factor of the person, rather than as representatives of a more broadly meaningful contextual relation. The former position would render these mediating factors no more theoretically significant than individual differences. They are considered examples of the important person-task relation from the contextual integration perspective, however, because they significantly alter the person-environment relation such that the meaning of the environment is changed for the person as a result. In sum, "the *meaning* of a physical configuration of an environment has powerful influences on whether those physical conditions will elicit stress" (Evans & Cohen, 1987, p. 596; emphasis added) or whatever reaction is under consideration. At the very least, these mediating factors should be seen as person factors that exert a significant influence upon, or derive their meaning from, the person-environment relation.

Whether comprising one of the key contextual relations or simply modifying another, the inclusion of mediating factors such as control, evaluation, or receptivity in models of human reactions to, and functions in, the environment still only raises those models to a moderate level of overall contextual integration. Stokols (1979) also considers such models incomplete. He suggests greater complexity is the key to better representing true environmental contexts, tempered by a consideration of the plans and goals a person brings to a situation. In a later discussion, Stokols (1987) says that experimenters must more precisely determine the "*effective context* of the target phenomenon" (Stokols, 1987, p. 46). The point about plans and goals (Stokols, 1979), regardless whether in relation to more or less complexly representative environments, is exactly in line with the contextual integration approach. According to this approach, it is in fact the plans given to subjects that render the situation in the Ward et al. (1988) study more representative of a true context. This is because the plans guiding behavior had demonstrable effects upon the meaningfulness of the task-environment relation.

Theoretically, if the over-arching experience to which an individual is exposed obtains the highest level of contextual integration, all other influences upon memory or any other cognitive process should become secondary. In the case of memory, recalling any one part of a contextually integrated whole should call forth the full experience, which is why contextual memory is of such interest when addressing this topic. Context reinstatement should not matter in the case of full contextual integration because the stored information is maximally available regardless the testing situation. High level, or full, contextual integration is, like transactionalism, a rather high empirical ideal that is difficult to achieve in practice and therefore quite rare. In some instances, as with stress research (Evans & Cohen, 1987), obtaining the same impact as the situation of interest may in fact be unethical. As Stokols (1987) says, environmental psychologists must do what they can to match contexts as much as possible, focusing upon those features that matter most. Contextual integration may offer a useful template for categorizing those features and determining the pattern of contextual information most likely to trigger a genuine affective reaction.

Once aware of the full contextually integrated situation, the mind establishes an array of reactions appropriate to potential changes in the given milieu. According to Ward and Russell (1981b), when a situation reaches this level of significance, recognizability, or meaning, it is said to have developed "emergent properties" that, in part, help to categorize the situation as part of an existing conceptual framework for environmental meaning. That framework guides what can be expected from, and contributed to, an environment in a given category. What this type of environmental categorization suggests with regard to the dependence of affective states upon cognitive processes is arguable, but in terms of the receptivity and reactivity of the human mind to environmental stimulation, it clearly suggests that there are many levels of environmental influence and that the mind has a hierarchical priority structure for dealing with them. The use of a fully integrative contextual approach may be the best possible way to track and predict the function of that hierarchy and truly begin the process of learning what matters to the human mind.

The Present Empirical Approach

Given the foregoing argument that a primary function of human cognition is to create order out of life's continual chaos, it is possible to see the naturally occurring contextual integration process as a sort of mental or affective triangulation. In order to make sense of an environment, and to aid the tasks that must be accomplished in it, the mind seeks meaningful associations and prefers, or at least begins with, those that fall into the relational categories, or key factors, described earlier. In a sense, full contextual integration represents the lowest common denominator or base template for the complex network of associations comprising an individual's personal knowledge. Incoming stimuli that do not fit the contextually integrated pattern are either rejected as anomalous but irrelevant or tagged for further analysis to resolve the idiosyncrasies. In order to capture this mental triangulation process and to allow some predictions regarding what types of contextual cues are likely to be used in which situations, the present empirical approach simultaneously addresses three different aspects of the experiments in this project. The cognitive aspect is concerned with the creation and assessment of the desired contextual relations, the affective aspect examines subjects' reactions to the cognitive elements, and the trait aspect considers some person-related factors that might mediate the effects of the cognitive and affective elements.

Cognitive Aspect. The foremost concerns in the present experiments were the creation of realistic and modifiable relations among the different contextual categories and the use of unobtrusive outcome measures to gauge the salience of those relations for the subjects. Subtle variations in the instructions were used to create task manipulations like those in the Ward et al. (1988) study, engendering the same types of meaningful associations between the tasks and the environment. In a similar way, the element of stimulus choice was used to alter the relation between the subjects and their task, in essence changing the depth of their consideration of the materials. Finally, a context-dependent-memory approach was used in the design of the experiments in order to capitalize on previous demonstrations of the person-environment relation and its possible sensitivity to cue selection strategies.

The dependent measures of verbal and global spatial memory were the primary means by which the present experiments assessed what was most salient about the experimental situations. Memory is often used as an experimental tool to reflect the function of deeper mental processes which cannot be measured directly themselves. By tracking what is successfully retained in memory, we are observing the preservation of that which is important to the cognitive system that achieved the retention. It is in this way that memory for a particular stimulus pattern may be understood as an indication of an underlying association to that pattern, an association that may represent something akin to personal relevance.

In general, it was hypothesized that an increase in the number of activated contextual relations would increase the salience of, and memory for, contextual elements both verbal and spatial, but only if each activated relation involved a different pair of contextual categories. Multiple activations of a single categorical relation were not expected to contribute to greater memory for the elements involved. Redundant person-environment relations, however, were recognized as a possible exception in that spatial memory should benefit from the resulting increased attention to environmental elements. With regard to context-dependent memory effects, the performance of subjects experiencing the minimum and maximum levels of contextual integration was expected to reflect little or no influence from a reinstated context. The context was not expected to be salient enough in the minimal condition and the high overall performance in the maximum condition was expected to leave little room for improvement. Context-dependent memory effects were considered most likely to occur in situations with incomplete contextual integration but involving at least one task-environment relation, due to the resulting increase in the relevance of the environment to the task.

Affective Aspect. In addition to the purely cognitive measures, the present experiments included affective measures to further assess potential changes in the salience of contextual elements attributable to their incorporation in activated relations. There were not any direct manipulations of mood, as in Eich's (1995) experiment, but it was carefully tracked, and affective and other qualitative ratings of the environment were also collected.

The general hypothesis for the affective ratings was an overall increase in positive ratings and a decrease in negative ratings associated with increases in contextual integration. This follows from the assumption that higher levels of integration should render a context more cognitively manageable and therefore more appealing, as measured by environmental and personal affective ratings. As Kaplan (1975) suggests, "humans would be expected to prefer an environment where both recognition and prediction can be achieved without undue effort" (p. 98).

Trait Aspect. The design of the present experiments did not allow for the independent manipulation of person-related factors, but it was considered worthwhile to control for two factors deemed relevant to the other topics, sex and cognitive style. Although neither is a "trait" in the often-used sense of a personality factor, this term was chosen as a category label because of its general reference to stable, as opposed to transient, individual qualities.

There were no sex differences expected with the verbal memory measures, nor with the affective measures, but sex was balanced across groups in the present experiments because past research suggests there may be sex differences in spatial abilities (McGuiness & Sparks, 1983; Moffat, Hampson, & Hatzipantelis, 1998). Based upon the results of these studies, male subjects were expected to perform slightly better on the spatial memory measure.

The cognitive style measure used in the present experiments is also related to spatial ability. An attempt was made to balance the groups with regard to subjects' scores on a measure of field-independence (Witkin, Oltman, Raskin, & Karp, 1971), which is roughly defined as the tendency to readily separate an object from its background or context. Sternberg and Grigorenko (2001) debate whether it is a tendency or an ability, perhaps even a component of intelligence, but there is general consensus that field-independence is not a personality factor due to its basis in observable perceptual performance differences.

Assessing field-independence was considered important for the present study because there is research to suggest that field-independent individuals may be more inclined to engage in "cognitive restructuring" of incoming stimulation (Davis & Frank, 1979). Cognitive restructuring can take the form of three different possible operations, all capable of influencing performance in the present experiments:

> (1) breaking up the organization of a stimulus complex so that its elements can be operated upon separately or in new combinations; (2) providing structure for an ambiguous stimulus complex; and, (3) providing a structure different from that implied by the inherent structure of the stimulus complex (Davis & Frank, 1979, pp. 469-470).

The evidence for field-independence-related differences in memory is somewhat inconsistent and has been summarized by Goodenough (1976) as the result of differences in the use of memory strategies rather than in general ability. Smith (1984) found differences in his contextual memory results attributable to field-independent versus field-dependent characteristics, although he did not discuss the result much because it did not interact in any meaningful way with his other results. Given the variability in the designs and results of previous research, there was no attempt made to predict any role of field-independence in the present experiments, hence the decision that it would be sufficient to balance the groups with regard to this measure.

EXPERIMENT 1

Ideally, the contextually integrated experiment should represent a more significant, interesting, and enjoyable event for those participating in it. Such attributions undoubtedly would contribute to more ecologically valid results given that such affective indicators are probably some of the criteria that people use to determine their willingness to participate in day-to-day activities. Both of the present experiments were designed to demonstrate the cognitive and affective effects of complex contextual relations in a situation more natural but less easily controlled than that of the typical laboratory, using methods intended to be as engaging yet unobtrusive as possible. Thus, every effort was made to create experimental situations that were as realistic and enjoyable as possible. The choice of a naturalistic outdoor environment in which to conduct the experiments was just the first step of that process. The Nitobe Japanese Garden on the University of British Columbia campus was chosen because (a) it is a naturalistic environment, which makes it more engaging and pleasant, (b) it is only 6 minutes away, by foot, from the University of British Columbia Psychology Department, and (c) it was the pleasant mood environment in Eich's (1995) experiment.

The qualitative guideline for a realistic, engaging experimental situation was also applied to the creation of the primary task for both experiments, which was designed to make sense in the environment, to complement its design and appearance. To use Barker's (1968, 1987) terminology, the task was intended to feel appropriate for the behavior setting. The primary task created for the present research was essentially a wayfinding task wherein subjects were told to explore the Garden as thoroughly as possible. This task was chosen because it is not an unusual behavior in a new outdoor environment, particularly one with inviting paths winding about it, like the Nitobe Garden. An exploration task was also chosen because it would easily accommodate the additional tasks related to the cognitive and affective aspects of the experiments.

