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Mode specific representation in long term memory

Unnava, Hanumantha Rao, Ph.D.
The Ohio State University, 1988

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MODE SPECIFIC REPRESENTATION IN LONG TERM MEMORY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Hanumantha Rao Unnava, B.Tech., M.B.A.

* * * * *

The Ohio State University
1988

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Hanumantha Rao Unnava
1988
Dedicated to my wife Vasundhara
and to the Lord who blessed me with her
ACKNOWLEDGEMENTS

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Chapter I
INTRODUCTION

In recent years, marketing scholars are paying increasing attention to research on human memory. One of the main reasons for the interest in memory is its important role in day-to-day decision making. For example, Biehal and Chakravarthi (1983) found that the choice of a calculator by student subjects was affected by their ability to retrieve previously encountered information. When the students could not retrieve that information, they ended up choosing an inferior calculator. More recently, Chattopadhyay and Alba (1988) demonstrated that the attitude of subjects toward a target brand was dependent on the amount of information about the brand that was recalled. Thus, consumers appear to make decisions based on the information they retrieve from memory.

Research in consumer behavior has examined several aspects of memory, one of the most important being its organization of information. In an influential series of articles, Sujan (1985; Sujan, Bettman and Sujan 1986) examined the implications of a category-type of organization. According to this view, first proposed by Rosch (1975), information in memory is organized in the form of categories. The categories are arranged hierarchically, with each higher level category including several lower level categories. For example, sparrow and robin are included in a 'bird' category, and all
birds and animals are included in a higher 'living beings' category. In one study, Sujan (1985) found that when people encounter information that matches a category in their minds, they stop processing that information. For example, when a person sees an ad for a sports car, and it matches a category of 'sports cars' in his/her memory, s/he will store the information in the ad in the sports car category without further processing the ad. The properties of the category 'sports cars' (e.g., they have high power, they are not fuel efficient) are attached to the memory representation of the new car that was depicted in the ad. The person will process all the information presented in the ad only when it does not match the category in his/her memory. For example, if the sports car ad says that it is fuel efficient, which does not match the present category properties, the person exposed to the ad will process the information carefully. Thus, categories help a person organize his/her knowledge about various things. They also serve to reduce information processing by selecting the information that needs to be processed in detail.

In other consumer behavior memory research, Smith and Houston (1985) examined 'script' type organization in memory. Scripts are knowledge structures formed in memory based on repeated exposure to an event. For example, people generally know the sequence of events that occur when they go to a restaurant. The knowledge of sequence (first wait to be seated, then make a choice based on the menu, and so on) will guide their behavior when they go to a restaurant. This type of
knowledge is assumed to be organized in memory as a 'restaurant' script. Using the script concept, Smith and Houston showed that people who had knowledge of placement services on a college campus were more stable in their rank ordering of various placement activities than people who had limited knowledge of placement services. The higher knowledge, they argued, is stored in the form of a script because one of the basic properties of a script is the knowledge of sequence. Thus, scripts in memory will guide our information processing by telling us what to expect next in a sequence of events that occur regularly.

Even though categories and scripts described above are based on different assumptions, one common assumption that they share is that the representation of category and script information in memory is of an abstract form. In fact, all memory research that is based on 'semantic' and 'network' models of memory (Anderson and Bower 1973; Collins and Loftus 1975) assumes that memory representations are abstract. According to this line of thinking, whether information is encountered in the form of a picture, sound, or smell, the memory representation will be the same, as long as the information contained in the picture, sound, or smell is identical. In other words, the mode of input information is immaterial for the internal representations.
FOCUS OF THE DISSERTATION

The models of human memory described above presently guide the memory researchers in marketing. These models do not differentiate between the various modes of input information. However, their assumption of abstract memory representations has not been questioned in the marketing literature to date. This dissertation is focused on the issue of mental representations and questions the assumption of abstract representations. In fact, this dissertation argues against the assumption of abstract mental representations.

It is proposed that information that is encoded through a particular mode will retain the input properties of that mode when it is coded into memory. Thus, a memory trace (or code) is viewed as mode specific. If the memory trace is mode specific, then a person exposed to information in two modes will have two traces form in memory, each being distinguished by the mode in which it is presented. In contrast, a person exposed to identical information twice in the same mode will have a memory representation in the form of only one mode specific trace.

This type of representation departs significantly from the existing views of memory. A concept, according to this view, is not stored as just an abstract code. Instead, it is a rich collection of independent but interconnected mode specific traces that have the properties of the input information that gave rise to them. For example, the representation of an 'apple' in memory is not a pale description of its various properties. It is comprised of a smell
code, a touch code, a taste code, a visual code, and an auditory code (representing the sound of biting into an apple, perhaps). Thus, a mode specific view of memory radically differs from an abstract representation view of memory. In fact, one can make predictions from this view of memory that contradict the predictions of the existing views of memory.

The representation of any concept in multiple modes suggests that each mode specific representation can be used to access the concept. Thus, multiple retrieval routes are laid in memory for any concept, one for each mode in which it is encountered. Other retrieval routes for the concept are also possible, like the context in which a concept is learned. The important point is that the mode in which a concept is encoded will itself become a retrieval route for that concept. Some literature in learning shows that the retrievability of a concept is dependent on the number of retrieval routes that are available for that concept (Melton 1970). This will be described in more detail shortly. But it is interesting to observe that the concept of mode specific representations coupled with the concept of multiple route superiority leads to some predictions that contradict the existing views of memory and are meaningful to marketers.

If a product is assumed to be stored as a concept in the mind of a consumer, then, the larger the number of memory paths that lead to the concept, the greater will be its retrievability. Therefore, if a marketer presents information on his product in multiple modes, rather than several times in a single mode, the mode specific view of memory
predicts that consumers will exhibit superior retrieval of that information. Note that if memory is not mode specific, the mode in which information is presented is unimportant as long as each mode contains the same information. Therefore, the existing views of memory that rely on abstract representation will not predict differential retrievability between presentation of information in multiple modes or several times in just one mode.

The main hypothesis that is tested in this dissertation, therefore, posits superior recall when subjects are exposed to identical information once in each of two modes than when they are exposed twice to the same information in one mode. This prediction is based on the finding in learning literature that information presented in multiple contexts enhances learning (Melton 1967, 1970). This effect is assumed to be due to the formation of multiple paths in memory, one for each context in which the information is presented. Each path will then act as a cue and aid in the retrieval of the to-be-learned information. Under the assumption that each mode specific trace will act as a path, information presented in two modes will result in two paths in memory, while information presented in one mode will result in only one path. Applying the multiple path superiority argument to this situation, one can predict that information presented once in each of two modes will be remembered better than information presented twice in only one mode.

In addition to the effect on the memorability of information, multi-modal presentation is also hypothesized to affect the confidence
of subjects' responses to questions based on that information. This is because each mode specific trace will act as a source of information for the subject who is answering questions. When the subject conducts a memory search in order to answer a question, the two mode specific traces with identical information in them act as two sources that agree on the answer. This agreement between the two sources should result in enhanced confidence in the answer compared to when the subject has only one source to provide the answer.

An experiment is proposed to test these predictions in a learning situation when subjects are exposed sequentially to information either in the auditory mode, visual mode, or a combination of the two modes. There will be two exposures each of auditory or visual presentation for the single mode groups, while the dual mode groups will receive one exposure each of auditory and visual presentations in different orders. Subjects' recall of the information will be measured immediately after exposure. In a second experiment, it will be measured after a five-day delay. Subjects will also be asked questions based on the target message and their confidence in their responses will be measured. Greater recall and greater confidence for the dual mode subjects compared to the single mode subjects will support a mode specific view of memory.

The proponents of abstract memory representation cannot explain greater recall when information is presented in two modes compared to when it is presented twice in any one mode except by suggesting that when information is presented in two modes, subjects will pay greater
attention to the second message because of the mode change. This enhanced attention in the two mode case would then serve as an alternative explanation for the superiority of the mixed mode presentation. The predictions of the mode specific view are not based on differential attention. They are based on the formation of multiple paths for information presented in multiple modes. To rule out the alternative explanation that recall and confidence differences are due to differential attention, subjects' attention to the message will be measured using a reaction time task. Demonstration of lack of attention differences between dual and single mode subjects in the presence of significant recall and confidence differences would argue against the differential attention explanation, and would strengthen the support for the mode specific view of memory.

The advantage of understanding the form of representation of information in memory is then demonstrated in Chapter 3 by applying this knowledge to a problem that has generated much research in memory literature. This problem refers to an effect called the "picture superiority effect". The consistent finding in research comparing pictures and words is that pictures are recalled better than words. Several explanations have been offered in literature, some relying on the differences between pictures and words as stimuli, and the others addressing the processing differences between pictures and words. The conclusion from this research, as discussed by Childers and Houston (1984), is that words must be processed semantically to be as memorable as pictures. This is because pictures are spontaneously
'understood' by people; i.e., when a person sees a picture, s/he knows what the picture 'means', or what the central idea of the picture is. In contrast, one has to process words to considerable depth to understand them. Until this difference in understandability between words and pictures is removed, pictures will be remembered better than words. For words to be remembered as well as pictures, words must be processed 'semantically'. Semantic processing of words ensures that they are understood in the same way as pictures are spontaneously understood. Using this logic, Childers and Houston demonstrated the absence of a picture superiority effect with semantic processing in an immediate recall task. However, the picture superiority effect was found in delay. Therefore, semantic processing of words could not eliminate the picture superiority effect in delay.

The same problem is addressed differently in this dissertation. Instead of focusing on the differences in processing of words and pictures, the differences between pictures and words in the ultimate representations they create in memory are viewed as crucial in explaining the picture superiority effect. According to the mode specific view of memory, the representations in memory will retain their input mode properties. Thus, pictures will be encoded as pictorial representations, while words will be encoded just as words.

The superior recall of pictures is argued to be due to the representational differences between words and pictures. Based on this explanation of the picture superiority effect, it is argued that processing words to any depth will not eliminate the effect as long as
representational equivalence is not achieved between words and pictures. In other words, if words can be processed so as to create picture-like representations, then pictures and words will be remembered equally well because both have similar representations. But if words cannot be processed to create picture-like representations, then the differences between the retrievability of pictures and words will persist.

Several types of evidence are reviewed which suggest that visual imagery and visual perception involve the use of the same resources in memory. Some neuropsychological evidence is also presented which shows that the brain centers that are activated during visual imagery are the same as those that are activated during visual perception. Based on this type of evidence, it is argued that when people process information that is highly imagery provoking, they generate mental images which are similar to the pictorial representations of that information. In such a situation, the actual provision of pictures with that information may be redundant because the visual imagery that subjects spontaneously employ is equivalent to externally provided pictures. Hence, for information that is highly imagery provoking, addition of pictures to the verbal information should not be beneficial for the recall of that information.

When information is not imagery provoking, people may find it difficult to generate images for the information. Therefore, the verbal information will form only a verbal representation in memory. If pictures that contain the same information are added to low imagery
verbal information, it is equivalent to presenting information in two modes. This is because the same information is being presented both as pictures and words. As argued earlier, presentation of information in two modes will result in the formation of two mode specific traces in memory. Therefore, presenting low imagery information with pictures will result in the formation of two codes in memory, one verbal and the other pictorial. Because two codes in memory increase the retrievability of a concept compared to only one code, presenting low imagery information with pictures should increase its retrievability compared to presenting low imagery information without pictures.

An experiment is proposed to test these predictions in which the type of information - imagery provoking or not imagery provoking - is manipulated. This information is presented to subjects with or without pictures and their recall of the information is measured. Support for the arguments made above will be provided if it is found that pictures enhance memory only for information that is not imagery provoking.

The experiments described above will test the implications of the mode specific view of memory. The first experiment will test the assumption that presenting information in two modes will enhance its retrievability compared to presenting it twice in any one of the two modes. The second experiment will test the assumption that ensuring representational equivalence between words and pictures will eliminate the picture superiority effect.
The next chapter will be devoted to developing the idea that representations are mode specific. Two experiments that test this view of memory by presenting information either twice in one mode or once in each of two modes are then discussed. The mode specific view of memory is used in Chapter 3 to explain the picture superiority effect in terms of the representational differences between words and pictures. The role of spontaneously evoked visual imagery in substituting for externally provided pictures is described. It is based on the assumption that imagery and perception share the same resources in memory, and therefore create similar mental representations. The results of an experiment that tests this explanation of the picture superiority effect are then described. Chapter 4 summarizes the findings of all three experiments and discusses directions for future research.
Chapter II

MODE SPECIFIC REPRESENTATION IN MEMORY

The information encountered by a person will be processed by his/her information processing system. The outcome of processing will be stored in the person's memory, from where it can be accessed for subsequent use. This process is analogous to a set of instructions delivered through the keyboard of a computer which will activate its central processing system; this system then processes and stores the information to be retrieved later through programming instructions. The information inputs in the case of humans, however, unlike computers, occur through any of the five senses with which one is endowed. Each of the five senses handles a distinct type of input. Also, one sense cannot handle information that some other sense is specialized to handle. For example, a painting can only be seen, not heard, and music can only be heard, not seen or tasted. This type of input system, however, does not preclude the activation of multiple senses by the same stimulus - like a good chef's cooking which may be seen, touched, tasted, and smelled at the same time.

The question that is intriguing to a memory researcher is how the human information processing system combines and stores the multiple inputs delivered through the various senses. The question is of significance because if the information that is stored in memory retains the properties of the input sense that delivered it, then the
constraints on that input sense should also apply to this piece of stored information. These constraints will then be manifest as constraints on the use of that information. For example, because sound is processed temporally, the internal representation of sound may retain the temporal order if the representation is isomorphic with the external input. It may be because of this property of stored sound that when a person tries to retrieve the middle words of a song from memory, s/he cannot do it spontaneously. However, when the person starts with the beginning lines and sings up to the point he wanted to remember, then he can retrieve those middle words relatively easily. Thus, it appears as if the person must trace the time course in which the sounds of the song were coded in order to retrieve a word somewhere in the middle of the song. Isomorphism of internal representation with external stimuli, if existent, will hence pose constraints on the type of usage this stored information can be put to, subsequently. The dual coding model (Paivio, 1969, 1971, 1986), for example, argues for such mode-specificity of internal memory traces. This type of representation will be addressed as mode-specific representation from hereon.

An alternative viewpoint, that parallels the working of a computer, argues in favor of all types of inputs being converted into a single, uniform internal code. One of the main advantages of this type of storage, as claimed by its proponents, is the economy of storage space. Savings in storage space occur because a concept need be stored only once irrespective of the input sense that delivers it,
thus avoiding duplication in storage. If this were the case, the
input sense that delivers the information would be inconsequential to
the resulting internal representation. As long as their meaning is
the same, two inputs to two senses should result in the same internal
representation. Another advantage of this type of storage is evident
-- constraints on the input senses are not applicable to the internal
representations. Such a viewpoint dominates theories of memory that
are based on propositional structure of memory representation
(Anderson and Bower, 1973; Collins and Loftus, 1975). This type of
representation will be called abstract representation from now on.
The word 'abstract' is used because theories based on this notion
assume that the meaning of any stimulus is 'abstracted' by the
information processing system, and it is this abstract meaning code
that forms the internal representation of the perceptual experience.