The secondary tasks, intended to manipulate the various levels of contextual integration, control for alternative processes, and present the to-be-remembered stimuli, required considerably more compromise between the qualitative guideline of realism and the quantitative reality imposed by the desired level of experimental rigor. To satisfy the intended quantitative guideline for experimental precision and control, and to fit within a general incidental verbal memory paradigm, all the tasks needed to be only slight modifications of the same basic task and they had to present word lists to the subjects without letting them know that they would be tested for memory of the words later in the experiment. The similarity across tasks was to ensure that any elicited differences in performance would be attributable to the different levels of contextual integration each task invoked, as opposed to some other quality, such as difficulty or required depth of processing (Cermak & Craik, 1979; Lockhart & Craik, 1990). This requirement often conflicted with the qualitative guideline determining that the tasks seem as natural and unobtrusive as possible. The incidental nature of the memory task fortunately satisfied both the qualitative and quantitative guidelines. Qualitatively, incidental memory is a far closer approximation to the function of memory in day-to-day circumstances, since most people do not go about life trying to memorize everything they encounter. Quantitatively, incidental memory techniques are preferable to intentional memory techniques because the latter afford subjects the opportunity to utilize their own rehearsal strategies, greatly reducing experimenter control over the actual mental processes elicited by the tasks (Bellezza & Reddy, 1978; Lockhart & Craik, 1990; Neill, Beck, Bottalico, & Molloy, 1990).

Therefore, the basic secondary task in both of the present experiments was creative storytelling. Although this task and the changes used to vary its integrative nature were somewhat unusual and not always probable for the Garden location, they were deemed satisfactory because (a) in all but the most contextually integrated conditions, discordance between the task and environment was appropriate, (b) task-environment discordance supported the ostensible role of the secondary task as a distraction intended to interrupt the subjects from their primary task of exploring the environment, and (c) all tasks met the minimum guideline for contextual integration, they each appeared to acquire their own unique meaning and significance. There is ample research demonstrating that convincing instructions can instill what has been called a cognitive or perceptual set that can alter affective judgments (Ward & Russell, 1981a), memory for the environment (Ward et al., 1988), environmental categorization (Genereux et al., 1983), and visual perception (Coren, Porac, & Theodor, 1986). Care was taken in the present experiments to ensure that it was exactly this type of distinct approach that was adopted for each task.

An ancillary purpose of these experiments was to demonstrate the valuable role of computer control and automation in research examining such complex phenomena. All procedures in both experiments, from group selection through presentation of the instructions to data collection, were initiated and controlled automatically by computer programs written specifically for this project.

In the simplest terms, these experiments both involved the presentation of word lists interspersed with the exploration and rating of an outdoor environment, along with mood ratings, all occurring on the first of two days. Testing for memory of the word lists and environmental locations occurred 24 hours later, give or take an hour, with or without some form of reinstatement of the first day's environmental context. Both experiments were run relatively concurrently with the exception that Experiment 1 was nearly half completed before Experiment 2 started and was finished about a month earlier. The experiments were run continually over the course of a year and a half. The weather varied according to the seasons throughout this time, but extreme conditions were always avoided such that it was never raining and there was only snow on the ground twice. Other variations were minimal and distributed across all groups.

The principal goal for the first experiment was to test the predictive power of the contextual integration approach, compared with the less specific cue-combination approaches more typical in psychology, such as in context-dependent memory research. If a meaningful, memorable association with the features of a new situation can result from any random activation of cues, regardless of their quality, nature, or source, then activating three redundant versions of the same relation in the contextual integration model should exert no less influence upon cognitive and affective measures than the same number of activations distributed across the three different relations of the model.

Method

Subjects

The subjects in the first experiment were 54 men and women, ranging in age from 18 to 28 years old, randomly chosen from among those University of British Columbia psychology undergraduates responding to a departmental advertisement. All subjects received extra course credit for their participation. Sex and field-independence were balanced across all groups. The most common paper-and-pencil measure of field-independence, the Embedded Figures Test developed by Witkin et al. (1971), was deemed too time-consuming to administer, so a related measure, the five minute "flexibility of closure" (Cf) subscale of the Comprehensive Abilities Battery (CAB; Hakstian & Cattell, 1975), was used to infer this cognitive style. The CAB-Cf was administered after group assignment, however, and exhibited a pronounced ceiling effect, so the balance across groups was imperfect.

All subjects were screened when they signed up in order to exclude those who had visited the Garden before, so as to eliminate any pre-existing familiarity. Three subjects were allowed who had been there before, but so long ago and for such a brief time that they insisted they had no recollection of the Garden's features.

Materials

The to-be-remembered stimuli were 60 common nouns, chosen from the Toglia and Battig norms (1978; clusters 7 and 8). The word list was created using another computer program designed for this experiment, but applicable to any research wishing to use verbal stimuli from the published norms from which the program draws. The program can be instructed to generate lists of any length, to restrict the length of the words, and to generate lists weighted on any of the seven "semantic dimensions" reported in the norms (Toglia & Battig, 1978). The only restrictions placed on the words for the present list were a minimum word length of four letters, a maximum word length of eight letters, and an average concreteness rating of 6.3 (out of a possible 7). After slight manual adjustments were made in order to limit internal associations (e.g., reducing the unusually high number of food-related words), the words in the final list had an average concreteness rating of 6.0, an average imageability rating of 5.7, and an average meaningfulness rating of 4.4. This list was then divided randomly into six different lists of ten words each. The lists, complete with semantic dimension ratings, can be found in the Appendix.

All subjects were shown all ten words from each list but were instructed to use only half of them for the verbal processing (e.g., storytelling) task. In conditions where a person-task relation was desired, the subjects were allowed to choose their own words. Subjects in the other conditions received the words chosen by another subject, in a yoked control fashion, and were told that they were random selections. The logic behind having some subjects choose their own words was that the additional processing required to select the words would create a more meaningful, and therefore more memorable, personal association with the chosen words, in a way similar to the effect of generating words from ambiguous stimuli (Slamecka & Graf, 1978). The yoking process of giving the word choices from each subject in a word-choice group to a single subject in each of the other groups in the same experiment was intended to off-set the fact that each chosen list was unique.

Mood was assessed at the beginning and end of each experimental day using the Positive and negative affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) and the mood grid developed by Russell, Weiss, and Mendelsohn (1989). The PANAS is comprised of 20 adjectives that subjects rate on a five point scale to describe how well each one indicates their mood, from "very slightly or not at all" to "extremely". The mood grid, shown in Figure 3, was developed from a circumplex approach to the measurement of affect (Russell & Lanius, 1984) and is completed by placing a single point on the grid to indicate mood. That point is then converted into two scores, ranging from -4 to 4, indicating arousal level and the qualitative assessment of that arousal level in terms of how pleasant or unpleasant it feels.

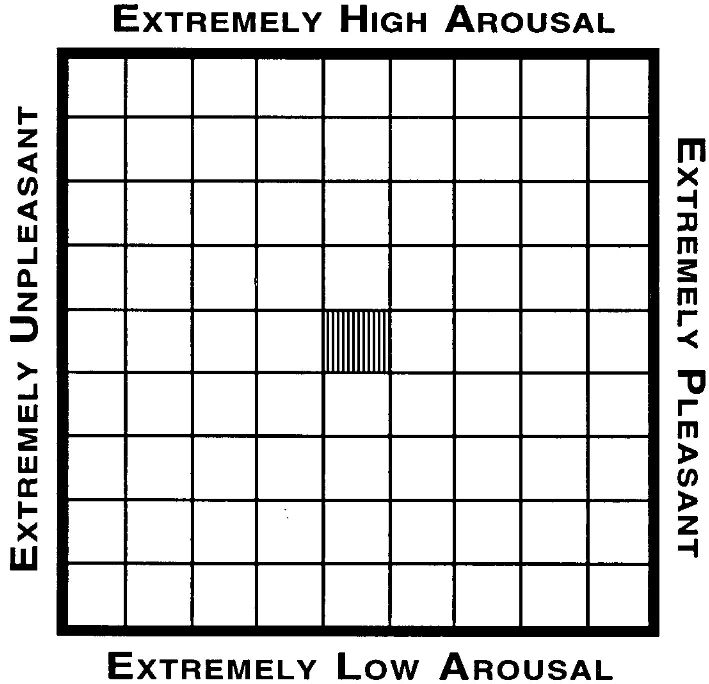

Figure 3. The Mood Grid.

Subjects were also asked to use the PANAS and the mood grid to rate the experimental environments each day. This was not peculiar in the case of the mood grid, which was adapted from a method for interpreting environmental ratings (Russell & Lanius, 1984), but there is no known precedent for using the PANAS in this way. The most similar approach is that of Ward et al. (1988) who used a 40-item questionnaire designed more specifically for rating environments. For both measures used in the current study, subjects were told to rate "the mood attributes of the environment itself," with emphasis placed on the independence of those attributes from their own moods. For clarification, they were told to rate "how this environment would generally affect the average person." Subjects also rated the environments for complexity and preference, on a 5-point scale ranging from "little or no" to "very." Prior to these ratings, subjects were given the Herzog, Kaplan, and Kaplan (1976, p. 630) definitions for these variables: "intricateness, or the opposite of simplicity" for complexity, and "how much you like the scene for whatever reason" for preference. In addition, it was emphasized that complexity should be considered a visual or aesthetic measure of the environment as a whole, as opposed to an approximation of something more scientific like the biological complexity of individual plants.

Equipment

All of the computer automation and presentation was accomplished using Apple's HyperCard program. HyperCard uses the HyperText computer language, an early precursor of HyperText Markup Language (HTML), which is currently the most widely accepted language for creating web-sites. HyperCard's use of HyperText, however, is far more powerful than HTML, allowing variable naming, complex mathematical calculations, and conditional responses to input. The HyperCard programs designed for these experiments were presented on an Apple Power Macintosh G3 computer with a 17-inch monitor. A hand-held Canon ES970 8mm portable video recorder was used to record images and short videos of the Garden for later use in the spatial location memory test. The video camera was also used by subjects as part of the exploration of the environment on the first day of both experiments. The videos for use in the location memory test and a short demonstration simulation of the Nitobe Garden were digitized using the Adobe Premiere video digitizing and editing program. They were compressed into Apple QuickTime files using the Sorenson 3 compressor. Still image editing was accomplished with Adobe Photoshop and a Wacom Graphire pen tablet.

All word presentation and data collection occurring in the Nitobe Garden used a Palm IIIe personal data assistant (PDA) running the HanDBase data entry and management program. Because the data on the PDA could be transmitted directly to the computer, this effectively eliminated experimenter data entry error, automated the data tabulation process, and greatly reduced the amount of paper used. Better still, it increased the ease and efficiency of data collection and allowed the word selection yoking manipulation described earlier. Without the PDA, the yoking procedure would have been unwieldy and error-prone at best. In addition to the word lists, there were

PDA versions of the PANAS, the mood grid, and all the environmental ratings. Finally, the PDA was used to make shorthand notations of subjects' progress through the garden and it recorded the start and finish times of that progress.

Design and Procedure

The satisfaction of the cognitive aspect of the present empirical approach required the manipulation of two principal independent variables, the type of processing applied to the stimulus words on the first day (task) and the presence or absence of the first day's environment on the second day (reinstatement). The task variable manipulated the degree of contextual integration by combining various types of processing according to the categories of contextual information activated by them. The reinstatement variable was included to track potential context-dependent memory effects.

The three levels of the task variable were independent activities, redundant activities, and integrated activities. The first and third conditions represent the lowest and highest possible levels of contextual integration in this project. In the independent activities condition, subjects were instructed to create a brief story using the five list words pre-selected from the original ten. This, like all the verbal tasks, was repeated six times using each of the six lists, interspersed throughout the exploration of the environment on the first day of the experiment. The independent activities task was not intended to activate any contextual relations, but the person-environment relation was considered to be activated across all conditions by the environmental exploration task. Thus the independent activities condition featured an activation of only the person-environment relation. This was presented to the subjects as an exploratory task that would be randomly interrupted by a storytelling task.

At the opposite extreme, the integrated activities task condition was designed to do more than just activate each of the relations depicted in Figure 2. Conceptually, it combined two of the relations (those of the person and environment with the task, labeled "b" and "c" in Figure 2) and then had the third relation (that of the person with the environment, labeled "a" in Figure 2) interact with that combination. Subjects were instructed to select and then imagine hiding five of the ten words in spots of their choosing in the immediate vicinity. Again, this was repeated six times throughout the Garden. The person-task relation was activated by allowing subjects to choose their words, the task-environment relation was activated by the process of hiding the words, and both were encompassed by the person-environment relation activated by the Garden exploration task. The interruptive nature of the verbal task in relation to the exploratory task was de-emphasized for subjects in this condition in favor of a more interactive interpretation of the relation between the two. For instance, subjects were told to think of the hide-spot selection process as an extension of the exploration of the Garden, a means of more thoroughly examining it. It was assumed that the person-environment relation would achieve greater activation in this condition than in the others, engendered by the subjects' freedom to choose the hiding spots and the spatial orientation and planning required to perform the entire operation, along with the filming of the entire process. This may not have been the case, however, as the spontaneous reactions of most subjects, in all conditions, suggested that at least the verbalization part of the word-hiding task was very much a distraction from the exploration and enjoyment of the environment.

The redundant activities task, involving three different activations of the person-environment relation but none of the others, was designed essentially to increase the salience of the environment without increasing its relevance to the verbal task conducted within it. The idea was to bring together the important qualitative and procedural aspects of the distinctly different independent and integrated activities tasks, combining the complexity of the latter with the low contextual integration of the former. In terms of its presentation to the subjects as two competing tasks, exploration interrupted by storytelling, the redundant activities task was nearly identical to the independent activities task. Subjects used pre-selected words to create a story which they then told aloud. Prior to the verbal part of the task, however, subjects performing the redundant activities task were instructed to do something very similar to portions of the integrated activities task. They were told to imagine they had to hide something in the Garden and to videotape three distinct views of the immediate surroundings in which that could be done. This provided the second activation of the person-environment relation in addition to that provided by the mere exploration of the environment. The third activation of the relation was accomplished at the very beginning of the exploration of the Garden. Upon first entering the Garden, subjects were directed to the bench just inside the gate and the ratings of the environment were done prior to exploration, rather than afterwards as in all other conditions. This immediate consideration of its qualities was expected to increase subjects' overall attention to the environment.

The levels of the reinstatement variable were none and physical. In the "none" condition, subjects did not return to the garden on the second day of the experiment and no attempts were made to remind them of it. Half of the subjects were assigned to this reinstatement condition, the other half experienced the physical reinstatement condition, which meant returning to the garden on the second day.

The experimental design is summarized in Figure 4, which illustrates the intersection of the three task conditions with the two reinstatement conditions and the number of subjects successfully run through each resulting group. What follows is a description of the actual sequence of events for the experiment.

The laboratory room where each subject began the experiment was a small (approximately 4 meters square) non-descript room, the only distinguishing feature of which was that it did not have any windows. The door joining the room to the rest of the laboratory, via access to a common corridor, was left open as often as the noise level in the rest of the laboratory permitted. This was nearly all of the time. The room was illuminated with soft lighting and a floor fan was running at all times to prevent the room from becoming too stuffy and to mask distant noises.

Level of Contextual Integration
(Task)

Reinstatement	Independent Activities	Redundant Activities	Integrated Activities
Physical	$n = 9$	$n = 9$	$n = 9$
None	$n = 9$	$n = 9$	$n = 9$

Figure 4. The design for Experiment 1.

The first day began with the administration of the CAB-Cf to determine subjects' cognitive style, during which the experimenter left the room to limit distractions. This was followed by a thorough instruction period, guided by the computer but elaborated by the experimenter, that took approximately half an hour. This included descriptions and practice/baseline versions of the mood measures, in addition to the detailed instructions for the cognitive tasks to be performed in the Garden. Not only was care taken to ensure that the instructions were clear and that they defined a unique approach to the tasks involved, they were followed by a short computer simulation which allowed subjects to practice their given task before proceeding to the actual environment. Using only the area just outside the Garden gate, the simulation allowed subjects to explore several different views and allowed the interaction appropriate for the condition to which they had been assigned. The most important feature of this is that for the subjects in the integrated activities condition, the simulation actually allowed them to physically hide the words in spots in the images that opened up, via animated image pieces, to allow the insertion of the words. Subjects were not just told to imagine hiding words in the Garden, they were given a visual example of the process. Critical stages of the simulation are illustrated in Figure 5. Note that the simulation utilized the labels "word 1" through "word 10" rather than actual words in order to avoid proactive interference from this practice task.

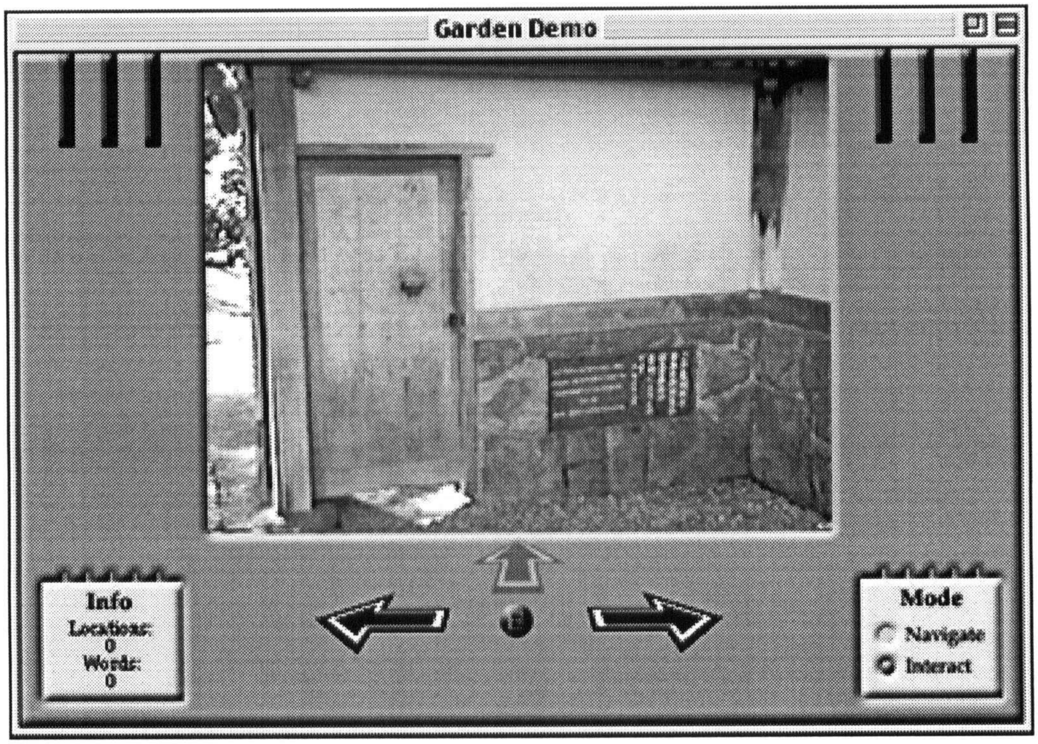

Figure 5a. Arrival at an interactive location in the experimental simulation.

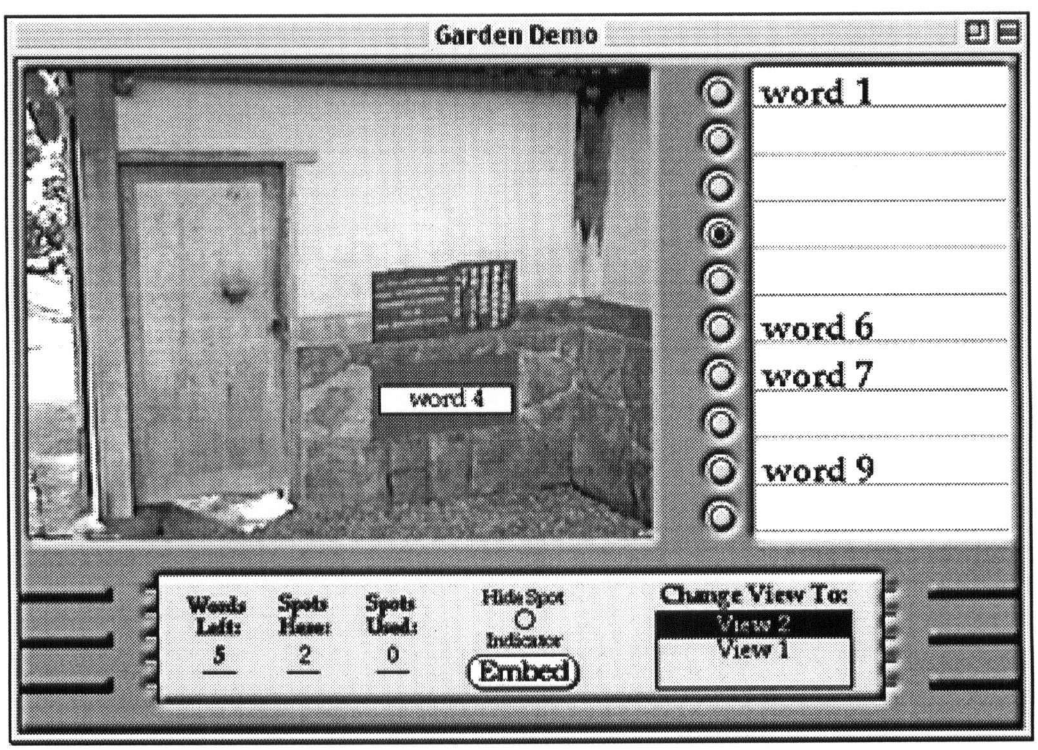

Figure 5b. A selection disappearing into a hiding spot within the interactive mode.

Upon arrival at the Garden, subjects were given details about the exploration of the Garden (e.g., travel restricted to the counter-clockwise direction) and shown how to use the video camera. The time was recorded on the videotape and the PDA and exploration commenced. For the redundant activities subjects only, the exploration was interrupted almost immediately in order to collect the environmental ratings at the point of initial exposure to the Garden.