In the next few pages, empirical evidence supporting the concept
of mode specific representation is reviewed. Based on this evidence,
a set of hypotheses are developed that argue in favor of greater
retention of information when it is presented in multiple modes as
compared to presentation in one mode. Two experiments conducted to
empirically test these hypotheses and the results of those experiments
are then discussed.

EMPIRICAL EVIDENCE FOR MODE SPECIFIC REPRESENTATION

It is argued in this dissertation that the memory trace left
behind by incoming information preserves its mode. That is, a visual
scene is represented as a spatial code and an auditory message is
represented as an auditory code in long term memory. One way of demonstrating support for this argument is by showing that people exhibit remarkable similarities between usage of information in long term memory and information available through perception. If the constraints experienced by individuals are the same whether they are using information from memory or externally presented information, it can be argued that the mental representations have properties similar to external information. These findings provide grounds for inductively arguing in favor of mode specific representations, and are presented in the following section.

Visual Long Term Memory

Spatial memory tasks. One type of task that is used to infer the presence of a visual component in long term memory is called the spatial memory task. In this task, memory performance is tested when subjects are using analog (or continuous) information like shape, size, or distances between objects. If performance in the memory task gives results similar to those of performance in a perceptual task (where subjects are using information presented externally), then it is concluded that the internal representation is similar to (isomorphic with) the external information.

Baum and Jonides (1979) tested the proposition that memory representations of spatial relations are analogous to the relations that are observed in reality. That is, if two objects are separated in distance in reality, their mental representations will preserve this relationship between them. Subjects in their experiment were
asked to judge which of the two distances in a familiar environment was shorter. The judgment was based on the information subjects had in their long term memory. It was shown that the more similar (or closer) the two distances, the greater the reaction time. An increase in judgment time with distances that are about equal is also found in a task where subjects make judgments based on information presented externally (e.g., a map; see also Moyer, et.al. (1978)). Because of the similarity of the memory task, with a task that involved judgments based on external information, Baum and Jonides concluded that mental representations are analog (continuous) in nature, just like perceptual information.

In another experiment, Merrill and Baird (1987) used a reaction time task to test the organization of various campus buildings in the minds of college students. Interest centered on whether various campus buildings were organized by function (e.g., dorms, laboratories, etc.) or spatially (i.e., proximity to one another). In the first experiment, students sorted a list of all the buildings into various categories. There was no limit on the number of categories that could be formed, and no criteria were defined for the sorting task. The students were just asked to put 'those buildings that you think will go together' into one pile. Cluster analysis of the data revealed clusters that were based both on functional similarity and spatial proximity. In other words, subjects seemed to represent various buildings in their minds based on their function as well as their spatial separation, the latter being closely related to
perceptual experience. This similarity of internal representation with external reality suggests that spatial component may also form part of the memory representation.

In their second experiment, Merrill and Baird’s subjects were asked to indicate if two building names, presented sequentially on a screen, were both local or if one was local and the other nonlocal. The major prediction was that reaction time would vary as a function of the relatedness of the pairs of local building names. Relatedness was defined by the results of the first experiment. The buildings could be a) spatially and functionally related, b) only functionally related, or c) not related. Activation of the first building name was assumed to prime related items in memory. If the first building name was followed by one of those related items, reaction time to the pair would be shortened by the priming process. The authors found that priming occurred only for pairs that were both spatially and functionally related, but not for pairs that were unrelated or pairs that were related only functionally and not spatially. Thus, functional similarity alone was not sufficient to induce priming effects, but when spatial similarity was included, significant priming effects were found. Spatial similarity alone, however, could not produce priming effects either (experiment 4). The fact that priming was not observed for either spatial or functional similarity alone suggests that the relationship between buildings in memory is a function of both space and function. The important point, however, is that mental representations preserve spatial relationships which are
analog in nature. Merrill and Baird, based on these findings, argued in favor of mental representations that included both functional and spatial aspects of environment.

Face recognition studies. Another class of evidence supporting the presence of visual component in long term memory comes from studies on face recognition. Substantial research has been done to understand how faces are recognized. The question is, what information from a face is encoded to enable subsequent recognition? Winograd (1981) proposed that faces are encoded as sets of features, and the presence of a distinctive feature facilitates memory for that face. Any theory that argues against mode-specific representation must favor a representation that breaks down a face into a set of several descriptive features. This is because a face is continuous, and if one does not subscribe to a representation that maintains this continuity, then one has to posit a mechanism by which this continuity can be re-created from some description. Features seem to be one such mechanism. However, it has been shown that configural information (spatial relationships between the features of a face) is sufficient to identify very blurred faces (Harmon, 1973). This occurred even when no details about the appearance of features were available and hence the features themselves could not be identified. If features were not identifiable, an internal representation that is a set of features could not have been used to identify a face because there was no feature information that could be matched. Thus, the
representation of faces in long term memory must be different and more complex than a simple set of features.

In one study on face representation in memory, Sergent (1984) presented subjects with pairs of faces that had to be judged same or different. There were a total of eight faces that varied factorially on three dimensions. She then fitted several models to the reaction time data to explain how the judgments were made. While the feature-matching model provided the worst fit to the data, the Euclidean model provided the best fit. The Euclidean model considers not only the features in a face, but the interactions between features that represent configural information of the face. Based on these results, Sergent concluded that faces were not processed analytically, but in terms of their gestalt. Davies, Ellis and Sheperd (1977), in another study testing the feature theory of faces, found that subjects experienced difficulty in discriminating between features (e.g., two different noses) when different features were embedded in the same face. This evidence suggests that the assumption that a face is encoded as a set of features is simplistic at best, and conceptually wrong at worst. Both studies suggest that faces are not represented as a set of features, but instead, are represented holistically. A theory of mode specific memory representations would also predict that a face will be encoded in a way that preserves its configural relationships, i.e., holistically. This prediction is derived from the assumption that the properties of an input mode are represented in
memory. Therefore, the continuous nature of visual input is retained in its memory representation.

In a more recent study supporting holistic representation of faces, Rhodes (1986) found that subjects consistently chose normal (correct) photographs as better likenesses of familiar faces than mirror-reversed photographs. This effect was stronger for familiar faces, and did not depend on the presence of any asymmetric hairstyles or single asymmetrically located features (e.g., moles, warts). Since the features were unchanged and only the configural information was changed (by mirror-reversing), Rhodes argued that information about individual features may not be stored independently of other information about the face. To cite Rhodes (1986), "Configural information, which the present results demonstrate is also represented, seems especially unsuited to representation in an analytic structure, such as a feature list....A more natural and heuristically useful alternative would be that faces are represented in a holistic or analogical representation, whose structure directly mirrors the spatial properties of the face" (p.218).

Based on the foregoing evidence, it is argued that spatial information is represented in analog fashion in long term memory rather than as an abstract list of features. More importantly, a visual input retains its visual properties in its long term representation, which suggests that the long term representation is mode-specific.
Auditory Long Term Memory

The transfer paradigm. In the transfer paradigm, the effect of learning one list on learning a second list is investigated. If learning the first list reduces (increases) the number of trials required to learn a second list compared to a control group who learn only the second list, positive (negative) transfer is said to occur. Investigations on auditory long term memory have typically used the transfer paradigm as described below.

Laurence (1970) conducted two experiments that examined the role of homophones (acoustically identical words) as elements in transfer learning. The first experiment used a paired-associate task where subjects had to learn two lists. Positive transfer occurred between the two paired associate lists provided that a) homophones of response items in list 1 served as response items in list 2, and b) no re-pairing of items had occurred. For example, if in the first list the digit '1' (stimulus) was paired with the word 'pray' (response), and in the second list, the digit '1' (stimulus) was paired with the word 'prey' (response), subjects learned the second list faster if they had initially learned the first list. Subjects seemed to detect the acoustic similarity between the response items of the two lists and employ the strategy of an acoustically based spelling translation in learning the responses for the second list. In other words, the subjects did not 'learn' the response items in the second list as they learned the first list. Instead, they seemed to adopt a strategy of using their knowledge of the response items of the first list by cuing
themselves with those words and then generating items that are acoustically similar to those words, at the time of recall. Since the commonality between the response items of the two lists was in how the words sound and not in their meaning, the subjects must have used this acoustic information to derive the advantage that was found in this study. Since this acoustic information must have come from their long term memory (they learned the second list after they learned the first list), the results favor the presence of an auditory component in long term memory.

The second experiment involved the use of a free recall task. There were two lists containing 30 words each with the second list containing homophones of the items in the first list. Subjects learned the first list for 10 trials and then learned the second list for another 10 trials. In the learning of lists, subjects are known to use organizational strategies to facilitate learning (Tulving 1966). This organization is semantic in nature in that items within a category formed by the subjects are known to share a common underlying meaning (e.g., instances of animals, living beings, etc. See Bousfield 1953, for example). Let it be assumed that list 1 is learned through this semantic organization, and acoustic information from that list is not represented in long term memory. In that case, subjects learning a second list containing words that are acoustically similar (but semantically different) to the words in the first list should not show interference effects from the first list. This is again because learning of the second list should involve semantic organization of
items in that list and any acoustic similarities between the lists should not interfere with the semantic organizational strategies of the subjects. Interference due to acoustic similarity is possible if acoustic information is stored in long term memory. The reason for interference is that semantic organization is normally not the same as acoustic organization. Therefore, a subject trying to organize words semantically will be facing a conflicting organization that is based on acoustic organization. Thus, acoustic similarity between the two lists will have a negative transfer effect on learning, if acoustic information is represented in memory. In Laurence's experiment, compared to control subjects, subjects learning homophones in the second list showed negative transfer effects from the first list. They made about five times as many acoustic confusion errors in their responses as the control subjects did. The author concluded that acoustic information is represented in long term memory because acoustic information from the first list interfered with the subjective organization of the second list.

In a somewhat similar study, McGlaughlin and Dale (1971) found that when the stimulus items in two separate lists of a paired associate task were semantically or acoustically similar (A-B, A'-B paradigm which means that the response items are the same in both the lists, but the stimulus items change. These stimulus items in the lists could be semantically or acoustically similar in this study), positive transfer occurred in the learning of the items of the second list. The transfer effect due to semantic similarity was no greater
than the transfer effect due to acoustic similarity. This suggests that acoustic encoding in the long term memory may also be an important part of the total encoding of the unit.

Yet another convincing demonstration of auditory long term memory came from Nelson and Rothbart (1972), who had subjects learn a list of 24 words to a criterion of one accurate recall in a paired associate task. The subjects were made to come back four weeks later and were asked to recall words from the list. As expected, performance was very poor on this unexpected delayed recall task. The subjects were then given a second list that had the same stimulus items as in the first list and acoustically similar but semantically different response items (like PREY in the first list and PRAY in the second list). The dependent measure of interest was the proportion of errors made when subjects were tested on the second list after one study trial. They found that compared to a control group who learned only the second list, the experimental subjects made significantly fewer errors. The authors argued that the acoustic information from the first list must have been encoded into long term memory and those acoustic savings (i.e., the long term memory for the acoustic component of the words) resulted in the superior performance of the experimental subjects. This is because the only difference between the experimental and control subjects was that the experimental subjects learned the first list while control subjects did not; hence any improvement in the performance of the experimental subjects must be due to whatever memory they had for the items in the first list.
The general practice effect for experimental subjects is ruled out as an alternative explanation because there was a time delay of one month between learning the two lists.

In a somewhat different approach to the same problem, Brown and McNeill (1966) explored the tip-of-the-tongue phenomenon where subjects seem to know a concept or a word but cannot retrieve it from memory. They carefully prepared several definitions that describe a concept unambiguously and asked subjects what the correct word was for those definitions. Subjects could give the right words for some definitions, but could not come up with the right words for the other definitions. When the right words were not retrievable, Brown and McNeill found that subjects sometimes could retrieve the synonyms of those words. On some other such occasions, subjects could tell the researchers how the words 'sound', even though they could not come up with the word. The authors concluded that long term memory is not only semantic but also acoustic in nature because subjects could retrieve some acoustic information about the words.

The transfer learning studies demonstrate the influence of acoustic properties of words in one list on the learning of words in a second list. No such influence would be expected if sound is not encoded into long term memory. The Brown and McNeill experiment demonstrates that a person may not remember a word but still remembers how it sounds. This suggests that the acoustic property of words is distinct from the word itself and can be remembered independently of
the word itself, which in other words, argues in favor of acoustic component storage in long term memory.

A strong case for acoustic encoding in long term memory can be made based on the preceding literature. Evidence that supports visual and auditory encodings in long term memory has been reviewed to this point. Research exploring the presence of other types of modes (smell, taste, touch) in long term memory is, unfortunately, scarce. Whatever research exists, is neither sophisticated nor conclusive, which may reflect the difficulty of experimentation using other senses. Therefore, other types of evidence that address the visual and auditory encoding in long term memory are reviewed next.

Memory For Mode Of Input

When subjects are exposed to stimuli in various modes, the proponents of abstract representation predict that mode information is lost (Anderson and Bower 1973; Sachs 1967). However, the evidence presented so far argues that long term representation preserves the input mode. One question that arises here is, if mode is indeed part of a memory trace, do subjects remember information about the mode of input? There is a distinction between subjects encoding the mode of input information into long term memory and remembering the mode information. For example, a person may read some important information about a car s/he wants to buy, but will s/he remember at a later point whether s/he had read or heard the information? If information is encoded in a mode-specific manner, the person in the above example will have a memory trace that is visual in nature.
However, no evidence has been presented up to this point to show that people remember the mode in which they encounter any information.

Hintzman et al (1972) attempted to answer this question by presenting subjects with eight lists, each 18 words long. Within each list, half the words occurred in one input mode (audio or visual) and half in the other. Assignment of words to input modes was random except that more than four words could not occur consecutively in the same mode. At the end of each list, three minutes were given for written recall of words in the list. After this exercise was completed for all the eight lists, subjects were given a recognition task that contained items presented in the eight lists and some distractor items. The subject was to identify items as ‘old’ or ‘new’ and if an item is ‘old’, was to identify the input mode in which it occurred. This was a direct test of retention of input mode in an episodic memory task.