The six locations at which the experimental tasks took place were all pre-determined to ensure that the words were processed in the same specific surroundings across all groups. Arrival at the locations was orally announced to the subjects in all conditions except the independent activities condition. To avoid an implicit association between the words and the locations (activation of the task-environment relation), arrival at the locations was announced to the independent activities subjects via an alarm on the PDA. They were led to believe that the alarm was sounding at random intervals, when in actuality the experimenter was activating it surreptitiously as each pre-determined location approached.

For the redundant and integrated activities subjects, the first step upon reaching the task location was to choose and videotape three unique views of the location wherein they could hide something. The "something" was not specified for the redundant activities subjects, but the integrated activities subjects were told that these were the views wherein they would be hiding their words. The second step for these two conditions, and the first for all other conditions, was to read all ten of the list words aloud. This procedure was partly included to insure that all subjects were familiar with the words (and allowed the explanation of unrecognized words), but was more important as a means of getting all subjects to process all ten words, something required of subjects having to choose from among them but easily avoided by subjects given a pre-selected subset of five words.

After the words were either chosen or "randomly" determined, subjects performed the task appropriate to their condition. Subjects in the independent and redundant activities conditions were given as much time as they liked to create a story and were then instructed to recite the story aloud with the video camera recording. Subjects never visually appeared in the videos but their voices were recorded to keep track of the types of stories told and to motivate subjects to take the task seriously. Subjects in the integrated activities condition also had the video camera running while performing their mental hiding task, with the added instruction to aim the video camera at each of their hide spots in turn while giving a verbal description of the reasoning behind their hiding decisions or some similar verbalization relating each word to its hiding spot. This was intended to match the verbalization of the subjects telling the stories. It also served to underscore the associative process. Upon completion of their respective experimental tasks, all subjects resumed their exploration of the Garden until the next experimental location was reached.

Upon arrival back at the front gate, having visited all six experimental locations, subjects in the independent and integrated activities conditions completed the environmental and mood ratings on the PDA. The redundant activities subjects only completed the mood ratings at this point because they had done the environmental ratings earlier. Regardless when it was done, the environment was rated first using the PANAS and then the mood grid. The personal mood ratings used the same measures in the same order. For the independent and integrated activities subjects, the environment was then rated for complexity and preference in that order, the time for the next day was confirmed, and the first day was complete. As with the other environmental measures, the preference and complexity ratings of the redundant activities subjects were collected earlier. The point at which the next day's time was confirmed was also the first time either the subject or the experimenter learned whether the next day would take place in the Nitobe Garden or back in the laboratory. Both subject and experimenter were kept blind to the subject's exact condition by having the computer place that information in a file on the PDA, which was not consulted until the end of the first day.

The procedures for the second experimental day varied considerably according to the different types of study context reinstatement involved. Subjects in the physical reinstatement condition returned to the Nitobe Garden and performed all tasks on the PDA while sitting on or standing near a bench just inside the front gate, the same location from which the affective ratings had been made the previous day. This bench afforded an expansive view of most of the central Garden, rendering it a perfect spot from which to survey the Garden while reminiscing about the previous day's activities there. Most of the general areas where the verbal tasks were performed could be seen in the distance, but detailed features were not discernible for any but one of the specific locations. Subjects in the "none" reinstatement condition reported to the laboratory and completed the experiment on the computer.

Subjects completed the same environmental and mood ratings conducted at the end of the first day. The order of the ratings was counter-balanced such that half of the subjects rated the environment first, whereas the other half rated their moods first. This was to control for any influence of one set of ratings on the other. It is important to note that subjects in the "none" reinstatement condition, returning to the laboratory on the second day, were told to make their environmental ratings with regard to the immediate laboratory surroundings.

After the mood and environment ratings, all subjects were asked to venture a guess regarding the purpose of the experiment. This was included to determine if any subjects had anticipated the verbal memory test, which would ruin its incidental nature. Free recall was measured to assess the degree to which the task manipulations affected memory for the task materials. Subjects were told to write down as many of the selected words from the previous day as they could recall, with no penalty for guesses. They were told to continue until they felt they would be unable to recall any more. A time limit was not imposed because it was felt that time pressure would have highly variable effects upon performance, depending upon subjects' reactions to being tested. The instructions implied, however, that five minutes was a reasonable amount of time to spend on the task. none of the subjects spent longer than 12 minutes and, though not measured, the average time spent was approximately five minutes. When subjects first indicated that they were finished, the experimenter gently encouraged reconsideration by saying "Are you sure? There aren't any more words just on the tip of your tongue dying to get out?" This elicited one or two more words, whether correct or not, from at least half of the subjects.

The final experimental task was the spatial memory test, administered to all subjects except those in the Garden on the second day. Spatial memory could not be sensibly measured within the environment itself. The spatial memory test used the computer to present subjects with five different images of locations in the Garden and they were to click on a map of the Garden to guess the locations. To avoid cross-test cuing, the locations were never the same as the verbal task locations. The subjects began the test with three points for each slide for a total starting score of fifteen. The scoring worked deductively with one point deducted for each wrong guess, but with no negative scoring. Thus, no more than the three points could be lost per slide. Hint buttons were provided that subjects could click in order to view a video panning one direction or the other. This cost a point for each direction selected, but provided a great deal more locational information to help the subject. As a testament to the engaging nature of this test and subjects' motivation to perform well on it, it is worth noting that nearly all subjects continued to make guesses after losing all points for a slide, even when they were reminded that their scores would no longer be affected and that the experimenter was willing to provide the answer.

All subjects completed a post-experimental questionnaire at the close of the experiment. The questionnaire asked various questions regarding the significance and subjective nature of the manipulations. It also included a question regarding the degree to which subjects anticipated the verbal memory test, with possible answers ranging from 0 to 6. Scores higher than 3 were grounds for excluding the entire data set because the memory of subjects providing such a rating could not have been incidental. After completing the post-experimental questionnaire, subjects were debriefed and thanked for their participation.

Results

Power analyses were not conducted prior to either of the present experiments for three reasons: (1) Many of the considered factors and relations are either unique or derived from inconsistent previous findings, so there is not a straight-forward source for the estimation of the non-centrality parameter, (2) those factors for which power analyses are possible would almost certainly register as under-powered, but (3) given the great number and variety of measured factors and their interactions, there was a strong likelihood of some effect being found somewhere despite the power levels, so the present experiments would have been conducted regardless the results of any power analyses.

Given the number of dependent measures used in the same or similar situations in these experiments, multivariate analyses of variance (MANOVAs) could have been used to allow comparative analyses of the relative contributions of each of the measures. MANOVAs were in fact included in an earlier version of this dissertation, but the results were not deemed meaningfully interpretable to a degree that justified the added level of complication nor the degree of sophistication that had to be dropped from the individual ANOVAs in order to make them compatible for an overall MANOVA. Furthermore, the only comparison between dependent measures of any real interest, the relation between mood and memory, is discernible in finer detail through the transformation of the affective measures into dichotomous independent variables for use in post hoc analyses of the sort to be described at the end of the results section.

Cognitive Measures

Verbal Memory. The analysis of variance (ANOVA) performed on the recall data found a significant main effect of the task variable, $F(2,48) = 3.93$, $p < .05$, which an orthogonal contrast reduced to significantly greater recall on the part of the integrated activities task subjects (M = 18.72) over that of subjects in both the independent (M = 13.50) and redundant (M = 14.28) activities task groups, $F(1,48) = 7.70$, $p < .01$. The respective effect sizes of those differences, relative to the overall variance in the model, were .87 and .74 of a standard deviation. There was also a non-significant trend toward an interaction between the reinstatement and task variables, $F(2,48) = 2.85$, $p = .07$. All of this can be seen in Figure 6. There were no effects of field-independence upon verbal memory, nor did it interact with the task or reinstatement factors.

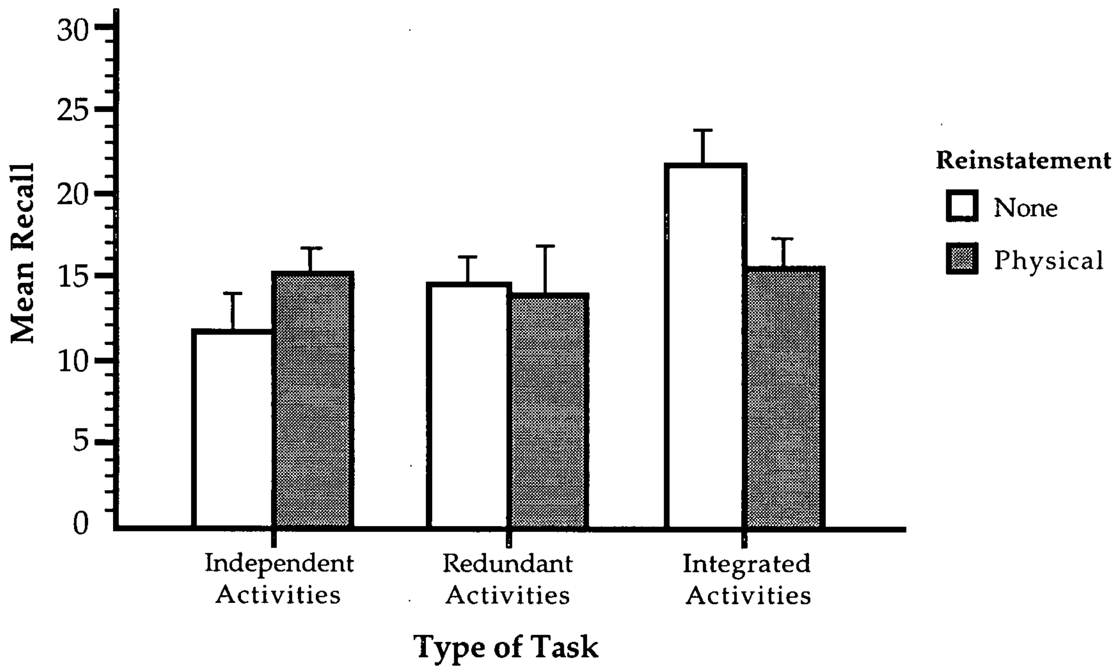

Figure 6. Recall by levels of task and context reinstatement, Experiment 1.

Spatial Memory. There were no significant effects of the task or reinstatement variables upon subjects' memory for locations in the Garden. The means, out of a total possible of 15, were 3.00 for both the independent and redundant activities task groups, and 4.44 for the integrated activities task group. Adding sex as a factor in the analysis produced no change. There were no main effects of sex on spatial memory, nor did it interact with either the task or the reinstatement factors.

Affective Measures

Mood and Environment Ratings. The fact that half the subjects were in a different environment on the second day necessitated a dual approach to the mood data analyses. An ANOVA was conducted for the data from each of the two days. The data for the first day were analyzed using a between-within design with task as the between-subjects variable and time as the within-subjects variable. The three levels of task (independent, redundant, and integrated activities) have already been described and time had two levels, the baseline and post-task ratings. The data from the second day were analyzed using a two-way between-groups design with task and reinstatement as the independent variables. Furthermore, separate analyses were conducted for each of the four dimensions into which the two mood measures can be divided, positive affect, negative affect, pleasantness, and arousal.

Table 1 lists all four mean mood ratings by levels of the time and task variables. The means from the second day are not split by level of reinstatement because that variable had no effect, all main effect Fs(1,48) < 1 and all interactive Fs(2,48) < 1.5, ps > .25.

Looking at the PANAS data, the only finding of interest for the positive affect dimension was a trend toward increased positive affect from baseline to post-task on the first day, $F(1,51) = 3.54$, $p = .07$. For the negative affect dimension, time also had an effect, showing a significant decrease from baseline to post-task, $F(1,51) = 5.81$, $p < .02$, with an effect size of .47 of a standard deviation. In addition, there was a significant difference in negative affect on the first day depending upon the type of task performed, $F(2,51) = 3.45$, $p < .05$. A Tukey test narrowed the effect to a significantly greater amount of negative affect for subjects in the integrated activities condition, as opposed to those in the independent activities condition ($p < .05$), an effect with a size of .61 of a standard deviation. There was a similar, though non-significant, trend in the data for the second day, $F(2,48) = 2.49$, $p = .09$. This was the only effect on the second day approaching statistical significance.

	Task	Baseline		Post-Task		Day 2	
Positive Affect	Independent	28.78	**28.98**	31.72	**30.61**	29.11	**28.28**
	Redundant	28.89		28.94		27.44	
	Integrated	29.28		31.17		28.28	
Negative Affect	Independent	11.22	**12.67**	11.00	**11.61**	10.83	**12.06**
	Redundant	12.94		11.72		12.61	
	Integrated	13.83		12.11		12.72	
Pleasant	Independent	1.67	**1.76**	3.00	**2.57**	2.61	**2.28**
	Redundant	1.56		2.17		2.11	
	Integrated	2.06		2.56		2.11	
Arousal	Independent	.72	**.87**	.72	**.81**	1.28	**1.11**
	Redundant	.83		1.22		1.28	
	Integrated	1.06		.50		.78	

Table 1. Mean ratings of mood in Experiment 1, by levels of task and time.

Turning to the mood grid, the pleasantness dimension displayed the same time effect as the positive affect dimension, with a significant increase in pleasantness from baseline to post-task, $F(1,51) = 25.83$, $p < .0001$, and an effect size of .98 of a standard deviation. There was also a trend towards an interaction of the task variable with time, $F(2,51) = 2.66$, $p = .08$. Finally, there were no significant effects upon the arousal dimension of mood in this experiment.

As with the mood data, the environmental ratings had to be divided prior to analysis due to the different environments used on the second day of the experiment. In this case, the data were split by the levels of the reinstatement variable, none versus physical. The ratings from subjects returning to the Garden on the second day (physical reinstatement) could be analyzed using between-within ANOVAs nearly identical to the analyses conducted for the first day mood ratings. The only difference in this case was that the levels of the time variable were day 1 and day 2. In the case of ratings gathered from subjects placed in different environments on the two days ("none" reinstatement), separate ANOVAs were conducted for ratings made on each of the experimental days.

No effects were found for the complexity nor the preference ratings of the environment for either reinstatement group. The PANAS and mood grid dimensions, however, were more sensitive to the experimental manipulations. With regard to the data from the physical reinstatement subjects, the time variable again showed the most consistent effect across all the affective dimensions except arousal. The positive affect of the environment was rated significantly lower upon returning the second day (M = 29.59) then it had been on the first day (M = 32.89), $F(1,24) = 7.28$, $p < .02$, an effect with a size of .73 of a standard deviation. The negative affect dimension also showed a decrease in affective intensity from the first day (M = 11.93) to the second (M = 10.89), $F(1,24) = 5.08$, $p < .05$, with an effect size of .62 of a standard deviation. There was no main effect of time on the rated pleasantness of the environment, but time significantly interacted with task, $F(2,24) = 6.00$, $p < .01$. An orthogonal contrast found the change across time for the redundant activities group to be significantly different from that of the other two task groups, $F(1,24) = 11.92$, $p < .005$. The effect sizes were 1.90 and 2.09 standard deviations for the differences in change compared to the independent and integrative activities conditions respectively. Looking at Figure 7, it is possible to see that the change due to time was in fact reversed for the redundant activities group, compared to the others. There were no significant effects of the independent variables upon any of the affective environmental ratings from the none reinstatement subjects.

Although mood was not explicitly manipulated, exploratory analyses examined the possible influence of subjects' moods upon memory performance in an attempt to find some indication of mood-dependent effects. The mood data were dichotomized in three separate fashions for these analyses and then compared to both the verbal recall and the spatial memory measures. The first dichotomy was between those subjects exhibiting a small versus a large difference in their mood ratings from the first to the second experimental day. This nominal indicator, referred to as mood difference, was

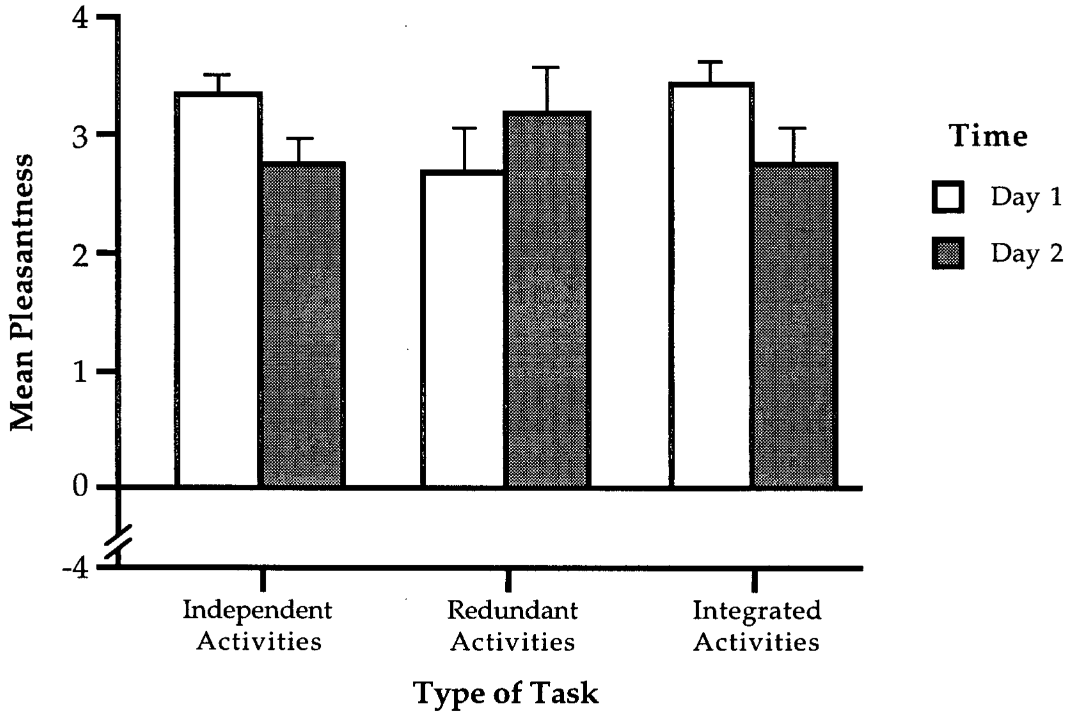

Figure 7. Environmental pleasantness by levels of time and task, Experiment 1.

obtained by calculating the absolute value of the difference between the first and second day mood ratings and separating the result into large versus small difference by means of a median split. There were no significant differences in verbal or spatial memory in Experiment 1 due to this criterion.

The second and third dichotomies in mood ratings relevant to the memory measures involved the moods occurring on the first day, during the learning tasks. These were divided in two ways, depending on the type of measure. The individual PANAS ratings of positive and negative affect and the mood grid dimensions of pleasantness and arousal were all subjected to a median split into high and low ratings of each mood dimension, referred to as the valenced intensity. The two mood grid dimensions, each having positive and negative valences, were also subjected to a median split based on their absolute values, referred to as their absolute intensity (also divided into high and low), regardless of valence. For the pleasantness dimension, however, the latter dichotomy made no difference compared to the previous because there were no subjects providing negative ratings on the pleasantness dimension of mood.

The results indicated a marginally significant difference in recall based on the valenced intensity of negative affect on the first day, $t(52) = 1.97$, $p = .054$. The recall ($M = 16.97$) of subjects experiencing high negative affect was higher than that ($M = 13.52$) of those experiencing low negative affect. This effect did not interact with the type of task, $F(2,48) = 1.13$, $p > .25$. No other differences were found for any of the dichotomies of any of the other mood dimensions.

Discussion

Although there was not a preponderance of significant results in the present experiment, and no evidence of context-dependent memory effects (the possible reasons for which will be discussed in the General Discussion section), the different modes of processing the stimulus words did have an effect on later memory for those words, and there were some notable changes in the mood and environment ratings.

Cognitive Implications

The realization of the predicted superiority of verbal memory on the part of integrated activities subjects supports the hypothesis that carefully patterned contextual integration can increase the memorability of individual contextual elements. Within the confines of this single experiment, however, there is no indication that the result was necessarily a function of the integrative nature of the task. Other possible explanations will be informed by a consideration of the affective results. The lack of any effects on spatial memory was not entirely unexpected. The number of subjects per group was particularly low for this measure because only the subjects returning to the laboratory on the second day could be tested. A replication at least of the previously found effect of sex (McGuiness & Sparks, 1983; Moffat et al., 1998) would have instilled greater confidence in the validity of the new measure, but that was only a minor concern for the present project.

Affective Implications

The overall decrease in negative affect and increase in pleasantness from the beginning to the end of the first day confirm that the Nitobe Memorial Garden was generally considered a pleasant place to be, regardless of what task was performed there. The significantly higher overall negative affect for subjects performing the integrated activities task, however, suggests that this task may have been more annoying, anxiety-provoking, or otherwise unpleasant to subjects than the independent activities task. Given that even the baseline reading was higher, it may be that the instructions for the task alone were sufficient to induce a negative affective response. This makes intuitive sense since the integrated activities task was more complex than the others and greater complexity has been known to decrease affective appeal (Berlyne, 1963). Such a conclusion runs counter to the assumption that contextually integrated situations should be more desirable and easier to process. Furthermore, it provides an alternate explanation for the superior verbal memory of integrated activities subjects. The greater negative affect of subjects in this condition may have contributed to the memory improvement, for instance by rendering all associated material more memorable. Equally likely, the negative affect and greater recall performance may have both resulted from greater effort spent on the integrated activities task.

Although the post hoc analysis of the effect of mood on memory indicated greater recall for those subjects experiencing greater negative affect the first day, this effect did not interact with the task variable, so there is no independent support of the foregoing argument. That is, greater negative affect during learning appears to have increased later recall regardless the method for processing the to-be-remembered stimuli. Since there was no change in recall based on the mood difference from the first to the second day, mood congruence cannot adequately explain this result. Thus a slight degree of negative affect may serve to enhance memory for materials learned during that mood, regardless the other factors present.