First, an analysis of recall protocols for the eight lists was performed. The analysis revealed significant clustering of recall by input mode, i.e., items occurring in the same mode were more likely to be recalled together. This result suggests that the input mode must have been somehow encoded by the subjects, because if it is abstracted away, as proponents of abstract representation would argue, it cannot be used as a clustering parameter. The results also suggest that mode differences between items in a list are powerful enough to act as an organizational base. This, by itself, is strong evidence in favor of mode-specific representation because semantic clustering is normally
expected in free recall tasks (e.g., Bousfield, 1953), not clustering by mode. Clustering by mode implies that items that are presented in a particular mode are stored together and separately from items that are presented in another mode. This is similar to semantic clustering where items sharing a semantic base are assumed to be stored together and separately from other items. Because subjects exhibited clustering by mode, one can argue in favor of mode specific storage.

The second analysis was on the memory for the mode of input. From the words that were correctly recognized by the subjects, the mode in which they occurred was correctly identified 77% of the time. This high recognition rate even when subjects were exposed to as many as 144 words (only one exposure per word) indicates that the memory trace subjects are accessing preserves mode information. One can thus conclude from this study that people not only represent information in a mode specific manner, but also remember the mode of the input.

Automatic encoding of mode. Memory for mode, according to this thesis, must result because the encoded representation is isomorphic with the input. Due to this isomorphism, the memory trace automatically contains information on the mode of the input. That is, any memory trace is not just a trace but will be an 'auditory' memory trace, a 'visual' memory trace, and so on. Hence, the information on mode is part of the trace itself. Memory for mode is not because subjects consciously process information on the mode of the input. One study reviewed below supports this argument.
Lehman, et.al.(1985) argued that if encoding of mode information is automatic, then memory for mode should be age invariant. This is because one of the criteria for automatic processes is that they are age invariant (Hasher and Zacks, 1979). To test for automaticity in the encoding of mode of input, the authors gave subjects a mixed-mode continuous recognition task (here, every trial is a test trial and subject responds 'old' or 'new') followed by a final recognition test after delays of 0 hour, 4 hours, one day and 7 days. Subjects were third and fourth graders and adults. One dependent measure was the rate of forgetting of the input mode of the words at various delay intervals (rate of forgetting means the slope of the line connecting the amount of information on the input mode remembered at various delay intervals. If 90% of the subjects remembered the input mode at a delay of 0 hour and 70% remembered the input mode at a delay of four hours, then the rate of forgetting will be 5% per hour). The authors found that the rate of forgetting of mode information was not different for children and adults, and children and adults had comparable and high mode identification scores in the short term (more than 90% accuracy in the 0 hour delay condition), and even after a delay of one week (about 60% accuracy). Age invariance, as mentioned before, is one of the characteristics of automatic processes. Since age invariance was observed in subjects' memory for mode of input information in this study, it supports the idea that the encoding of mode is an automatic process. Also because subjects could remember mode information even after long delays, it must have been encoded in
long term memory. Thus, one may conclude that mode information is represented in long term memory, and this is not a conscious but automatic process.

This completes the review of evidence in favor of mode representation in long term memory. It was argued earlier that information could either be represented in a mode-specific manner or in an abstract form that is independent of the input mode that delivered the information. The evidence presented in the foregoing sections strongly favors mode-specific representation. Specifically, existing literature shows that visual and auditory components can be present in long term memory, that mode information is encoded automatically, and is remembered even after delays of as much as seven days. These findings cannot be accommodated by a view of representation that argues for abstraction and filtering away of input mode. Based on these findings, hypotheses are developed in the next section that test the concept of mode-specific representation when verbal information is presented auditorily and visually.

Development Of Hypotheses

The first hypothesis follows naturally from the discussion on mode representation in long term memory. Two important conclusions from the review are used in the development of this hypothesis.

The first conclusion pertains to the representation of mode information in memory. The evidence reviewed in the foregoing section supports the assumption of an input retaining its mode when it is encoded in long term memory. Therefore, when a consumer is exposed to
a radio ad, it is assumed that an auditory trace of the message is left behind in long term memory. Similarly, when a consumer reads a print ad, a visual trace is stored in long term memory.

The second conclusion is derived from Hintzman et.al's (1972) finding that subjects' recall protocols showed clustering by input mode. This type of clustering indicates that items occurring in each mode are stored separately from each other, just as one semantic category is stored separately from another semantic category. One can argue, then, that if a word is presented in two modes, two separate representations will result for that word because each mode is stored distinctly. The two separate representations may also be viewed as two separate paths that are formed in memory for that word.

A considerable amount of research exists to support the claim that multiple paths in memory for a concept will enhance the probability of retrieval of that concept. Referred to as the encoding variability hypothesis, this contention has been tested in learning studies where it has been found that varying the context in which a stimulus is presented makes it more memorable than repeatedly presenting the stimulus in the same context (Burnkrant and Unnava 1987; Melton 1967, 1970). The explanation for this finding is based on the theory that the context of learning forms part of memory representation of a stimulus item (Anderson and Bower 1973). The context acts as a retrieval cue when a subject tries to access that item in a subsequent recall task. When an item is presented in the same context repeatedly, the subject will have only that one context
as a retrieval cue. If the same item is presented in multiple contexts, however, each context acts as a cue in the retrieval of that item. The likelihood of retrieving any item in memory has been shown to be directly related to the number of contextual cues that will lead to that item (e.g., Gartman and Johnson 1972). This research establishes the superiority of multiple context presentations of information over single context presentations. The availability of various contexts for any given concept is also viewed as multiple paths because each context is believed to lay down a separate path between the context and the stimulus item. The consistent finding is that the probability of retrieval of a concept is directly related to the number of paths associated with or tied to that concept.

Applying this literature to the situation of interest here, one can argue that multiple presentation modes will also act as multiple paths in memory. For example, when information is presented visually, it is expected that a visual trace will be formed in memory. When the same information is presented a second time, auditorily, an auditory trace should also be formed for that information. If information occurring in a particular mode is stored distinctly from information occurring in another mode, the two exposures described above should result in two mode specific traces or paths. Thus, identical information presented in two modes will be represented in memory as two mode specific paths that contain identical information.

In contrast, when identical information is presented twice in only one mode, the existing trace in that mode will only be
strengthened, but a second path will not form. Presentation of the same information twice in one mode will enhance retrievability of that information due to repetition, but the advantage of multiple paths will not be obtained. Thus, if identical information presented in two modes leads to two paths containing the same information, retrieval of the information presented in two modes should be superior to retrieval of the information presented twice in any one mode. The first hypothesis is based on this logic and is stated below:

H1: Subjects exposed to the same information in two modes will recall more of that information than subjects exposed to the same information twice in any one of the two modes.

The presence of two paths in memory for some information may also affect the confidence with which subjects will answer questions on that information. The following discussion will provide the basis for hypothesizing effects of multimode versus single mode presentation of information on confidence.

When a subject is asked a question about the information to which s/he was exposed, a memory search should take place to answer the question. A subject exposed to information in only one mode will have to rely on the information contained in one path in memory to answer the question. This is because when information is presented in a single mode, only one path is expected to form in memory, as noted earlier.

In contrast, when information is presented in two modes, two paths should form in memory. A subject asked a question in this
situation will have two paths in memory that can provide the answer. Since the information presented in both modes is identical, the information contained in both the paths will also be identical. Hence, the subject will have two sources that provide the same answer when s/he conducts a memory search to answer a question. The agreement between the sources on an answer should result in an increase in the subject's confidence in the response. The second hypothesis, then, posits that when subjects are asked questions on the message information, those subjects who are exposed to information in multiple modes will have greater confidence in their responses than subjects who are exposed to the same information in only one mode. This hypothesis is formally stated below.

\( H_2: \) Subjects exposed to information in two modes will report greater confidence in their answers to questions on that information than subjects exposed to the same information twice in any one of the two modes.

The confidence differences between the dual mode subjects and the single mode subjects are due to the differences in the number of paths they have for that information in their memories. In other words, the confidence differences are caused by the differences between the subjects in their internal representation of information. However, it may be argued that some extraneous variable, and not the number of paths in memory, enhances the confidence of the dual mode subjects on all their responses. That is, the differences in confidence may be due to some other variable, and are not mediated by memory.
representations. If this argument is correct, the dual mode subjects should be more confident than the single mode subjects on their answers to any question. On the other hand, if the number of paths in memory are responsible for the confidence differences, those differences should disappear when the subjects' responses are based on memory representations that are not different. For example, if the message they were exposed to is on AIDS, and a question they are asked deals with AIDS but cannot be answered based on the information in the message, the subjects will have to rely on other information in memory to answer the question. When subjects use information other than what was contained in the message, no representational differences for that information are expected. Therefore, there should be no difference in their confidence about their responses. This argument is now summarized as the third hypothesis.

**H3:** For questions that are related but cannot be answered from the presented information, there will be no confidence differences between the dual mode and the single mode groups.

The argument that confidence differences are related to the differences in the representation of information, and are, therefore, memory mediated, will be strongly supported if confidence differences are obtained for questions related to the message, and are not obtained for questions unrelated to the message. That is, attainment of support for both H2 and H3 strengthens the confidence one can have in the effect and indicates that it is memory mediated.
A research design developed to test the hypotheses proposed above will now be described. The results of two experiments that provide an empirical test of the implications of these hypotheses are discussed later, followed by concluding remarks.

EXPERIMENT ONE

Method

The hypotheses to be tested required information to be presented in two modes. Messages were presented auditorily and/or visually. The experiment conformed to a 2 X 2 between subjects factorial design. The independent variables in this design are described below:

1. First exposure mode: Subjects were exposed to either auditory messages (taped) or visual messages (typed).

2. Second exposure mode: The same subjects were exposed again to either auditory messages (taped) or visual messages (typed). These messages were identical to what they were exposed to the first time.

Thus, one group of subjects was exposed to auditory messages both times (auditory only group), one group to visual messages both times (visual only group), one group was exposed to an auditory message followed by a visual message, and one group was exposed to a visual message followed by an auditory message (dual mode groups).

Subjects. Seventy six subjects recruited from undergraduate introductory marketing classes were used in the study. All subjects participated for extra course credit. The study was conducted in several sessions and each session was systematically assigned to an
experimental condition after beginning the first session at random. Thus, the only constraint on subject assignment was that subjects in a particular session were all in the same experimental condition. This constraint emerged because the second exposure of the message followed the first exposure immediately. Therefore, it was not possible to manipulate the second mode within a session.

**Stimulus materials.** The most important concerns in developing the stimulus materials were:

a) that the message used in the study was sufficiently interesting to the students that they would attend to the message. This concern arose because the effect being investigated depended on the information being encoded into long term memory. Long term encoding was possible only if subjects first attended to the information in the message. An interesting topic would enhance the subjects' attention to the messages.

b) that the target message was reasonably long so that ceiling effects would not limit variance in the data. Ceiling effects were expected for short messages because every message in this experiment was repeated twice. With a short message, this could have caused high levels of learning at least in the short term (cf. Chattopadhyay and Alba, 1988; Eagly and Chaiken, 1984).

c) that the target message was informative and was relatively unfamiliar to subjects so that true learning was measured with minimal contamination by prior knowledge.
Based on the above considerations, it was decided to use a message on AIDS. The study was conducted prior to the distribution of information on AIDS by the Federal Government. Information on AIDS was obtained from various sources including the Surgeon General's report, another report published by the American College Health Association, a flyer circulated by Ohio Department of Health, and a report by American Red Cross. The information from various sources was condensed into a message that was about 1200 words long. This message was then read into a tape to make an auditory version of the message. The reading of the message into the tape was done at normal speed with limited intonation. This precaution was taken to minimize differences between auditory and visual versions of the message, attributable to voice expressions in the auditory message. A filler message on the US trade deficit, about 500 words long, followed the target message and served the purpose of clearing the target message from the short term memory of the subjects. The messages are reproduced in Appendix A.

Procedure. Subjects participated in the study in groups of four to five each. The cover story informed the subjects that they were participating in a research project examining students' opinions on some contemporary topics. The subjects were then exposed to the messages on AIDS and US trade deficit. After the first exposure, instructions changed depending on whether the subjects were exposed to the same or a different mode the second time. For subjects exposed to the message in the same mode, the instructions stressed the importance
of their understanding everything in the message before giving their opinions. They were asked, therefore, to read or hear the messages a second time. For subjects exposed to a different mode, the instructions were the same as above, except that they were told that they would be exposed to the message in a different mode the second time.

If instructing all subjects to concentrate on the message during the second exposure had any effect, it would have enhanced their overall learning of the message. If this were the case, the likelihood of differences emerging between the dual mode and the single mode conditions would be lower because all the subjects would be concentrating on the message. The tests comparing the recall of the dual mode and the single mode subjects would hence be more conservative, thus providing a stronger test of the hypotheses. Later debriefing revealed that subjects neither viewed this manipulation suspiciously nor did they guess the hypothesis.

After the two exposures, subjects were given a questionnaire (see Appendix B). The first question asked them to recall everything they could from the AIDS message presented earlier. The subjects were given as much time as they wanted to complete this task. After this, they responded to 14 questions which were based on the topic of AIDS. Out of the 14 questions, 10 were close re-statements of sentences that appeared in the message. The remaining four questions were unrelated to the message copy but dealt with the topic of AIDS. These latter questions provided the data needed to test Hypothesis 3. Each of the
14 questions was followed by a five-point Likert Scale anchored by Strongly Agree and Strongly Disagree with the correct answer scored as 1. These questions will be called belief questions for the remainder of this chapter to avoid confusion between them and the questions on confidence. The belief questions are presented in Figure 1.

The confidence of the subjects in responding to each of the belief questions was measured using a question that asked them how confident they were in their response. This question followed every belief question, so that there were 14 questions measuring the subjects' confidence in each of their responses to the 14 belief questions (see Appendix B). The confidence in each response was measured by a seven-point scale anchored by Very confident (scored as 1) and Not at all confident (scored as 7).

The subjects were also asked two questions measuring their behavioral intention. These questions were included to see if differential availability of information in memory would affect behavioral intentions. One of the questions asked subjects how likely they were to accept donated blood if they needed it. The second question asked them how likely they would be to work with a colleague who was infected with AIDS. Both responses were measured using a seven-point Likert Scale anchored by Extremely Likely (scored as 1) and Extremely Unlikely (scored as 7). The message contained
FIGURE 1
BELIEF QUESTIONS USED IN EXPERIMENT ONE

Message Related Belief Questions:

1. AIDS is caused by a type of bacteria called lymphocytes.
2. Everyone who is infected with the AIDS virus will die.
3. AIDS can be a hereditary disease.
4. The symptoms of AIDS are not very different from those of minor illnesses like fever and diarrhea except that they are persistent.
5. Drug abusers get AIDS by sharing needles infected with the AIDS virus.
6. AIDS can be spread through sneezing or coughing.
7. Sharing bed linen with an AIDS victim is not dangerous.
8. The number of people infected with classic AIDS in the U.S. is about two million.
9. Even if a cure for the AIDS virus as it exists today is found, the virus may change its form and become uncontrollable again.
10. Sex is the second most important mechanism through which AIDS spreads.

Message Unrelated Belief Questions

1. All types of condoms available in the market offer adequate protection from AIDS.
2. The U.S. ranks second in the world in the number of AIDS victims per thousand of population.
3. Women appear to be more resistant to the AIDS virus than men.
4. Some cases involving cancer of genital organs have been linked to the AIDS virus.
information on how donated blood goes through automatic AIDS tests, thus making blood transfusions safe. Another part of the message stressed on the lack of risk in casual social contact with an AIDS victim. Since the behavioral intention questions were related to this message information, differential availability of the information to the subjects was expected to affect their behavioral intention.

Finally subjects responded to three questions that measured the amount of attention paid to the message. These questions were included to counter a potential alternative explanation that recall differences between single and dual mode conditions were due to the dual mode subjects paying greater attention to the message when it was repeated in a different mode. The greater attention of the dual mode subjects could be because of the novelty introduced into the task by a change in the mode of presentation. Alternatively, the single mode subjects may pay less attention to the second exposure because of boredom. These attention differences, if any, should thus occur during the second exposure. The attention measures, therefore, measured the subjects' attention to the second exposure of the message. The three questions used to measure attention were:

a) I paid as much attention to the AIDS message the second time as I did the first time
b) I put as much thought into evaluating the AIDS message the second time as I did the first time
c) I put as much effort into evaluating the AIDS message the second time as I did the first time
Subjects responded to these attention questions on five-point Likert scales ranging from Strongly Agree (1) to Strongly Disagree (5). Similar questions have been used in prior research by Petty, et.al. (1977) and have been found to reliably predict attention differences between groups. After responding to these questions, the subjects were dismissed.

**Results**

**Recall.** The recall protocols were coded by two judges who were blind to the experimental condition of the subjects. Judges were asked to record every meaningful phrase in the message and allocate one point to each recalled phrase. For example, if the sentence in the message read 'the HIV virus is particularly difficult to combat because, in addition to its ability to lie dormant in cells, it also is able to alter itself,' a subject recalling the sentence completely will get three points (one for 'the HIV virus is difficult to combat,' the second for 'its ability to lie dormant in cells,' and the third for 'it is able to alter itself.')

The correlation between the scores of the two judges (r=0.96) supported their reliability. Therefore, it was decided to use the mean of the two scores as the dependent measure in subsequent analyses. This mean score will be called the recall score in the remainder of the analysis.

The first hypothesis holds that subjects exposed to information in two modes will recall more than subjects exposed to the same information in any one mode. No differences between the visual only
and the auditory only conditions were expected. Similarly, no differences between the two dual mode conditions (the two modes presented in two orders) were expected. Thus, the first hypothesis required a significant interaction between the first exposure mode and the second exposure mode, with the dual mode conditions yielding higher recall than the single mode conditions. The hypothesis also called for a contrast between the mean recall score of the dual mode conditions and the mean recall score of the single mode conditions. These means were, therefore, created and are presented in Table 1.

As expected, the 2 X 2 factorial analysis of variance performed on the dependent variable revealed a significant interaction between the first and the second exposure modes ($F = 14.81, p < 0.0001$). The interaction is plotted in Figure 2. No main effects even approached significance ($p > 0.1$).

The mean of the group exposed to two visual presentations and the group exposed to two auditory presentations ($M = 27.73$) was then contrasted with the mean of the groups exposed to dual mode presentations ($M = 36.3$). This a priori contrast was examined using a multiple t-test (Kirk 1982, p.95). The contrast revealed that the dual mode groups recalled significantly more than the single mode groups ($t_{72} = 3.85, p < 0.0001$). Thus, Hypothesis 1 was supported.

**Confidence ratings for message related questions.** The confidence ratings given by the subjects to their belief responses were then analyzed. First, the mean confidence of the subjects was computed for
all the message-related questions (Cronbach’s alpha = 0.59). These scores are presented in Table 1.

The second hypothesis predicted that subjects exposed to the message in two modes would express more confidence in their responses than subjects exposed twice to the message in any one mode. No differences between the two single mode conditions or between the two dual mode conditions were expected. Therefore, Hypothesis 2 required a significant interaction between the first exposure mode and the second exposure mode. The hypothesis also called for a contrast between the mean confidence scores of the single mode and the dual mode subjects.

In line with expectations, the 2 X 2 analysis of variance performed on the confidence scores revealed a significant interaction between the first and the second exposure factorial modes (F = 6.49, p < 0.02). This interaction is plotted in Figure 3. No main effects even approached significance (p > 0.5).

The mean confidence score of the dual mode groups (M = 1.47) was then contrasted with the mean confidence score of the single mode groups (M = 1.76). A multiple t-test used for this a priori contrast revealed that the dual mode groups were significantly more confident on their responses than the single mode groups (t_{72} = 2.55, p < 0.01 (one-tailed)). Hypothesis 2 was, therefore, supported.

Confidence scores for message unrelated questions: The mean confidence score for each subject was computed for all the message
unrelated questions (Cronbach's alpha = 0.67). The confidence scores for each experimental group are presented in Table 1.

Hypothesis 3 predicted that the single and the dual mode groups would not differ on how confident they were about their responses. Similarly, no differences were expected between the two single mode groups or between the two dual mode groups. Therefore, no main or interaction effects were expected in the analysis of the confidence scores. The hypothesis also called for a contrast between the mean confidence scores of the single mode and the dual mode groups, to show that the groups were equivalent in their confidence scores.

The 2 X 2 factorial analysis of variance on the confidence scores produced expected results. There was neither a main effect nor an interaction between the first and the second exposure modes (all F's < 1.5). An a priori contrast was performed between the mean confidence scores of the single mode groups (M = 2.98) and the dual mode groups (M = 2.79), using a multiple t-test. This contrast showed that the two groups did not differ in their confidence scores (t_{72} = 0.69, p > 0.4), which supported Hypothesis 3.

The dual mode subjects expressed greater confidence than the single mode subjects in their belief responses, as expected. However, this increased confidence was evident only in those beliefs that were directly derivable from the message and was not evident for message unrelated beliefs.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Dependent Measure</th>
<th>Visual</th>
<th>Auditory</th>
<th>Visual, then Auditory</th>
<th>t-value^2(df)</th>
<th>p &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
<td></td>
<td>30.02</td>
<td>24.67</td>
<td>38.21</td>
<td>34.66</td>
<td>3.85(72)</td>
</tr>
<tr>
<td>Confidence (Related)</td>
<td>1.78</td>
<td>1.73</td>
<td>1.50</td>
<td>1.45</td>
<td>2.55(72)</td>
<td>0.007</td>
</tr>
<tr>
<td>Confidence (Unrelated)</td>
<td>3.15</td>
<td>2.77</td>
<td>2.93</td>
<td>2.66</td>
<td>0.68(72)</td>
<td>0.497</td>
</tr>
<tr>
<td>Related beliefs</td>
<td>1.87</td>
<td>1.79</td>
<td>1.70</td>
<td>1.70</td>
<td>0.99(72)</td>
<td>0.400</td>
</tr>
<tr>
<td>Unrelated beliefs</td>
<td>3.05</td>
<td>2.58</td>
<td>2.95</td>
<td>2.75</td>
<td>0.25(72)</td>
<td>0.866</td>
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<tr>
<td>Behavioral Intention</td>
<td>2.80</td>
<td>3.00</td>
<td>2.26</td>
<td>2.68</td>
<td>1.85(72)</td>
<td>0.070</td>
</tr>
<tr>
<td>Attention Index</td>
<td>2.80</td>
<td>2.60</td>
<td>3.10</td>
<td>2.40</td>
<td>0.30(72)</td>
<td>0.500</td>
</tr>
</tbody>
</table>

1. The lower the score, the greater the confidence, intention or attention.

2. The t-value and p values are for the contrast (M\textsuperscript{dual mode} - M\textsuperscript{single mode}).

3. The lower the value, the more accurate the answer.
Figure 2. Plot of Recall as a Function of First and Second Exposure Modes
Figure 3. Plot of Confidence as a Function of First and Second Exposure Modes.

Note: The scale used to measure confidence ranged from 1 = very confident to 7 = not at all confident.
It is interesting to note that the confidence difference between the dual mode and single mode subjects for message related questions is small (0.29 on a seven point scale) and is highly significant; however, a confidence difference of 0.19 for message unrelated questions, on the same scale, does not even approach significance. In addition to the smaller mean difference in confidence, the confidence scores for message unrelated questions were also higher in variance (variance = 1.05) than those for the message related questions (variance = 0.49).

Behavioral intention. Insofar as the expressed behavioral intention is a function of the amount of information recalled by the subjects, one would expect the dual mode subjects to be more willing to work with a colleague who has AIDS. Similarly, the dual mode subjects would be expected to be more willing to accept donated blood. This is because the information presented in the message argued against any danger in working with an AIDS victim, and against the possibility of the spread of AIDS through blood transfusions. Differential availability of information that supports the behaviors mentioned in the questions should cause the dual mode subjects to be more positively inclined toward those behaviors. However, no hypothesis was made about behavioral intention because the expected differences were contingent upon differences in availability of two pieces of information from a long message, which did not provide sufficient grounds for the statement of a hypothesis.
A separate analysis of variance was performed on each of the intention measures. The analyses again conformed to the 2 X 2 factorial design with two levels of first exposure mode and two levels of the second exposure mode as the independent variables. No significant main or interaction effects emerged when this analysis was performed on the question asking subjects if they would accept donated blood (all p-values > 0.25). Informal discussions with the subjects revealed a possible reason for the lack of effects on this variable. The question specifically asked subjects the likelihood of accepting donated blood, if they needed it. It was felt by many subjects that once the need for blood arose, they would have to accept it.

Interestingly, an interaction approaching conventional levels of significance ($F = 3.42; p < 0.07$) emerged in the analysis of subjects' willingness to work with an AIDS victim. No main effects even approached significance ($p > 0.2$). The direction of the group means indicated that the dual mode subjects were more willing to work with an AIDS victim ($M = 2.49$) than the single mode subjects ($M = 2.89$). Because no hypothesis was made about behavioral intentions, the mean intention score of the dual mode subjects was contrasted a posteriori with the mean intention score of the single mode subjects using Newman-Keuls test. The analysis revealed that the dual mode subjects were no more willing than the single mode subjects in working with a colleague who had AIDS ($p > 0.05$). It was concluded, based on these results, that presenting information in multiple modes did not affect subjects' behavioral intentions.
Attention. Finally, the attention measures were analyzed. These measures were collected in order to test the alternative hypothesis that greater recall by dual mode subjects was due to their paying more attention to the message during the second exposure.

A reliability analysis was first performed on the attention measures which indicated that the three measures were internally consistent (Cronbach's alpha = 0.84). Therefore, the three measures were averaged to form an attention index which was used in the subsequent analyses.

A 2 X 2 factorial analysis of variance was performed on the attention index with the first and second exposure modes as the independent factors. The analysis revealed a significant main effect of the first exposure mode ($F = 10.69$, $p < 0.002$). This effect was due to the subjects having paid greater attention to the second exposure of the message when the first exposure mode was auditory ($M_{\text{auditory}} = 2.34$, $M_{\text{visual}} = 3.08$). Although the reason for this finding is not clear, it is possible that subjects who had the first exposure auditorily might have experienced lapses in concentration as the tape was played. The lapses in concentration might have resulted in their missing some parts of the message because with auditory presentation, their ability to go over points missed is limited. They might have tried to make up for the concentration lapses on the first exposure by concentrating more during the second exposure.

Importantly, the interaction between the first and second exposure modes was not significant ($F < 1$). This indicates that
subjects exposed to the message once in each mode did not pay more attention to the second exposure than subjects exposed twice to the message in the same mode. This finding, therefore, argues against the attention alternative hypothesis.

To provide further evidence against the differential attention hypothesis, the attention index was used as a covariate and all the analyses reported above were repeated. The attention index did not even approach significance in any analysis, and all the results reported above were unaffected by the covariate. It was concluded, based on these analyses, that attention differences between conditions were not responsible for the effects obtained in support of the hypotheses.

DISCUSSION

It has been argued in this thesis that the representation of information in memory is mode-specific. That is, the mode in which the information is encountered is not abstracted away. Rather the memory trace that results from exposure to information retains the properties of the mode in which that information was encountered.

Identical information presented in different modes was hypothesized to result in different paths in memory, one for each mode. One of the predictions of a theory that argues for this type of representation is that when people are exposed sequentially to identical information in two modes, they would recall more than people exposed to the same information twice in the same mode. This prediction was supported by the data.
A second important prediction that found support concerned the confidence ratings given by subjects on their responses to questions that were based on the target message. As predicted, the dual mode subjects reported greater confidence in their answers to these questions than the single mode subjects. The fact that this increased confidence was expressed only for those questions that were directly drawn from the message, and not for other message-unrelated questions on the same topic, suggests that the confidence enhancement was memory mediated.

It was suggested earlier that a possible alternative explanation for these findings is that subjects pay more attention to the second message when it is repeated in a different mode rather than the same mode. In this research, this alternative hypothesis was ruled out using self report attention data. Dual mode subjects did not report that they paid more attention to the second exposure of the message than the single mode subjects. In addition, an analysis of covariance with self-reported attention as a covariate and recall and confidence scores as dependent variables revealed that attention differences between groups had virtually no effect on the results.

However, one concern regarding self reported attention measures requires further consideration. The validity of self report attention measures may be questionable. Some past research has successfully shown that self report attention measures will actually capture attention differences between experimental conditions (i.e., Petty and Cacioppo 1979; Petty, Harkins, Williams and Latane 1977). This
research supports the predictive validity of self reported measures of attention. However, it may perhaps be argued that these measures are not sufficiently sensitive to tap the minor differences in attention between conditions that may be a potential alternative explanation for the findings reported earlier. In order to rule out this argument, a second study, to be described below, employed a reaction time secondary task measure of attention.

When secondary task measures are employed, subjects are asked to perform a second task concurrently with their performance of the task of interest. The reaction time to the secondary task, which usually requires subjects to respond to auditory or visual signals, is the variable that is employed to measure attention. The assumption that is made in this procedure is that people have limited processing capacity. This capacity is allocated to various tasks depending on the processing goals of the individual. However, because of the limitation on the total capacity, greater allocation of attention to one task implies lesser attention to the other tasks. Therefore, in the secondary task method of measuring attention, as more attentional resources are expended on the primary task, there will be fewer resources left to perform the secondary task (Kahneman 1973; Kerr 1973; Lynch and Srull 1982). As more attention is paid to the message, in the present context, the reaction time should be greater in responding to the signals presented as a secondary task. In other words, differences in attention to the message between experimental
conditions will be reflected directly in the reaction time of the subjects to the secondary task.