Considering the ratings of the environment, the fact that both positive and negative affective qualities of the environment were rated lower on the second day suggests that there may have been some degree of habituation to the environment generating less pronounced affective reactions upon returning to the familiar place. This type of environmental habituation, and the detection of novelty against the backdrop of an otherwise familiar context, is considered by Nadel and Willner (1980) to underlie cognitive mapping processes. The significant interaction of task with time in the ratings of environmental pleasantness may seem to contradict this interpretation, given that the redundant activities group exhibited an opposite trend, attributing more pleasantness to the Garden on the second day than on the first (see Figure 7). Since that group's day 1 rating of the Garden occurred upon their first entering it, however, the reverse trend in their ratings may have been due to a lower initial rating resulting from the limited environmental information available.

EXPERIMENT 2

The redundant activities task in Experiment 1 was derived from a theoretical stance internal to the concept of contextual integration. That is, given the ideal of full contextual integration, a task was created that would mimic its complexity without the integration. A primary goal of Experiment 2 was the isolation of the personal significance factor inherent in full contextual integration, with a means of doing so based upon existing theory and research. The provision versus restriction of word choice during the verbal task was used to systematically add or remove a person-task relation from the experimental context. This was done with the hope of creating or negating an effect like that exerted by the element of control (Baum & Valins, 1979;

Evans & Cohen, 1987; Glass and Singer, 1972) from the environmental literature, or like the generation effect (Slamecka & Graf, 1978) from the cognitive literature. In addition, the resulting tasks, when added to the independent and integrated activities tasks, provided a systematic progression through four levels of increasing contextual integration.

By adding the element of choice to the independent activities task, an activation of the person-task relation was added to the person-environment relation, without a higher-level relation between the two. The resulting task is labeled "Choice Only" in Figure 8. The other task created for this experiment simply removed the element of choice from the integrated activities task. This eliminated the person-task relation from the normally well-integrated word hiding portion of that task. What remained was a relation between the person and the environment that was then related to the task-environment relation, but with no significant connection between the person and the task. This task condition is referred to as "No Choice" in Figure 8.

Level of Contextual Integraton
(Task)

Independent Activities	Choice Only	No Choice	Integrated Activities	**Reinstatement**
$n = 9$	$n = 9$	$n = 9$	$n = 9$	None
$n = 9$	$n = 9$	$n = 9$	$n = 9$	Mental

Figure 8. The design for Experiment 2.

The expected effect of these progressively more integrated task modes was an incremental increase in recall performance and affective significance across the groups. That is, in the case of recall for instance, the independent and integrated activities task modes were expected to induce the lowest and highest levels of recall, as demonstrated in Experiment 1, with choice only and no choice falling between them in that order. If, on the other hand, contextual integration owes its influence entirely to the person-environment relation, perhaps through something like personal significance or control, then the two conditions involving word choice should influence a more pronounced, generally positive, affect and greater recall than the other two conditions. In addition, there should be no difference between the two choice nor between the two no-choice conditions. There were no specific hypotheses with regard to context-dependent recall, just the same general expectation, mentioned in relation to Experiment 1, that the mid-levels of contextual integration should be more susceptible than the extreme levels to variations in context across experimental sessions, hypotheses generated prior to the realization that Experiment 1 did not demonstrate context-dependent memory.

Method

Subjects

The subjects in this experiment were 72 men and women, ranging in age from 18 to 27 years old, randomly chosen from among those University of British Columbia psychology undergraduates responding to a departmental advertisement. All subjects received extra course credit for their participation. Sex and field-independence were balanced across groups as in Experiment 1.

Materials and Equipment

All materials and equipment in this experiment were identical to those used in Experiment 1.

Design and Procedure

The design of the experiment is illustrated in Figure 8. It is very similar to the design of Experiment 1.

On the first day, the procedures for Experiment 2 were nearly indistinguishable from those of Experiment 1. The independent and integrated activities task procedures were not only identical to those for Experiment 1, but thanks to the computer-controlled double-blind procedure, once both experiments were running concurrently it was impossible to tell which was being run when independent or integrated activities was the task. Furthermore, to the untrained eye, the two new tasks did not appear different from their predecessors, since the only change was the word-choice manipulation.

On the second day of the experiment, things began a little differently for half the subjects, those assigned to the mental reinstatement condition. Subjects in this condition stayed in the laboratory and were instructed to spend a few minutes thinking about the Garden as vividly as possible, including the entire path traveled. It was suggested that they might want to imagine not only the visual sensations experienced there, but the sounds and smells as well. They were also encouraged to close their eyes if doing so would help them mentally return to the Garden. The mental reinstatement condition was modeled after a similar condition used in Smith's (1979) research, and the instructions were nearly identical to his.

After the mental reinstatement, or right away for subjects in the none condition of the reinstatement variable, subjects rated their mood and the environment, in a counter-balanced order across subjects. An important detail about the environment ratings is that the mental reinstatement subjects were asked to rate the Garden environment they had just mentally revisited rather than their current laboratory surroundings. This further encouraged the reactivation of any associations with, or cues from, the previous day's environment. There was also a still image of the view from the previous day's rating location in the Garden displayed during the affective ratings.

Results

Cognitive Measures

Verbal Memory. The ANOVA performed on the recall data found a significant main effect of the task variable, $F(3,56) = 11.81$, $p < .0001$, an effect that significantly interacted with subjects' categorization as either field-dependent or field-independent (based upon a median-split of the project-wide CAB-Cf scores), $F(3,56) = 3.12$, $p < .05$. Orthogonal contrasts reduced the main effect of task to a significant difference between the recall performance of the two non-word-hiding groups, independent activities and choice only, and the performance of the two word-hiding groups, no choice and integrated activities, $F(1,56) = 29.04$, $p < .0001$. The size of this effect was 1.21 standard deviations. In addition, contrasts found the interaction between task and CAB-Cf group (independent versus dependent) to lie primarily in greater memory performance for dependent subjects in the choice only group, when compared to that of dependent subjects in the independent activities group, $F(1,56) = 10.55$, $p < .002$ (effect size = 1.53 standard deviations), with no corresponding difference for the field-independent subjects in the same groups, $F(1,56) < 1$. These results are displayed in Figure 9.

Spatial Memory. After reductions in the model to eliminate such non-significant factors as reinstatement and the interaction between CAB-Cf group and sex, a main effect was found of sex on spatial memory, $F(1,63) = 4.60$, $p < .05$, indicating greater memory on the part of males ($M = 5.25$) versus females ($M = 4.05$), effect size = .46 of a standard deviation. There was also a marginally significant interaction between the task and CAB-Cf group variables, $F(3,63) = 2.65$, $p = .056$. Figure 10 displays those data.

Affective Measures

Mood and Environment Ratings. The same dual approach used for the analyses of the mood data from Experiment 1 was used for Experiment 2. Table 2 lists all four mean mood ratings by levels of the time and task variables.

Considering the PANAS data from the first day, an ANOVA indicated a significant effect of time for both positive affect, $F(1,68) = 4.65$, $p < .05$, and negative affect, $F(1,68) = 8.88$, $p < .005$ with effect sizes of .34 and .50, respectively. Positive affect increased while negative affect decreased from baseline to post-task. There were no significant results in the day 2 positive or negative affect ratings.

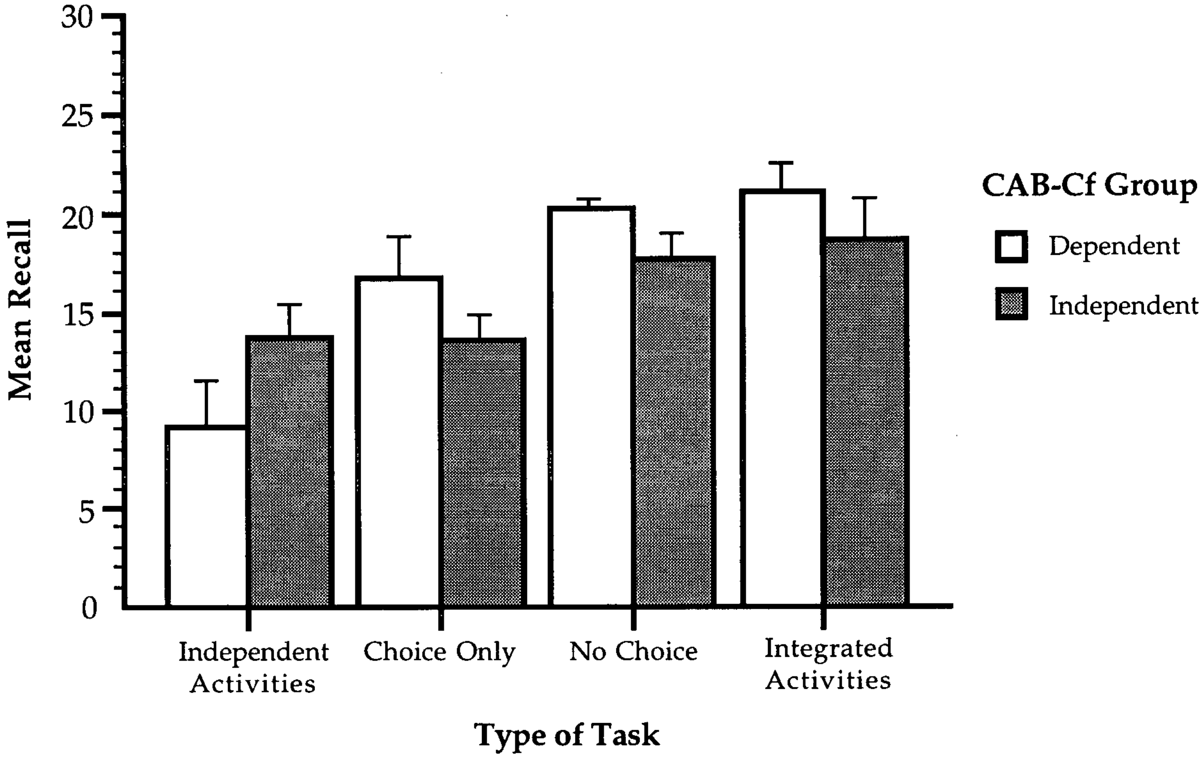

Figure 9. Recall by levels of task and CAB-Cf group, Experiment 2.