The secondary task method of measuring cognitive effort has been employed by several researchers with successful results. For example, Tyler, Hertel, McCallum and Ellis (1976) employed this procedure to measure cognitive effort and found that the time required to respond to the secondary task (tone recognition) was directly related to the recall of information processed in the primary task. More recently, Moore, Hausknecht, and Thamodaran (1986) used the secondary task procedure and found that time compressed messages reduced viewer's attention to the messages. When the messages were speeded up by 60%, subjects performed better on the secondary task (pressing a computer key bar when the digit '3' appeared on the screen), which indicated that their attention to the message dwindled. This lower attention was reflected in their recall scores which were lower than the recall scores of the other subjects. The secondary task method of measuring attention has thus been validated across several studies. Considering the importance of differential attention as an alternative explanation to the findings of the present research, the use of a validated and accurate method of measuring attention was deemed appropriate. Therefore, the experiment described below employed a secondary task method of measuring attention.

Another consideration pertains to the elapsed time between message exposure and the administration of the recall task. The recall effects described earlier have emerged in an immediate recall
task. Even though one may rule out the possibility of any short term memory effects (because of the filler message that followed the critical message), the recall task still was administered not very far in time from the message administration. One question that may arise here is about the longevity of the recall effects - i.e., will the dual mode group's superiority persist with longer time delays? The importance of delayed recall measures has been strongly argued for by Chattopadhyay and Alba (1988). Thus, it may be far more convincing if the recall effects in long term memory tasks are demonstrated over time.

The two foregoing concerns are addressed in a replication of the first experiment that is described now. First, a reaction time secondary task was used to measure attention paid to the message when it was repeated. Second, there was a surprise delay task which followed the message administration after five days. The experiment and the results obtained will now be described in detail.

EXPERIMENT TWO

Method

This experiment was identical to the first experiment except for the few minor changes in methodology reported here. First, all subjects performed a reaction time secondary task during their second exposure to the message. Second, the immediate recall task was limited to just five minutes for reasons which will be explained subsequently. And third, this study employed a delayed recall test.
Subjects. A total of 67 subjects from an undergraduate introductory marketing course participated in the experiment for course credit and additional monetary reward ($3 each). The experiment was held in several sessions, and subjects self-selected the session they preferred to attend. All the subjects in a given session were assigned to the same experimental condition. The various sessions were assigned systematically to the treatment conditions after starting the first session randomly, as was done in experiment one.

Materials. The stimulus materials used in this study were the same as those used in experiment one. There was, however, some additional equipment used in this study to measure the attention paid by the subjects to the message. This was accomplished by using a secondary task.

The secondary task required subjects to press a button on a handheld switch upon hearing an auditory tone that was generated by a computer. The tone was generated by the computer at random intervals and was recorded onto an audio tape. The message was recorded on another audio tape. These two tapes were used as masters to produce the other tape required in this study for subjects who performed the secondary task while being exposed to the taped message. This tape had the message on one channel and the tones on the other channel.

For those subjects who read the message during their second exposure, the tape which had just the tones recorded on it was played through a speaker system. This tape player was connected to a
Commodore Personal Computer which recorded the time at which the tone occurred. The subjects were given one hand-held switch each and they were asked to press the button on the switch whenever they heard the tone. The switches were connected at the other end to the personal computer which recorded the time at which the button was pressed for each subject. The subjects were told that they should be as fast as possible in pressing the button. They were, however, reminded that it was more important for them to pay attention to the message because they would be asked some specific questions after they were finished with the message.

For those subjects who listened to the message on the second exposure, the second tape was played through a stereo speaker system. A small announcement preceded the recorded message and the volume controls were adjusted when the announcement was being played so that subjects felt comfortable with the volume. The instructions to these subjects about the secondary task were the same as given for the other subjects.

Procedure. Subjects participated in the study in small groups of one to four each. The limit of four on the group size was due to the availability of only four switches that could be used for the secondary task. Upon entering the room, the subjects were told that they were participating in research on students' opinions on some contemporary issues of interest. They were then asked to read or listen to the message on AIDS and the US trade deficit just as in experiment one.
After the subjects were finished with the first exposure, they were asked to read or listen to the message once again. It was at this point, that instructions about the secondary task were given to all the subjects.

After the second exposure, all subjects answered a short questionnaire that measured their attention using the same self-report attention measures used in experiment one. Then they answered the behavioral intention questions that were used in experiment one. Following this, all subjects were instructed to recall as much as they could from the AIDS message and were given five minutes to write it down.

The limit on the amount of time allocated for message recall served an important purpose. It permitted completion of the first part of the study in one day. Completion of the first part of the study in one day was important because it was planned to measure delayed recall in a classroom, a few days after the exposure to the message. This meant that the delayed recall measure would be administered on the same day for all the subjects. To ensure that all the subjects had approximately equal time delay between the exposure and the delayed recall measure, it was necessary to administer the communication and immediate post-test questionnaire to all subjects on the same day. To complete all sessions in one day, it was necessary to limit the immediate recall test to five minutes. The problem with limiting recall time in the immediate recall task was that the time limit might prevent recall differences from emerging by constraining
the amount of recall that could be exhibited. Nevertheless, because immediate recall effects had already been obtained in experiment one and a major objective of this study was to examine delayed recall effects, it was felt that the immediate recall time constraint and possible masking of immediate recall effects would not be a serious problem. After the recall task, the subjects were thanked, paid and dismissed. No one was told that there will be a delayed recall task.

Five days after the exposure to the message, the subjects were given a recall task unexpectedly. This recall question was administered in a classroom. The subjects were told to take as much time as they wanted, and to motivate them to do their best, were told that the person who recalls the most would be given a cash award of $25. Following this recall task, they were debriefed.

**Results**

**Reaction time.** The reaction time data were collected in this study to measure the amount of attention paid by subjects to the second exposure of the message. These attention measures were required to counter the alternative explanation that the dual mode group superiority in recall, over the single mode groups, is due to the former paying greater attention to the message. According to the first hypothesis, the dual mode group superiority is not due to differential attention, but, rather, it is due to the formation of two paths in memory for the target information. In other words, no differences in attention were expected between the single mode and the dual mode groups. However, the alternative hypothesis of differential
attention calls for a significant interaction effect in the analysis of subjects' reaction times.

The time taken by each subject to respond to each tone was computed to the accuracy of one millisecond by the personal computer used for the reaction time task. Using these data, the mean reaction time was calculated for each subject by dividing the total reaction time (sum of reaction times to all tones) by the number of tones. The mean reaction time for each experimental group is presented in Table 2.

To test for differences in reaction times between the experimental groups, a 2 X 2 factorial analysis of variance of the mean reaction time was performed with first and second exposure modes as the independent variables. The analysis revealed no significant interaction effect (p > 0.25). The absence of an interaction between the first and second exposure modes indicated that the dual mode groups had no greater reaction time to the secondary task than the single mode groups (M dual mode = 487.9 ms, M single mode = 439.5 ms). Based on the above result, the alternative explanation of differential attention between experimental conditions was ruled out.

The results of the above analysis were also used to check if the secondary task which was auditory caused more interference when the message was presented auditorily than when the message was presented visually. This type of selective interference is possible when the mode of the secondary task is the same as the mode of the primary task (cf. Lynch and Srull 1982). If selective interference occurred,
the reaction time of those subjects who were given the second exposure auditorily should be greater than the reaction time of the subjects who were given the second exposure visually. In other words, there should be a main effect of the second exposure mode in the above analysis. However, the main effect of second exposure mode was not significant (p > 0.5). The absence of a main effect of second exposure mode indicated that whether the second exposure was auditory or visual, the reaction times were not different. In other words, when the mode of the secondary task and the primary task were the same, there was no additional interference due to the secondary task.

**Recall.** The recall protocols were coded by the same two judges as in experiment one, using the same criteria to assign points as before. The coding of each judge resulted in two scores for each subject, one for the number of points recalled in the immediate recall task and the other for the number of points recalled in the delayed recall task. The reliability of the judges was fairly high (r = 0.95 for immediate recall, r = 0.94 for delayed recall) and compared very well with their reliability in the first experiment. Therefore, the means of the two judges' scores were computed separately for immediate recall and delayed recall, and these means were used in the analysis.

The first hypothesis holds that subjects in the dual mode groups will recall more than the subjects in the single mode groups. No differences between the two dual mode groups were expected. Similarly, no differences between the visual only and the auditory only groups were expected. Thus, the first hypothesis required an
interaction between the first and second exposure modes with the dual mode conditions yielding higher recall than the single mode conditions. The hypothesis also called for a contrast between the mean recall score of the dual mode conditions and the mean recall score of the single mode conditions. These means were, therefore, created for immediate and delayed recall scores, and are presented in Table 2.

An analysis of variance of the immediate recall score with the first and second exposure modes as independent factors revealed no significant effects (all p-values > 0.2). The absence of an interaction between the first and the second exposure modes implied that the dual mode subjects did not recall more than the single mode subjects (M\textsubscript{dual mode} = 19.10, M\textsubscript{single mode} = 17.80). Nevertheless, because it was hypothesized that the dual mode subjects would recall more than the single mode subjects, a multiple t-test was employed as an a priori contrast. This contrast was not significant (t\textsubscript{63} = 0.86; p < 0.15 (one-tailed)).

As argued earlier, the absence of greater recall in the dual mode groups may be due to the time constraint imposed on the subjects when they performed the recall task immediately after exposure to the message. In fact, it was observed during the administration of the immediate recall task that all the subjects wrote continuously for five minutes, and had to be instructed to stop writing when the five minutes allotted for the task were over. This observation, coupled with the fact that recall differences emerged in an immediate recall
task in experiment one when no time limits were imposed, suggests that the lack of time suppressed recall differences between the groups.

The delayed recall scores were then analyzed using analysis of variance with the first and second exposure modes as independent variables. The analysis revealed a significant interaction between the first and the second exposure modes ($F = 7.57, p < 0.008$). This interaction is plotted in figure 4. No main effects even approached significance ($p$-values for both main effects $> 0.9$). Since the first hypothesis also called for an a priori contrast between the mean recall score of the dual mode subjects ($M = 22.27$) and the mean recall score of the single mode subjects ($M = 16.9$), a multiple $t$-test was employed for this purpose. The a priori contrast revealed that the dual mode subjects recalled significantly more than the single mode subjects ($t_{60} = 3.27, p < 0.001$ (one-tailed)). The first hypothesis was, therefore, supported.

**Analysis of covariance.** Even though there were no inter-group differences on the reaction time data described before, the mean delayed recall scores were reanalyzed using the reaction time measure as a covariate. The covariate was not significant ($p > 0.4$), and it had virtually no effect on the levels of statistical significance in the reported results. Therefore, no support was provided for the alternative explanation that the recall differences between dual and single mode subjects are due to differential attention.
### TABLE 2
Mean Scores for Recall and Reaction Time - Experiment Two

| Condition          | Measure       | Visual | Auditory | Auditory, then Visual | t-value (df) | P <  
|--------------------|---------------|--------|----------|------------------------|--------------|--------
| Recall (Immediate) | Visual Auditory | 17.30  | 18.40    | 17.90                  | 0.86 (63)    | 0.300  
|                    | Auditory      |        |          | 20.20                  |              |        
| Recall (Delayed)   | Visual Auditory | 16.82  | 17.00    | 21.80<sup>1</sup>      | 3.27 (60)    | 0.001  
|                    | Auditory      |        |          | 22.70<sup>1</sup>      |              |        
| Reaction Time (ms) |               | 413.80 | 468.20   | 485.00                 | 1.06 (59)<sup>3</sup> | 0.292  
|                    |               |        |          | 490.60                 |              |        
| N                  |               | 19     | 17       | 15                     | 16           |

1. N was 13 and 15 for these conditions for delayed recall measure.

2. The t-value and p values are for the contrast \( M_{\text{dual mode}} - M_{\text{single mode}} \).

3. The reaction time data were lost for two subjects due to the malfunctioning of one of the reaction time switches. All the analyses were repeated after dropping those two subjects. The results remained virtually unchanged.
Figure 4. Plot of Recall as a Function of First and Second Exposure Modes
Behavioral intention. Differential availability of information on the safety of blood transfusion procedures and the absence of danger in working with an AIDS victim, was expected to affect the subjects' intentions to accept donated blood or work with an AIDS victim. However, as explained earlier, no hypothesis was made on the effect of experimental manipulation on behavioral intentions of the subjects.

The two behavioral intention measures were, therefore, analyzed using an analysis of variance. The first and the second exposure modes served as the independent variables in this analysis.

No significant effects were obtained with either behavioral intention measure (p > 0.2 for all effects). The finding that the behavioral intentions of subjects were not affected by the experimental manipulation was consistent with the results of experiment one.

DISCUSSION

The main objective of this research was to show that internal representations are mode specific. That is, information that enters human memory from a particular input sense retains the properties of that input sense. According to this view of internal representations, information that is presented auditorily results in an auditory memory trace. Similarly, visually presented information results in a visual memory trace. Therefore, when identical information is presented sequentially in two modes, two mode specific memory paths are formed. On the other hand, if identical information is presented
sequentially in one mode, only one mode specific memory path should form. In other words, each mode forms a distinct path in memory.

The results of two experiments reported in this chapter provided support for the predictions of mode specific view of memory. Subjects exposed to a message in two modes (auditory and visual) were able to recall significantly more than subjects exposed twice to the same message in any one mode (auditory or visual). This finding cannot be explained by theories of memory that are based on abstract internal codes (Anderson and Bower 1973; Collins and Loftus 1975). If internal representations are abstract and are not mode specific, repetition in the same or a different mode should produce similar effects on learning. The results of the two experiments in this chapter, however, speak otherwise.

A plausible alternative explanation of the results reported here implicates attention differences between subjects, but not mode specific encoding, as causing differences in recall. According to the attention explanation, subjects exposed to information in two modes will pay more attention to the second exposure of the message than subjects in the single mode conditions. The greater attention of dual mode subjects is due to the novelty introduced by mode change at the second exposure. Alternatively, the single mode subjects pay less attention to the second exposure because of boredom. To counter the alternative explanation, experiment two employed a reaction time secondary task procedure to measure subjects' attention to the message. The results indicated that there were no attention
differences between subjects. In addition, using attention as a covariate in the analysis of recall scores did not mitigate the reported recall differences. The attention alternative explanation was, therefore, ruled out.

A major conclusion from the research reported here is that the mode in which information is encountered will itself become a part of the memory trace. The importance of the mode in which information is conveyed has only recently received attention in consumer behavior literature (e.g., Bryce and Olney 1988; Gutman 1988; Schmalensee 1983). The focus of this research, however, has been on the differences between one mode and another rather than the differences between multimode and single mode presentations. For example, Bryce and Olney (1987) found that information presented as television pictures was recalled better than identical information presented auditorily. Based on this, Bryce and Olney argued that pictorial information is recalled better than auditory information.