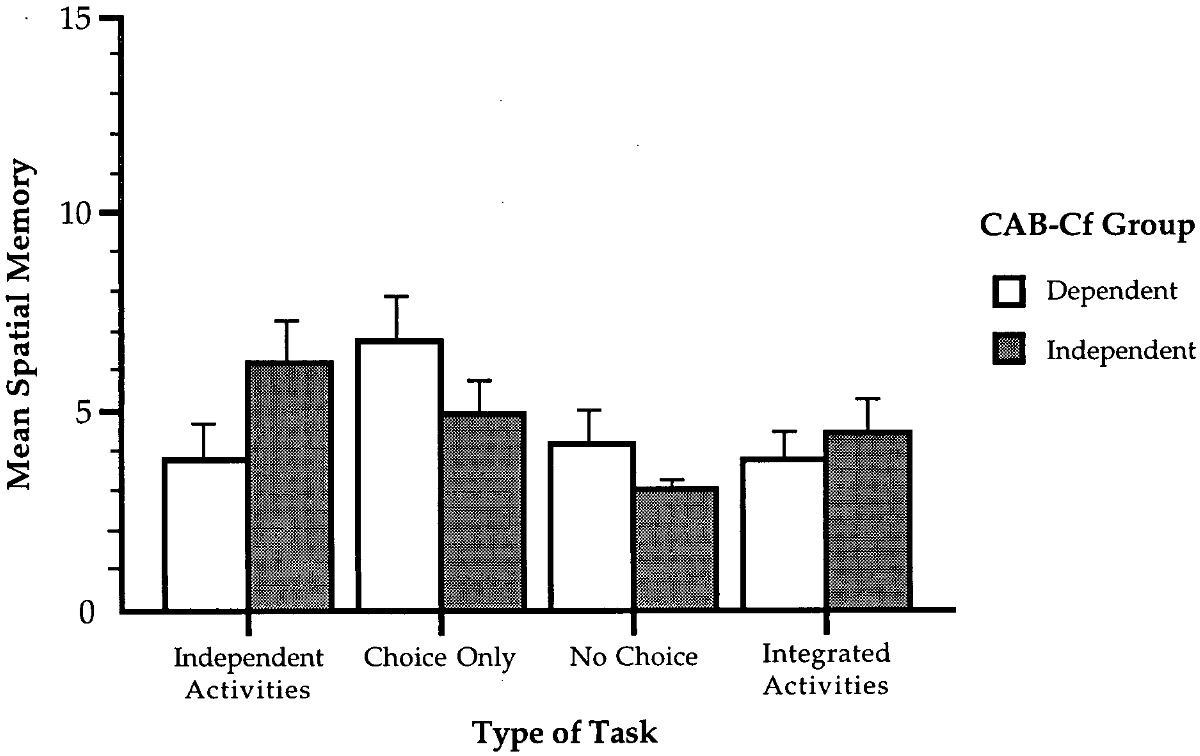

Figure 10. Spatial memory by levels of task, Experiment 2.

	Task	Time: Baseline		Post-Task		Day 2	
Positive Affect	Independent	29.11	29.47	31.06	31.32	26.28	26.88
	Choice Only	29.44		31.56		28.17	
	No Choice	28.28		29.56		26.39	
	Integrated	31.06		33.11		26.67	
Negative Affect	Independent	13.06	13.31	12.61	12.06	12.39	12.31
	Choice Only	13.78		10.78		13.28	
	No Choice	13.06		11.83		11.78	
	Integrated	13.33		13.00		11.78	
Pleasantness	Independent	1.89	1.56	2.17	2.47	1.67	1.72
	Choice Only	1.44		2.72		1.67	
	No Choice	1.61		2.78		1.67	
	Integrated	1.28		2.22		1.89	
Arousal	Independent	.56	1.04	1.22	.76	.22	.89
	Choice Only	1.28		.78		1.50	
	No Choice	1.00		.72		1.44	
	Integrated	1.33		.33		.39	

Table 2. Mean ratings of mood in Experiment 2, by levels of task and time.

ANOVAs conducted on the mood grid data found two significant effects, one for the pleasantness dimension on the first day and one for the arousal dimension on the second day. The results indicate that on the first day pleasantness significantly increased from baseline to post-task, $F(1,68) = 25.29$, $p < .0001$, with an effect size of .83, and on the second day arousal level was significantly dependent upon the type of task performed on the first day, $F(3,64) = 3.61$, $p < .02$. An orthogonal contrast found the latter result attributable to the greater arousal experienced by the choice only and no choice groups compared to the other two, $F(1,64) = 10.72$, $p < .002$, with an effect size of .77.

The environmental rating analyses were divided as in Experiment 1 to insure that all subjects in each analysis were rating the same environment. Once again, no effects were found for the complexity nor the preference ratings of the environment for either reinstatement group. Also similar to Experiment 1, there were no significant effects involving any of the environmental ratings made by the none reinstatement subjects. For the mental reinstatement data, positive affect ratings of the environment decreased significantly from the first ($M = 32.89$) to the second day ($M = 30.03$), $F(1,32) = 12.15$, $p < .002$, a change with an effect size of .82. Ratings of the negative affect of the environment also decreased from day 1 ($M = 12.08$) to day 2 ($M = 10.83$), $F(1,32) = 12.02$, $p < .002$, with an effect size of .82. Finally, the arousal ratings of the environment showed a marginally significant increase from the first ($M = .53$) to the second day ($M = 1.00$), $F(1,32) = 4.11$, $p = .051$, an effect with a size of .47.

As with Experiment 1, there were analyses conducted upon the present data to determine the influence of mood on memory performance. Considering the same three dichotomies of the mood data mentioned with regard to the results of Experiment 1, across the four different dimensions, the only significant difference was between the spatial memory ($M = 5.2$) of subjects experiencing a large mood difference from the first to the second day and that ($M = 3.9$) of those experiencing a small mood difference, $t(70) = 2.01$, $p < .05$. This effect was not found to interact with the type of task used during the first day, $F(1,64) < 1$. It may, however, be a by-product of the significant difference in the first day's positive affect between the two groups (large difference $M = 33.92$, small difference $M = 28.57$), $t(70) = 3.65$, $p < .0005$.

Discussion

Cognitive Implications

Matching the results from Experiment 1, Experiment 2 also failed to find a context-dependent memory effect. The main effect of task on verbal recall and its interaction with the cognitive style of the subjects (CAB-Cf group) is, however, rather informative and generally supports the contextual integration approach. By showing improved memory for subjects whose task connects verbal stimuli to the environment, regardless whether the stimuli are chosen or not, the main effect of task supports the hypothesis that the level of contextual integration has more of an effect upon recall than does the element of choice alone. The interaction with the CAB-Cf group factor suggests that this may only be the case for field-independent individuals. Field-dependent subjects show the same general trend in memory performance, but if the task-structuring influence of the word hiding task is absent, as in the independent activities and choice only groups, the subjects become dependent upon the ability to choose their words as a means of reducing the chaotic nature of the task. Field-independent subjects are probably not affected in this way because they are better able to generate their own structure for the less integrative tasks, making the element of choice less important as a guide for reducing the ambiguity of the situation.

With regard to the spatial memory data, it was encouraging to obtain results commensurate with the literature this time around. By replicating past findings indicating better spatial ability for men (McGuiness & Sparks, 1983; Moffat, Hampson, & Hatzipantelis, 1998), the unique measure of spatial memory used in this experiment satisfied one of the most important criteria for establishing the validity of a new empirical tool. It is also interesting to note that the spatial memory data follow a trend similar to that of the recall data, with the exception that the opposite groups appear to have improved memory performance. The result was not quite significant, but the possibility that increased contextual integration with specific locations might detract from attention to the layout of the overall environment is intriguing. If the trend is indicative of an actual tendency, then this would somewhat compromise the assumption that contextual integration leads to a better overall internal representation of the entire situation. On the other hand, it is important to bear in mind that the spatial memory was global locational memory and the locations tested were never the same locations where the verbal tasks were performed. The testing method may also have been non-optimal because it tested map-like locational knowledge when what was learned by the subjects was the knowledge gained by actively exploring an environment. Considering evidence that these are distinctly different forms of spatial knowledge (see Schacter & Nadel, 1991, for a review), there may have been an insufficient transfer of knowledge to allow such a mismatch between learning and testing methods. Many subjects in fact commented, while attempting the spatial memory test, that they had focused more on landmarks and had not formed a useful impression of the layout of the Garden the previous day.

It is also interesting to note that the spatial memory data for the independent and integrated activities task groups follow a pattern identical to that of the data from the "explore" and "spy" groups, respectively, in the Ward et al. (1988) experiment. They were testing memory for features of the environment rather than layout, but the precedent is striking nonetheless. Ward et al. (1988) explain their result in terms of the "narrower focus" of subjects in the "spy" condition (p. 4).

Affective Implications

The mood and environment rating results of this experiment in large part replicated those of Experiment 1. For the mood data, there were two exceptions. The greater overall negative affect reported by subjects in the integrated activities task condition in Experiment 1 was not replicated and there was a new effect in this experiment showing that arousal on day 2 was dependent upon the task performed. The fact that day 2 arousal was significantly higher for the two new groups, and not the independent nor the integrated activities groups, suggests that the intermediate levels of contextual integration comprising the tasks for the new groups may be associated with greater apprehension, anxiety, excitement, or some other such reaction related to high arousal. It is unusual that any such influence would function on the second day and not the first, but it is possible that the uncertain nature of the procedures on the second day created more anticipation, curiosity, or anxiety in subjects in the choice only and no choice groups than in the other groups. According to the contextual integration approach, this would have resulted from the more disjointed nature of the choice only and no choice tasks, which would have rendered them less meaningful and therefore more subject to speculation regarding their purpose, hence the greater arousal. This fits with how Berlyne (1963) would describe the reaction to an incongruous stimulus.

In the case of the environment ratings, the nearly identical decreases in affective quality, regardless of valence, might lend further support to the notion that subjects became habituated to the Garden environment. It is important to note, however, that in the present case the day 2 ratings were actually made based on memories of the environment considered while subjects were in the laboratory. Depending upon how likely it is that a person can become habituated to a remembered stimulus, it may be necessary to posit some other explanation of the attenuated day 2 environment ratings, such as regression to the mean.

Finally, with regard to the effects of mood on memory, given that significantly greater positive affect on day 1 may account for the greater decrease in positive affect for the large versus the small difference subjects (although mood difference was a non-valenced dichotomy, nearly all changes in positive affect were in fact decreases), it is possible that it was the greater initial positive affect that determined a greater attention to environmental details, hence greater spatial memory on the part of large difference subjects. One disadvantage to this explanation is that it ignores the lack of a difference in spatial memory based upon the valenced intensity dichotomy of positive affect on the first day. That is, there is no greater spatial memory for subjects experiencing high versus low rated positive affect during initial exposure to the environment. A better explanation for the greater spatial memory of subjects exhibiting large differences in positive affect is that the decreased affect reflects the use of more elaborative processing. Without some type of thinking or elaboration there would be nothing to cause a change in affect. Thus greater affective change could reflect a greater degree of cognitive elaboration or further processing. In sum, it may be the case that the large differences subjects were those who spent more cognitive resources processing the environment, which, in turn, led to increased memory for the environment as well as the change in affect over time.