The research reported in this dissertation addresses a more fundamental question -- "What happens to the input mode after the information is processed?" The results of this research indicate that the mode of presentation is very important because it determines the nature of representation of information. That is, information presented in one mode is represented differently from information presented in another mode. The differences between the retrievability of identical information presented in two modes are possibly related to the qualitative differences between the two mode specific memory
codes. For example, pictorial codes may lend themselves to easier retrieval than auditory codes. Future research should examine the qualitative distinctions between memory codes in different modes and the reasons for these distinctions.

Another implication of this research is based on the retrieval advantage of multiple mode specific codes over a single mode specific code. Specifically, this research has shown that identical information that is presented in two modes results in greater recall than the same information presented in only one mode. This finding has important implications for learning research in marketing. One example would be the case of a marketer who is communicating with his audience with an objective of enhancing their memory for his message. Assume that the communicator has a choice between presenting some product information through radio only, print only, or a combination of both radio and print. If we further assume that the audience are fixed for all the three options listed above, the results of this research suggest that the marketer should choose the last option. This will ensure that consumers have dual mode representations of the product information in their minds. The two mode specific representations will make the information more retrievable than when only one mode specific representation is available.

The mode specific view has implications for the way in which we characterize memory in consumer behavior research. As mentioned in the introductory chapter, consumer behavior researchers have not questioned the abstract representation view. Instead, the idea of
abstract mental representations was implicitly accepted when researchers subscribed to theories of memory based on categories, propositions, or schemas. The mode specific view argues for a representation that is far richer than the abstract representation view would suggest. A concept, according to the mode specific view, is composed of several mode specific traces. The representation of a concept, therefore, is isomorphic with the multiple senses that are stimulated by that concept. For example, the memory code for an 'apple' is not just a pale and abstract description of the properties of the apple. Instead, an apple is represented as sight, smell, touch, taste, and auditory codes.

The concept of abstraction, as proposed by schema theories, has also been attacked by Alba and Hasher (1983). In their review, Alba and Hasher presented research that supports the presence of several minute details in memory code (like the type face of a printed sentence). The presence of stimulus details that do not contribute to the meaning of the stimulus, is not predicted by the abstract representation view. This dissertation further discredits the abstract representation view by providing evidence for mode specific encoding, which is not predicted by the abstract representation view.

The finding that encoding information in dual codes enhances the confidence of subjects when they answer questions on that information has important practical implications. Some past research has shown that direct experience with an attitude object results in confidently held beliefs about the object. These beliefs will contribute toward
greater attitude behavior consistency (e.g., Fazio and Zanna 1977; Smith and Swinyard 1983). The present research shows that confidence in subjects can also be increased by presenting the same information in multiple modes. Therefore, if a marketer provides information about his/her product to consumers in multiple modes, the multimodal presentation will not only affect the retrievability of product attribute information, but will also make consumers feel more confident in their beliefs about the product. The increased confidence may result in greater attitude behavior consistency. In the research reported here, attitudes and behaviors were not measured. Future research should examine this issue to see if multiple mode presentation of information will also increase attitude behavior consistency.

It is also possible that the increased confidence with direct experience is at least partly due to the nature of representation of the experience. According to the mode specific view, direct experience with an attitude object is equivalent to multiple sense stimulation and should result in multiple mode specific representations. For example, tasting a brand of ice cream should result in visual, olfactory, tactile and haptic representations. The increased confidence that is reported by subjects who had experience with the ice cream, therefore, may be due to the multiple mode specific traces that tend to agree on several belief statements. The reasoning that is being used here is similar to the reasoning used in experiment one, where greater confidence for dual mode subjects was
hypothesized because the two modes were expected to act as two mutually compatible sources that agree on the answers they provide the subject. The role of mental representations in the confidence reported by subjects should also be addressed in future research.

Finally, the mode specific view has important implications for the understanding of the differences in retrievability of pictures and words. The picture superiority effect refers to the consistent finding in literature that pictures are remembered better than words (see Lutz and Lutz 1978 for a review). The greater retrievability of pictures compared to words has been a topic of considerable interest in consumer behavior literature (e.g., Alwitt and Mitchell 1985; Bryce and Olney 1988; Childers and Houston 1984). The most favored explanation for the picture superiority effect is that pictures are spontaneously processed to a greater depth than words. It follows from this explanation that if words are processed to the same depth as pictures, the picture superiority effect should be eliminated.

The mode specific view, on the other hand, predicts that pictures and words will form different memory representations. This is because, according to the mode specific view, differences in surface features of stimuli are reflected in their memory representations. The picture superiority effect is, therefore, because of the representational differences between pictures and words. The picture superiority effect will be eliminated if we can eliminate the representational differences between pictures and words. These arguments will be contrasted in the next chapter with the existing
explanations of picture superiority effect, to extend our understanding of the encoding of pictures and words.
Chapter III
UNDERSTANDING THE PICTURE SUPERIORITY EFFECT

A significant portion of a marketer's communication to consumers is nonverbal. Examples of nonverbal communication are pictures used in print advertisements, music in radio ads, and the visual scenes in television ads. Even about three decades ago, over 75 percent of all print advertisements had pictures that took up over half the space in the ad (Baker, 1961; cited from Edell and Staelin, 1983). An understanding of the effects of pictures in advertisements will help a marketer design his advertisements to better suit his objectives. In spite of its obvious importance, the impact of nonverbal information like pictures on the learning of accompanying verbal messages has received little attention in marketing. As MacInnis and Price (1987) note, "Information processing research has traditionally focused on discursive or descriptive information processing....researchers have examined how symbols (most commonly words and numbers) are combined in working memory to represent and solve problems" (p.473).

In recent years, the impact of pictures, especially in print advertisements, on the learning of the accompanying verbal information has generated interest in consumer behavior researchers. For example, Childers and Houston (1984) attempted to explain the 'picture superiority effect' (the superior memory for pictures over words) using a depth-of-processing explanation. According to this
explanation, pictures are processed to a greater depth spontaneously, while words are not. This greater depth of processing, according to Childers and Houston, explains the greater retrievability of pictures. It follows that it would be possible to eliminate the superiority of pictures over words by inducing subjects to process words to the same depth that they spontaneously process pictures. To examine this issue, Childers and Houston manipulated the depth of processing of stimuli presented as words only or as words and pictures. In line with their expectations, it was found on an immediate posttest that semantic processing of words led to equal retrievability for pictures and words. Sensory processing, which was induced by having subjects focus on the appearance of the stimuli, resulted in a substantial picture superiority effect. Their hypothesis was thus supported in an immediate recall task.

Interestingly, the picture superiority effect was observed even in the semantic processing condition, when recall was measured two days after subjects were exposed to stimuli. Although this effect was smaller than it was for those subjects who performed sensory processing, its presence indicates that the assumed depth of processing differences between pictures and words do not fully explain the picture superiority effect.

Houston, Childers, and Heckler (1987) argued in another study that when the verbal information presented in an ad is different from what is portrayed by the picture, more elaboration should occur. This is because the picture is assumed to create an expectation about the
contents of the ad copy, and when the copy is not in conformity with that expectation, more elaboration of the copy should occur. Their results were supportive of this argument.

One hypothesis that was not supported in the Houston et.al. research, however, is more pertinent to the focus of this chapter. Houston et.al. hypothesized that the recall of the discrepant attribute (attribute promoted in the verbal copy that is different from the attribute portrayed in the picture) will be more than the recall of the predictable attribute (attribute promoted in the verbal copy which is the same as the attribute promoted in the picture). That is, it was expected that when the ad copy and the picture conveyed different attributes, the attribute conveyed by the copy will be recalled better than when the same attribute is conveyed both through verbal copy and picture. The basis for their hypothesis was that greater elaboration due to picture-copy discrepancy would benefit the attribute promoted in the copy.

It was found, however, that recall was significantly greater when the attribute promoted in the copy and picture were the same, than when they were different. In discussing this finding, Houston et.al. offered two possible explanations. The first explanation hinges on the idea that information presented both as pictures and in words is equivalent to repeating the information, which leads to greater recall of the information. Note that this argument does not differentiate between presentation of information as pictures or in words. As long as the information content is the same in pictures and words, exposing
subjects once to pictures and once to words is the same as exposing them twice to words. It may be recalled that this argument conforms to the abstract representation view of memory that was discussed in the last chapter. According to this view, as long as pictures and words mean the same, their surface differences are inconsequential to the memory representations that they form.

The second explanation provided by Houston et.al. is "....that the dual code nature of the consistent information makes it more readily available in memory" (p.368). The assumption behind this explanation is that words and pictures form different codes in memory. Therefore, when identical information is provided as both words and pictures, two codes containing the same information are formed. The superior retrieval of information is because of these dual codes which enhance the likelihood of accessing the information.

The idea of pictures and words forming different representations conforms very closely with the predictions of the mode specific view of memory discussed in the last chapter. According to this view, internal representations retain the surface properties of external stimuli. Since pictures and words have different surface features, they are represented separately in memory. Therefore, identical information presented both as pictures and in words will form two memory codes, just as identical information presented in two modes was shown to form two memory codes (Chapter 2). The second explanation of Houston, et.al., thus, is consistent with implications of the mode specific view of memory that was developed and supported in the last
chapter. In fact, it is this idea that pictures and words form different mental representations, as predicted by the mode specific view of memory, that will be used in the present chapter to examine memory for pictures and words.

RESEARCH OBJECTIVES

The primary objective of the research reported in this chapter is to extend the research of Childers and Houston (1984) to increase our understanding of the picture superiority effect. The mode specific view of memory will be used to understand the storage differences between pictures and words. According to the mode specific view, mental representations for pictures and words are different. They are different because the mental representations retain the properties of the input information. Because a word and its picture equivalent are very different in terms of their characteristics, their mental representations will also preserve these differences. The picture superiority effect, it is argued, is because of these representational differences. It is proposed that when words are processed such that they create picture-like mental representations, the differences in the retrievability of words and pictures will be minimized. Thus, the type of elaboration that will eliminate picture-word differences is one which results in representational equivalence for pictures and words.

A second objective of this research is to further examine the two alternative explanations proposed by Houston, et al. (1987) for their finding that an attribute that is presented both as a picture and a
description is better retrieved than an attribute that is presented only as a description. The first explanation based on information redundancy suggests that superior recall is due to the repetition of the same information, once in a picture form, and a second time in verbal form. This repetition will serve to increase the strength of the memory trace, and enhance its retrievability. Alternatively, the dual coding explanation (Paivio 1971) suggests that pictures and words form two different codes and the presence of two codes enhances the retrievability of the concept relative to the condition in which there is only one code in memory. It may be recalled that this is exactly the same argument that was proposed in the last chapter to argue for the superior retrievability of information presented in two modes. The argument was based on findings in the encoding variability literature (Melton 1970). The multiple code superiority argument holds only if it is assumed that words and pictures form different representations. In contrast, the redundancy argument holds if it is assumed that words and pictures form identical codes, and presenting information both as pictures and words serves to strengthen the memory code and enhance its retrievability. Based on the findings in the last chapter, which support the idea of different representations for pictures and words, the dual coding view is favored in this research.

In the following section, research examining the differences between pictures and words is reviewed. A mode specific view of memory implicates the representational differences between pictures and words as causing differences in their retrievability. The dual
coding model (Paivio 1971, 1986) argues in favor of mode specific representations. Therefore, the dual coding model is briefly described and then research supporting the predictions of the model is presented. This evidence is also useful in further establishing the prediction of the mode specific view of memory that words and pictures form separate and independent codes in memory. Also, evidence in favor of the dual coding model helps us in identifying situations in which processing of verbal information gives rise to picture-like representations. Based on this type of evidence and the findings of last chapter, hypotheses are formulated that specify conditions for the picture superiority effect. An experiment designed to empirically test these hypotheses, and the results of the experiment are then described.

LITERATURE REVIEW

The Picture Superiority Effect

One of the consistent findings in research examining differences between pictures and words is that pictures are remembered better than words (Paivio and Csapo 1973; Paivio, Rogers, and Smythe 1968; Shepard 1967; Standing et.al. 1972; see also Lutz and Lutz 1978 for a review). For example, Shepard (1967) tested recognition memory of his subjects using pictures, words and sentences. After subjects were exposed to the stimuli (self-paced presentation), they were given a recognition task with some new and old item pairs. The medians of percent correct on the immediate test were 98.5, 90.0, and 88.2 for pictures, words, and sentences respectively. The contrast between
picture and word conditions was not reported, but the contrast between
pictures and sentences was significant. Even after a delay of 97 days
between exposure and testing, subjects correctly recognized 87 percent
of the previously shown pictures.

In another study on recognition memory for pictures and words,
Madigan (reported in Madigan, 1983) had subjects exposed to a sequence
of 90 presentations under intentional learning instructions. In one
condition, subjects saw slides and at the same time heard the common
label for the object depicted in the slide. In another condition,
subjects saw slides but heard the name of a different object (for
example, the slide depicts a car, but the subjects hear the word
'tree'). In a third condition, subjects heard a name only, with no
object shown on the slides. All three kinds of presentation occurred
in a mixed sequence - i.e., each subject was exposed to all types of
presentations in a random order. The recognition task that followed
was completely verbal. Picture superiority was adversely affected by
incorrect labeling. Even so, pictures were recognized significantly
better than words. The demonstration of picture superiority effect
under such adverse conditions speaks of the robustness of the effect.

Several explanations for the picture superiority effect have been
offered by researchers in cognitive psychology operating under vastly
different sets of assumptions (cf. Childers and Houston 1984). One of
the explanations that has received the strongest support is the dual
coding explanation. The assumptions and predictions of the dual
coding model are particularly relevant to this research because they
are based on a mode specific view of memory which was supported in two experiments discussed in the last chapter.

The Dual Coding Model

The dual coding model (Paivio 1971, 1986) postulates two systems of representation in memory - 1) verbal, and 2) nonverbal. The verbal system is specialized to deal with linguistic material while the nonverbal system helps us represent perceptual information like objects, events, and sounds. The verbal system is organized and processed sequentially because words are input and output sequentially. The nonverbal system, on the other hand, is spatial and nested in structure. By nested, it is meant that the representation of one object is embedded in the representation of another object. For example, the mental representation of various facial features are nested in the representation of the face as a whole. Note that the idea of internal representations having properties similar to external information is compatible with the mode specific view of memory discussed in the previous chapter. The dual coding model assumes that the representational units in each system are 'modality-specific perceptual-motor analogues' (Paivio 1986, p.59).

The two systems - verbal and nonverbal - are partially interconnected so that words can give rise to images and perceptual events can be labeled. The systems are only partially interconnected because it is assumed that abstract words (e.g., freedom, faith) generally do not have imaginal counterparts and hence have representations only in the verbal system.
**Functional independence.** An important assumption of the dual coding model is that both verbal and nonverbal systems can be independently activated and can also function independently. This suggests that one can process words without forming mental images and one can perceive a chain of events without verbalizing them. Concrete words, however, generally give rise to images when processed, and there is a tendency for individuals to automatically name pictures (cf. Paivio 1971, p.179-180). This sets up dual codes (i.e., two paths), verbal and nonverbal, for concrete words and pictures. The two paths formed for concrete words and pictures make them more memorable than abstract words for which only one code (verbal) is available. The greater memorability is because of the superiority of multiple paths over a single path in determining the retrievability of information.

Considerable evidence has accumulated over the past 15 years that supports several predictions made by the dual coding model. Paivio (1983), in reviewing the status of the model, presented approximately 60 published studies that have directly or indirectly tested the dual coding model and yielded supportive results. Various paradigms used to explore the issue of representational equivalence of visual imagery and visual perception may be viewed as testing the issue of modality specificity, which is an assumption of the dual coding model. This evidence is reviewed now.
Empirical Evidence

In testing the dual coding model, several researchers have contrasted its predictions with the predictions of what may be called 'propositional' models. The propositional models are the same as the abstract representation models discussed in the previous chapter. In addition to postulating an abstract and common memory code for all types of inputs, the propositional theorists argue that the common code is the 'meaning' of the concept being encoded. Thus, any input is processed for its meaning, and meaning alone forms the basis of organization of concepts in memory. That is, concepts are represented as abstract codes are are linked to each other to form a network-like structure (Collins and Loftus 1975).

Word concreteness effects. One of the predictions of dual coding model is that concrete words are recalled better than abstract words. The greater recall of concrete words is due to the images they generate in the subjects' minds. The words and their images are expected to form dual codes in memory. For abstract words, on the other hand, due to the difficulty of generating images, only a verbal code is stored in memory. Since concrete words have a greater number of memory codes than abstract words, concrete words are recalled better than abstract words. A substantial body of research has accumulated in support of the contention that concrete high imagery words are recalled better than abstract low imagery words (Paivio 1969; also see Paivio 1986, p.159 for a discussion).
Dual codes and interconnections. Paivio used the picture-word comparison task (comparing recall differences between pictures and words) to support his model’s assumption of independence of the dual codes. Paivio (1974, 1975a) presented subjects with words and used massed repetition (repeating target words twice successively). In addition, he used two other conditions. In one condition, subjects were presented with pictures using massed repetition; in the other condition, words and pictures were used in combination such that a word was followed by its pictorial representation or a picture was followed by its label, again under massing conditions. The four conditions of repetition that resulted were word-word, picture-picture, word-picture, and picture-word. As expected, the word-word and the picture-picture conditions showed recall improvements that were less than what one would expect if each occurrence of the item had an independent effect on recall. However, in the mixed mode conditions, recall performance approached what one would expect if each code was independent. This suggests that the codes set up by the word and the picture contribute to recall independently. More importantly, this suggests that pictures and words form different and independent codes, which is the central thesis of the dual coding model as well as the mode specific view of memory proposed in the previous chapter.

The concept of interconnected and independent codes can also be used to explain the results of Lutz and Lutz (1977). In their study on advertising stimuli, Lutz and Lutz searched the Yellow pages of a
telephone directory to collect samples of two kinds of pictorial advertisements: 1) an interactive illustration that integrates the brand name and the product into a single illustration. For example, an ad for Rocket Messenger Service that shows a flying messenger with a rocket tied to his back and a parcel in his hands. 2) a non-interactive illustration which either shows the brand or the product by itself. For example, Jack Fair guard dogs where the illustration is that of a dog chasing a burglar away.

Lutz and Lutz argued that interactive imagery facilitates memory and hence products advertised using interactive illustrations should be remembered better than when they are presented as only words. When the illustration is noninteractive, the effect of an illustration should be marginal or even absent (Bower, 1970). So, no advantage over words is derived when products are presented using noninteractive illustrations. The results were supportive of Lutz and Lutz's expectations - only products presented using interactive illustrations were recalled better than words.

The above results can also be explained using the concept of two codes being better than one. According to the mode specific view of memory, when the picture is interactive, the brand name and the picture should form dual codes, one verbal and the other nonverbal. These two codes will contain identical information because the nonverbal code is a pictorial representation of the verbal code. This is similar to the formation of two mode specific traces when a person is exposed to identical information in two modes (as discussed in the
last chapter). The presence of two codes, then, should enhance the memory for those stimuli. When the picture is noninteractive, two codes may still form but they do not contain identical information because the nonverbal code (image of a dog chasing a burglar) cannot be labeled Jack Fair. In such conditions, the association between the two (brand name and illustration) is similar to the association formed between an abstract word and its idiosyncratic image. In other words, presence of an illustration that is non-interactive will not help in the formation of multiple memory codes for that information. Therefore, the illustration will not aid in memory for that brand name.

The findings of another study in marketing literature, by Edell and Staelin (1983), however, are not explainable using the concept of multiple path superiority. In this study, Edell and Staelin argued that when a picture used in an advertisement is framed (when the pictorial information is also stated in verbal form), "the viewer uses this label as a framework for encoding the picture in relationship to the advertised brand.....a framed picture is processed more like the verbal material in the absence of the picture than the picture is in the absence of the verbal label" (p.47). The results of their study indicate that when the picture is framed, the number of brand items recalled is no greater than when there is no picture at all. In other words, a framed picture is equivalent to just verbal information only.

The multiple path explanation, on the other hand, predicts that when the picture is framed, two codes - verbal and nonverbal - should
form. When the information is just verbal, only one code should form. Hence, a framed picture must be recalled better than words alone. One reason why the predictions of the multiple path explanation were not supported in this study may be the presence of other recallable material. The message used by Edell and Staelin consisted of several sentences, and the picture used in the ad framed only one of those sentences, or part of one sentence. Under these conditions, recall should improve only for that one sentence or part of it. This is because dual codes will form only for that one sentence. As far as the other sentences are concerned, there is no difference between the verbal and framed pictorial conditions. This small difference may have been insufficient to cause a significant difference between the two conditions.

In general, the concept of two codes being better than one code, and the idea of functionally independent codes in the dual coding model have received wide support in memory literature (see Paivio 1983, for a review). Also, the results of two experiments reported in the previous chapter support the idea that two different mental representations for the same concept will enhance its retrievability. The mode specific view of memory thus provides support to both the assumptions of the dual coding model in explaining the picture superiority effect -- that pictures have different representations from words, and that two representations for a concept enhance its retrievability compared to only one representation. The next line of evidence supporting separate representations for pictures comes from
studies that attempt to infer equivalence between perception and imagery by observing performance on tasks that involve both visual imagery and visual perception.

Inferences From Performance On Imagery Tasks

The studies reviewed in this section examine visual imagery and visual perception. Visual imagery is defined as mental images generated by a subject, based on information in his/her long term memory. Visual perception, on the other hand, is encoding externally provided information. If the performance pattern of a subject using visual imagery in a task is no different from that of a subject using visual perception, then visual imagery and visual perception must be using the same resources in memory. Based on similarities between visual imagery and perception, the representations in long term memory are argued to be similar to what is perceived externally. In other words, visual imagery is viewed as processing picture-like representations. This type of evidence is important in this research for two reasons:

1) it tells us that some long term representations are picture-like, which supports the idea of separate representations for pictures, and,

2) it tells us that imaging an object and seeing the object require the same memory resources. Therefore, the mental representations formed when one images to words are the same as the representations formed when one sees the words and their picture equivalents. In other words, visual imagery is one way of equating mental representations for words and pictures.
Symbolic comparison task. In the symbolic comparison task, subjects are asked to make comparisons of real life objects on analog parameters like size, distance, and length. The information required to perform this task is generally from the subject's long term memory. For example, Moyer (1973) asked his subjects to indicate which of the two named animals is larger in real life. The dependent measure was the reaction time and the variable of interest was the difference in size between the two named animals in real life. Moyer found that it takes less time to compare the sizes as the size difference increased in real life. For example, reaction time was smaller for a comparison between mouse and dog than between cat and dog. The overall function between size difference and reaction time was logarithmic - i.e., reaction time varied inversely as the logarithm of the real life size difference of the objects being compared. A similar function characterizes comparison of perceptual stimuli that differ in size.

In other words, even when subjects use information from their long term memory, their performance would appear to be similar to when they make decisions based on externally presented information. Based on this evidence, Moyer argued for analog (i.e., continuous) storage of visual information. Although based on inference, the important point is that visual imagery (which is internally generated) and visual perception appear to tap on the same resources in memory.

Paivio (1975b) provided further support to this research using judgment tasks that involved size and distance as variables. Subjects saw pictures that were either congruent with real life size difference
(a zebra shown as larger than a lamp) or incongruent with real life size difference (a zebra shown smaller than a lamp). Two types of tasks were used. In one task, subjects were asked to judge which of the depicted objects was larger in real life. It was argued that when the depicted sizes were incongruent with stored sizes, response conflict arises which increases reaction time. Note that this argument relies on the storage of analog information, i.e., it is assumed that the larger object in fact has a larger memory representation than that of a smaller object. It was thus hypothesized that subjects in the congruent size condition should respond faster than subjects in the incongruent size condition because there was an easier match between the internal representation and the presented information when the depicted sizes were congruent with stored sizes. A propositional model cannot account for this effect because whatever the object, the size information is assumed to be stored as a descriptive feature. Thus, the propositional model leads to the prediction that whether zebra is depicted as being smaller or larger than a lamp should have no effect on reaction time of subjects judging which of the two objects is larger in real life. This is because, according to the propositional model, to make a judgment on size, the subject must recognize the object and then access the size information for that object which is assumed to be stored as a description in memory. Thus the propositional model suggests that recognition speed should not be affected by the size in which the object is presented. The results were supportive of
Paivio's reasoning and in conflict with the propositional model. That is, incongruency increased reaction time.

In a second task, subjects were required to tell which of the objects depicted in a picture was farther away from the subject. Here incongruency was expected to result in lower reaction time because objects known to be relatively large appear to be farther away when they are depicted as smaller than objects known to be relatively small. When the depicted picture is congruent with real-life size differences, it would be difficult to judge which of the objects is farther away because subjects would have to use other techniques (rather than relying on incongruency information per se) to arrive at an answer. Paivio's predictions were supported again. The reaction time of subjects was lower when the depicted sizes were incongruent with real life sizes than when the depicted sizes were congruent.

Note that both predictions made by Paivio are predicated on the assumption that size information is stored in memory in an analog form, and size differences in memory representations will mirror the size differences in real life. The fact that both predictions reviewed above were supported suggests that size information is indeed stored in memory in an analog form, rather than the descriptive form suggested by propositional theories.

The symbolic comparison task results are thus supportive of the assumption that visual imagery and visual perception share the same resources in memory and continuous dimensions of objects (e.g., size) are stored in a continuous type of representation (i.e., visual).
While the symbolic comparison task argues for commonality of memory for visual imagery and visual perception using a long term memory task, another task called ‘mental rotation’ (Shepard, 1978) provides supporting evidence using a ‘working memory’ task. Research employing this task will be described next.

**Mental rotation.** Shepard and his colleagues (Shepard, 1978; Shepard and Cooper, 1882; Shepard and Metzler, 1971) developed the mental rotation task in which the subject had to determine whether two presented pictures are of the same or different object. The second picture may be the same as the first picture, although different in orientation. Variations in orientation were achieved by angular rotation of the object in the first picture. The second picture could also be a mirror image of the first picture in which case the subject had to respond that it was the mirror image.

The assumption in these studies was that the subject must mentally rotate an image of one of the figures to determine whether it was the same as the other or a mirror image. Thus, if mental rotation was similar to physical rotation, the angle by which the object in the picture was rotated must directly affect the reaction time of subjects who were deciding whether the two pictures were the same or different. The general finding was that when the pictures were the same, the response time was a linear function of the angle by which the two figures were separated. This led to their conclusion that subjects were mentally rotating an image of the first picture in an analog fashion to arrive at an answer. Since this is exactly what a subject
would do (although physically) when two objects are presented physically and a similar judgment is to be made, it may again be concluded that visual perception and visual imagery utilize the same resources in memory.

The studies reviewed above demonstrate that visual perception and visual imagery are equivalent in terms of the memory resources they use. Several alternative explanations, however, have been offered to explain these findings, which limit the value of these findings. The objections raised against this stream of research, and another type of evidence that supports the equivalence of visual imagery and visual perception are now discussed.

Neuropsychological evidence. Farah (1988), in an excellent review article, points out that three arguments have been made against the evidence gathered by psychologists who favor representational equivalence between visual images and visual perception. First, a "tacit knowledge" explanation offered by Pylyshyn (1981) (tacit knowledge is unconscious knowledge) argues that subjects who perform imagery tasks in experiments believe that their task is to simulate visual experience. To achieve this objective, they make use of the tacit knowledge they have of the properties of their visual system and modulate their task performance to make it appear equivalent to perception. For example, when subjects participate in a mental rotation task, they have an idea of how they would have rotated the object in reality to get to the solution. This is tacit knowledge. Using this knowledge, they generate mental images and rotate them,
thus simulating visual experience in a mental rotation task. The tacit knowledge explanation holds, then, that these mental images are not really stored images, as inferred by imagery theorists, but are pictorial reconstructions of subjects' cognitions formed by their unconscious efforts to mimic visual experience. This argument is a powerful alternative explanation to several of the findings discussed earlier, and as Farah argues, "...without some independent way of verifying what subjects do and do not tacitly know about their own visual systems, researchers cannot exclude this type of alternative explanation of the large body of data in cognitive psychology showing visual properties of mental images" (p. 308).

A second argument implicates the role of experimenter expectancy. This argument gains support from the failure of several experimenters to replicate the results reviewed above, and it is further supported by the classic demonstration by Intons-Peterson (1983) of the susceptibility of the results to experimenter expectancy. In her experiment, Intons-Peterson manipulated the expectations of her research assistants so that each research assistant was expecting to find a different pattern of relationship between imagery and perception. The results reported by the research assistants were shown to have been biased by the expectation manipulation. The results produced by the research assistants tended to be in the direction of their expectations. Similar expectancy, she argued, could have resulted in the findings of apparent equivalence between visual imagery and visual perception.
The third argument against representational equivalence of imagery and visual perception comes from research with congenitally blind subjects. Specifically, it has been shown that normal subjects and congenitally blind subjects perform similarly on tasks that require mental imagery (e.g., Kerr 1983). For example, normal subjects take longer to mentally focus on parts of an imaged object if it is imaged next to an elephant (the image of the object will be very small at that scale) than if it is imaged next to a fly (e.g., Kosslyn 1975). Similar scale manipulations of images have been shown to affect the response times of congenitally blind subjects (Kerr 1983). This finding is incompatible with the assumption of representational equivalence between imagery and visual perception because congenitally blind subjects obviously were never exposed to visual presentations of the stimuli. Thus, the blind subjects must be using some other form of nonvisual representation to perform the given tasks. These representations may have spatial properties, but they cannot be based on visual experience. Since normal subjects exhibit similar performance patterns in those tasks, they too must be using some form of nonvisual representations.