GENERAL DISCUSSION

Despite the lack of contextual memory effects, the manipulations for the present experiments had a measurable influence on memory and affective ratings that revealed some interesting relations among the key contextual factors and other findings that are worthy of further discussion.

There were various effects of the task variable in these experiments, suggesting that at least some of the manipulations were successful in their attempt to establish unique contextual meanings for the subjects. The fact that only one of those effects involved the mood measures suggests that the environment may have been a superior determinant of mood and/or the tasks were not particularly affectively loaded. The higher negative affect for the mid-level contextually integrated groups in Experiment 2, however, indicates that there may have been some reaction like greater apprehension, possibly due to the perceived arbitrary nature or incongruity of those tasks. This can be interpreted as support for the notion that incomplete contextual integration leads to more confusing perceptual phenomena.

It is difficult to venture a guess as to why changes in the environment from the first to the second day did not affect recall in these experiments. Among the possible reasons are the incidental nature of the memory tasks, the moderate level of the moods experienced, and the rich and memorable nature of the environment.

Given that most contextual memory research involves intentional forms of memory (Smith & Vela, 2001), it is possible that the incidental memory used in the present experiments did not properly replicate the earlier studies. Perhaps intentional memory methods are required to ensure that the relevance of contextual factors will be considered by subjects learning new material. And yet, incidental memory has been shown to benefit from other mnemonic techniques (Bellezza & Reddy, 1978).

As for the moderate moods reported in the present experiments, given Eich's (1995) mood-mediation hypothesis, there may not have been any moods acquired that were distinctive enough to serve as memory cues. Without mood-mediation, the highly memorable nature of the Nitobe Garden may have maximized the usefulness of environmental cues for all groups. Neither of these speculations is particularly plausible, however, since the Nitobe Garden is the exact same environment used by Eich (1995) and thus at least some of the same effects should have been found. The effects of mood valence (Experiment 1) and change over time (Experiment 2) upon memory, while not interacting with the type of task, also attest to at least some influence of affective states upon both verbal and spatial memory. Perhaps the only explanation for the lack of context-dependent memory effects is that all of the experimental tasks and mood changes were equivalent in their disruption of any potential connections between the word lists and environmental cues.

The task-related spatial memory results, though non-significant, suggest that there may have been more or less of a division of attention based on the type of task performed. That is, the tasks involving hiding spots, as Ward et al. (1988) suggest, may have induced too narrow a focus on local environmental features, adversely affecting overall spatial memory (or at least not augmenting it) but assisting verbal memory. The more purely exploratory tasks, on the other hand, did not re-direct attention in this way, leading to the opposite results. Again, the effect of the type of task upon the spatial memory results was non-significant in the present experiments, but the foregoing interpretation is somewhat supported by the frequent comments of subjects in the hiding conditions that the verbal task had prevented them from observing more of the Garden. This underscores the fact that, despite the potential for contextual integration to greatly enrich an experience, it may simply represent a complex distraction if the integration is insufficient to engender a sense of meaningfulness, or if there is no obvious purpose to the integration.

The interaction of field-independence with the independent activities and choice only tasks in Experiment 2 supports the assumption that a person's individual perspective, and perhaps other factors of personal relevance, play as much of a role in the cognitive ordering and representation of contextual elements as those elements themselves. It also supports the notion of a hierarchical nature to the cognitive ordering process, as discussed in the Introduction. Without the task structure offered by the word hiding procedure in the no choice and integrated activities task conditions, field-dependent subjects in the other two groups in Experiment 2 remembered more if they got to choose their words. The exact mechanisms by which this might have worked are speculative because field-dependence itself is not thoroughly understood. Given the general perception that field-dependent individuals have difficulty developing their own structure for cognitive tasks (Davis & Frank, 1979), the word-choice procedure in the present experiments may have filled a void for them.

From this perspective, the present results support the general idea that field-dependent individuals rely more upon externally-imposed organizational approaches to information processing, whereas field-independent individuals are more likely to provide their own organization. Relevant conclusions in the previous literature include the observations that "field-dependent people are able to sample fully from sets of cues if the cues are provided in discrete form" (Goodenough, 1976, p. 678), and "the chances of field-independent individuals displaying superior recall increases as the inherent organization of the task material decreases." (Davis & Frank, 1979, p. 477) More generally, the field-independence finding is also important because it shows that it is possible to empirically create a threshold level of contextual structure and to dichotomize performance on either side of that threshold based on minor personal (field-independence) or procedural (element of choice) differences.

The most interesting result from the mood and environment data was the tendency for subjects to rate the same environment with a lower degree of affect upon a second encounter. Habituation and regression to the mean were already mentioned as possible explanations of this effect, but there is another. Given that people have been found to prefer environments with some degree of mystery (Kaplan, 1987), it is possible that affective ratings in the present experiments changed on the second day because the Garden no longer afforded any mystery after being explored the previous day. That would not, however, explain why ratings of negative affect decreased as well as those of positive affect. Perhaps the former decrease was due to some other factor, such as the reduction in arousal and associated negative sensations that Berlyne (1963) says follow a reduction in the incongruity or complexity of perceived stimulation. If both the foregoing speculations were indeed true, that would imply that familiarity can decrease both positive and negative affective qualities of a situation. There was not, however, the universal reduction in arousal in these experiments that such an interpretation would require.

One over-arching conclusion that can be made regarding the present experiments is that multi-faceted approaches to research in psychology can be usefully organized using the guideline of contextual integration. Regardless of whether or not the human mind naturally utilizes such an approach, organizing the contextual elements of an experiment according to the person, environment, and task categories can help clarify the likely results of their interactions. Furthermore, assuring activation of all of the contextual categories and their relations greatly enhances one's chances of uncovering previously undetected interactions among the determinants of behavior.

Contextual integration should not necessarily be limited to the three key factors, and their interrelations, as defined here. The person, task, and environment factors were chosen because they do a rather thorough job of circumscribing everything that comes together to create an environmental milieu. There are bound to be constraining factors that might replace one of the key factors defined here with some element more relevant to a particular situation. At the very least it is possible that the key factors and their relations may have different positions in each individual's hierarchy of personal significance. And yet the factors settled on here are so all-encompassing that both of the qualifications just mentioned can be reinterpreted as changes in those very factors themselves. From this perspective it is difficult to imagine what other contributory factors there could be that do not fit under the umbrella of contextual integration.

The possibility remains that contextual integration is just another way of saying something else, like depth of processing. Depth of processing remains the single most powerful remaining alternative explanation to what has been hypothesized here as the most basic way of looking at the psychological determinants of such key processes as attention and decision making. If thinking about words long enough to choose from among them qualifies as deep processing, then Experiment 2 may have already demonstrated the superior explanatory weight of contextual integration by showing that deep processing did not supercede the influence of contextual integration. The possibility still remains that they are part of the same concept or two parts to a still higher construct. The possible overlap of depth of processing with contextual integration is supported by the following quote:

> Finally, it seems necessary to bring in the principle of integration or congruity for a complete description of encoding. That is, memory performance is enhanced to the extent that the encoding question or context forms an integrated unit with the target word (Craik & Tulving, 1979, p. 291).

This shows that at the very least contextual integration and depth of processing are using the same explanatory constructs and defining qualities. Further research will have to discern how much the concepts overlap.

Contextual integration is not intended as another theoretical model so much as a general guideline for delineating the relevant constructs applicable to a given empirical question. Because it is modeled after the natural means by which the mind subdivides its surroundings, contextual integration might aid the rudimentary subdivision of an experimental context into its relevant and irrelevant parts. Not unlike the environmental preference studies mentioned in the Introduction, it should be possible to predict behaviors such as increased approach or avoidance to a given stimulus predicated upon, among other things, the match of a person's cognitive set to the available environmental affordances. But these are all high and mighty goals compared to the present status of this construct. For the moment, further research needs to more directly determine if the contextual integration approach is any more capable of predicting the patterns of human reactions to environmental stimulation than was indicated by the current project.

Future directions of the present research approach include the use of "virtual" environments, the use of a broad variety of environments, and possibly the creation of tasks capable of more complex manipulations of contextual relations. The use of a virtual environment has already reached the piloting phase and promises to allow the other enhancements of more variety and more complexity. For instance, the computer simulation used in brief for these experiments is presently capable of displaying either the Nitobe Garden or an indoor environment and has the potential to replace the verbal stimuli with pictures. Research in virtual environments will never replace the use of true physical surroundings, but the realism of the computer simulations is always improving and the greater sophistication of the person-environment relations that can be instilled using them is rather persuasive. Add to these considerations the potential to post such a simulation, with full data collecting capabilities, on the internet and suddenly the possibilities appear truly endless.

Whether in virtual or actual environments, the current project demonstrates the importance of considering a full spectrum of contextual factors when designing behavioral research, and the potential to do so without sacrificing much in the way of experimental rigor.

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APPENDIX
The Word Lists and their Semantic Ratings

Toglia and Battig (1978) Clusters used: 7 & 8 • Number of words: 60
LIST RESTRICTIONS: Min word length: 4 Max word length: 8
Con limited to 6.3 prior to manual modifications

List 1	List 2	List 3	List 4	List 5	List 6
apple	kite	cereal	blouse	pear	trolley
plane	nail	garlic	tripod	jacket	chalk
belt	rocket	basin	card	spike	lumber
spoon	coffee	tobacco	racquet	glass	knife
vest	spring	stocking	tomato	trailer	hook
dollar	necklace	rudder	badge	bone	walnut
cigar	seaweed	candy	mattress	gold	medal
magnet	baseball	bandage	beret	toast	cage
crystal	wine	canteen	cucumber	macaroni	orange
sardine	potato	boat	pliers	broom	plate
Con: 5.795	Con: 6.085	Con: 6.071	Con: 5.987	Con: 6.033	Con: 5.925
Img: 5.665	Img: 5.959	Img: 5.605	Img: 5.648	Img: 5.833	Img: 5.725
Cat: 5.770	Cat: 5.868	Cat: 5.496	Cat: 5.494	Cat: 5.725	Cat: 5.479
Mng: 4.152	Mng: 4.534	Mng: 4.410	Mng: 4.289	Mng: 4.499	Mng: 4.320
Fam: 6.099	Fam: 6.182	Fam: 5.957	Fam: 5.776	Fam: 6.237	Fam: 5.954
Noa: 3.613	Noa: 4.053	Noa: 3.724	Noa: 3.568	Noa: 3.661	Noa: 3.595
Pls: 4.326	Pls: 4.657	Pls: 4.109	Pls: 4.292	Pls: 4.169	Pls: 3.947

OVERALL:
Con=6.003 Img=5.715 Cat=5.633 Mng=4.368 Fam=6.011 Noa=3.685 Pls=4.212

Note: The full names for the semantic dimensions are: Concreteness, Imageability, Categorizability, Meaningfulness, Familiarity, Number of Attributes, and Pleasantness. Pleasantness is treated as a bipolar rating, with a rating of 4.000 indicating neutrality. The range for all ratings is 1-7.