Farah (1988) goes on to cite neuropsychological evidence that is less susceptible to the three arguments raised above. For example, some evidence reported on the possible equivalence of visual imagery and visual perception uses regional cerebral blood flow and electrophysiological techniques. Increased blood flow in a particular area of the brain implies increased activity in that area. Using this
technique, Roland and Friberg (1985) examined regional cerebral blood flow as subjects performed three types of cognitive tasks: 1) mental arithmetic (subtracting 3's starting from 50); 2) memory scanning of an auditory stimulus (mentally jumping every second word in a well-known musical jingle); and 3) visual imagery (visualizing a walk through one's neighborhood making alternating right and left turns starting at one's front door). The regional cerebral blood flow when the subjects performed these activities was compared to their blood flow at rest. The researchers found that only in the visual imagery task was there an increase in blood flow in an area of the brain that normally shows increases during visual-perceptual tasks. As Farah (1988) argues, a finding like this cannot be explained by a tacit knowledge theorist because the theorist will then have to assume that subjects unconsciously are aware of the parts of the brain that are activated during visual perception, and then activate those same parts during imagery tasks.

In conclusion, Farah (1988) favors an equivalence in the neural machinery used in visual imagery and visual perception. How can one explain the performance of blind subjects that was so similar to normal subjects? In Farah's words,

"Specifically, imagery is not visual in the sense of necessarily representing information acquired through visual sensory channels. Rather, it is visual in the sense of using some of the same neural representational machinery as vision....Given that the brain represents spatial information with auditory, tactile and visual modality-specific representations, it is not parsimonious to assume that normal subjects have a choice of using visual or nonvisual spatial representations for performing imagery tasks (cf. Davidson and Schwartz, 1977), and that the extent
of a subject's visual experience or deprivation would determine which of these representations is chosen" (p.315).

Even though Farah does not support the idea that visual information is necessarily represented in a visual channel, one can see that the flexibility she ascribes to representational mechanisms is basically to accommodate findings from research on blind subjects. Because congenitally blind subjects still seem to have their cortical visual areas for internal representation intact, they may be using this area of representation to represent information they acquire through other senses. The idea of one input sense activating others is fully compatible with the dual coding model and the mode specific view of memory. Congenitally blind subjects may be converting inputs from touch to a vision-like representation. This flexibility of representation, coupled with their undamaged visual neural representational machinery, may be the reason why congenitally blind subjects turn out performances similar to normal subjects. Farah's review may thus be viewed as providing support for a view of memory that argues for mode specific representations.

This completes the review of evidence in favor of the dual coding model. The review provides a clear indication of the convergence of findings from research utilizing different paradigms, and the findings largely support the predictions of the mode specific view of memory. Three conclusions can be made from this review and the findings of last chapter. The first conclusion is that pictures and words form different memory representations. Second, visual imagery and visual
perception implicate the same resources in memory. Therefore, visual imagery can substitute for visual perception. Finally, high imagery words are recalled better than low imagery words. The greater retrievability of high imagery words is because of the two codes they form in memory, one verbal and the other nonverbal while low imagery words form only verbal codes. These conclusions will be used to develop hypotheses that are presented in the next section.

DEVELOPMENT OF HYPOTHESES

The Childers and Houston (1984) study discussed in the beginning of this chapter is perhaps the most systematic study in marketing literature that explored the differences in retrievability of pictures and words. According to Childers and Houston, pictures induce spontaneous semantic processing while words are processed at a more shallow level. The levels of processing framework (Craik and Lockhart 1972) predicts that the retrievability of information is directly related to the depth to which that information is processed. Therefore, according to Childers and Houston, pictures which are processed to a greater depth than words, are also retrieved better than words. To equate their retrievability, one must process words and pictures to the same depth. In other words, when words are made to access semantic memory through semantic processing tasks, differences between pictures and words should disappear. The emphasis on 'meaning' and not representational differences, places the Childers and Houston study in the propositionist camp because pictures and
words are assumed to access the same meaning code in memory when they are semantically processed.

According to the mode specific view, however, differences between the retrievability of pictures and words are due to the differences in their internal representations. Evidence from face recognition studies, reviewed in chapter 2, supports the notion that the continuity and configural information in pictures are preserved in their mental representations. Therefore, mental representations of pictures preserve the properties of pictures. Words and pictures have different surface characteristics and their mental representations should reflect these differences. These representational differences are argued to cause the superior retrieval of pictures over words. To eliminate the picture superiority effect, words must be processed so as to create picture-like representations. This type of processing will ensure that words and pictures have similar mental representations and, therefore, equal retrievability.

One way by which picture-like representations are created for words is through the use of visual imagery. Evidence reviewed on imagery and perceptual tasks (e.g., symbolic comparison task) suggests that the performance of subjects on several tasks is similar, whether they use visual imagery or visual perception. Other evidence from neuropsychology that was reviewed earlier supports the idea that visual imagery and visual perception share the same memory resources. Therefore, whether a person actually sees a picture and its label, or images the picture based on its label, the mental representation that
is created is the same. This is a very important conclusion because it suggests that images generated by an individual can substitute for externally provided pictures. In other words, if an individual generates visual images, externally provided pictures are redundant because the internally generated images and the externally provided pictures result in the same mental representations.

People can be instructed to use visual imagery when they process verbal information. That is, subjects can be asked to visualize all the words they process. Alternatively, the use of high imagery words in a message can spontaneously evoke visual imagery. Evidence reviewed earlier supports the idea that high imagery words form dual codes in memory, one for the words and the other for the images that are generated by the words. Therefore, when a message contains verbal information that is rated high in its ability to evoke visual images, a subject who processes that information will spontaneously generate visual images. Based on the arguments presented up to this point, it can be argued that when verbal information is highly imagery provoking, the provision of pictures does not contribute to the retrievability of that information because the images that are spontaneously generated by subjects will make the externally provided pictures redundant.

To summarize, according to mode specific view, differences in the retrievability of pictures and words are related to differences in their internal representations. Therefore, picture-word differences are eliminated only when their representational differences are
eliminated. Representational equivalence between pictures and words is attained when visual images are generated during the processing of words. Spontaneous generation of visual images is more likely when the verbal information being processed is rated high in visual imagery. Therefore, provision of pictures with imagery provoking information is redundant because the spontaneously generated visual images will form representations that are equivalent to those formed by the externally provided pictures.

There are two reasons why the above prediction from the mode specific view is important. First, it tells us of a condition in which the picture superiority effect should be eliminated. Specifically, when verbal information can evoke images, the images will offset the retrieval advantage provided by pictures. Second, it is a crucial test for one of the two alternative explanations proposed by Houston, et.al. (1987) -- whether the redundancy when information is presented both as pictures and words will enhance recall. If redundancy in fact affects recall, presenting any type of information both pictorially and verbally should enhance its retrievability compared to presenting it only verbally. The prediction made by a mode specific view is that when the information is imagery provoking, no advantage from redundancy should result. This is because the images generated by the subject as s/he processes the information serve the same function as the pictures provided by the experimenter. Thus, the arguments presented in the previous paragraphs serve to contrast the predictions made by the redundancy hypothesis and the
mode specific view of memory. The first hypothesis derivable from these arguments is presented below:

**H1:** When the information in the ad copy is imagery provoking, ads with pictures are not recalled better than ads without pictures in an immediate post-test.

The first hypothesis is based on two premises: first, that pictures and words form different representations in memory; and, second, that images generated by an individual will serve the same function as externally provided pictures. Based on these premises, one can also predict the effect of pictures on memory, when they are presented along with low imagery information.

When verbal information is not imagery provoking, subjects processing that information do not spontaneously generate visual images. Therefore, their mental representation for that information will consist of only words. If the same information is accompanied by pictures that are informationally equivalent to the words, the mode specific view predicts that two representations, one verbal and the other pictorial, are formed. Since the pictures and the words contain the same information, the two codes they form in memory contain identical information. It was shown in the last chapter that having two memory codes that contain the same information enhances the retrievability of that information compared to having only one memory code. Therefore, low imagery information that is accompanied by pictures is retrieved better than low imagery information that is
presented alone. This is formally stated below.

H2: When the information in the ad copy is low in imagery, ads with pictures are recalled better than ads without pictures in an immediate post-test.

Both the hypotheses presented above provide a test of the mode specific view of memory. This is because the hypotheses are based on differences in mental representation of pictures and words. The idea of representational differences between pictures and words is derived from mode specific view. Therefore, a test of the hypotheses is also a test of the mode specific view.

It is interesting to note that the redundancy argument proposed by Houston et al. (1987) can explain H2 but cannot explain H1. According to the redundancy argument, providing identical information as pictures and words is equivalent to repeating the same information. Therefore, whether the verbal information is of high or low imagery, the addition of informationally equivalent pictures should enhance recall. However, H1 proposes that adding pictures to high imagery information does not enhance recall. Therefore, H1 is not explained by the redundancy argument.

Also, H1 and H2 are proposed under the assumption that subjects process the verbal information 'semantically'. If subjects do not even read the information, they cannot generate visual images. Generation of images, however, is a requirement for H1. Therefore, an experiment testing H1 and H2 will provide subjects with a semantic processing task. Given that subjects process information
semantically, note that the explanation proposed by Childers and Houston (1984) can explain H1 but cannot explain H2. According to Childers and Houston (1984), under semantic processing conditions, there should not be any differences between the retrievability of words and pictures. H2, however, proposes enhanced retrievability when pictures accompany verbal information, than when verbal information is presented alone.

In essence, the semantic processing explanation or the redundancy explanation can be used to argue in favor of only one or the other of the two hypotheses proposed above. Both the hypotheses are simultaneously supported only by the mode specific view.

High imagery copy should also affect the judgment or attitude of the subjects toward the product advertised. Support for this prediction is derived from the literature on effects of vividness on judgment. Because vividness of information normally is correlated very highly with its imageability (Nisbett and Ross, p.45), one can expect the findings in the vividness literature to generalize to imagery provoking stimuli. Similarly, literature on message concreteness is useful in predicting the effect of high imagery copy on subjects' attitudes. The reason, again, is the normally high correlations between concreteness and imagery value of stimuli (Paivio 1986, p.159).

In a recent study, Mackenzie (1986) found that concreteness of ad copy had a positive effect on subjects' attitudes toward the product that was promoted (a water-proof watch in his study). This effect of
message concreteness on judgment was mediated by the attention paid to the message. Mackenzie's finding of the effect of concreteness on judgment, however, stands in contrast to a substantial research base that has found no effects of concreteness on judgment (see Taylor and Thompson 1982 for a review).

One reason why most other studies in the past have not found concreteness effects may be because they may not have manipulated concreteness at all. As Mackenzie points out, only one study in the past (Winkler et.al. 1979) used manipulation checks, and in that study the manipulation failed. Hence, one cannot make any reliable conclusions from past research on the effects of concreteness, because, one is not sure whether concreteness was in fact manipulated. Another reason for null effects in this literature, as Taylor and Thompson (1982) point out, may be due to the manipulations making not only the target information, but all the surrounding information, vivid. The effect of concrete information on judgment is argued to be mediated by its greater availability in memory, compared to information that is not concrete. The greater availability of concrete information relative to abstract information is achieved if the target information in a message is made concrete, leaving the other information abstract. Taylor and Thompson argue that in most of the research on vividness, all information, target and non-target, has been made concrete and vivid. This makes all the information more available, not just the target information, resulting in null effects. In Mackenzie's study, however, not only was the concreteness
manipulation shown to have worked, but the hypothesized effect of concreteness on attitudes was also demonstrated. Recently, Debevec, Meyers, and Chan (1985) found that presenting brand information vividly resulted in subjects reporting more positive attitudes toward the product compared to abstract presentation.

As mentioned earlier, the effect of vividness or concreteness on attitude is due to the greater availability of vivid information. Message imagery should also have an effect on the subsequent availability of message information. Specifically, the mode specific view predicts that high imagery information will be more available than low imagery information. The greater availability of high imagery information is due to the dual codes it creates in memory. If a message contains material that is positive toward the advertised product, a subject exposed to the high imagery copy will have more of the positive information available than a subject exposed to the low imagery copy. The greater availability of positive information about the product should cause subjects exposed to the high imagery copy to report more positive attitudes. Based on the vividness literature and the prediction of mode specific view that high imagery copy will be more available than low imagery copy, the following hypothesis is proposed.

H3: The high imagery ad will result in more favorable attitudes toward the product than the low imagery ad in an immediate post-test.

Concreteness has been shown to not only affect judgments immediately after exposure to a message, but also after delay. This
delayed effect is due to the greater retention and availability of concrete information in memory compared to abstract information. Evidence for persistence of concrete information has been reported by Reyes, Thompson and Bower (1980). Subjects in their study participated in a mock jury trial and were presented with arguments favoring either the prosecution or the defendant. The arguments were presented as vivid or abstract arguments. It was found that both recall and judgment in delay (48 hours) were affected by the vividness manipulation. Interestingly, there were no differences between groups in the measures taken immediately after exposure to the arguments. Reyes, et.al. argued that in the immediate measures, very little forgetting occurred, which minimized the differences between vivid and abstract information. In the delayed measures, differences in retrievability between vivid and abstract information were argued to have caused the differences in subjects' attitudes. Therefore, the differences in retrievability of high and low imagery information will remain even after time delays. These differences, in turn, can be expected to affect subjects' attitudes.

The differences between high and low imagery information will not only persist, but it is possible that high imagery information is forgotten less than low imagery information. There are two reasons to expect greater persistence of nonverbal or imaginal information. One argument that can be extended is that for high imagery information, compared to low imagery information, there will still be two codes available in memory after delay, and two codes increase the
probability of recall compared to one code. A second possibility, supported by Bryce and Olney (1988), is that nonverbal codes are qualitatively superior to verbal codes. Bryce and Olney developed messages that were auditory or visual, after taking several precautions to equate their information content. Even so, subjects exposed to the visual information (television pictures) recognized and recalled significantly more than subjects exposed to the auditory (tape) information. Greater recall of visual information even when it is equivalent in content to the auditory information suggests that greater retrievability may be an inherent property of visual representations. Also, Paivio (1986) reports some evidence on the relatively slower decay of picture memory compared to word memory.

To summarize, the differences in retrievability of high and low imagery information have been shown to persist over time. There is also evidence to support the idea that high imagery information is forgotten less than low imagery information because of the nature of imaginal codes. The slower decay of nonverbal memory and the availability of two codes, together, are expected to result in delayed effects that are in line with hypotheses 1, 2 and 3. This is because, hypotheses 1, 2 and 3 are themselves based on the differences in retrievability of high and low imagery information, in the short term. Persistence of these differences over time should result in delayed effects that are in consonance with the immediate post-test effects.
Therefore:

H4a. When the information in the ad copy is imagery provoking, ads with pictures are not recalled better than ads without pictures in a delayed post-test.

H4b. When the information in the ad copy is not imagery provoking, ads with pictures are recalled better than ads without pictures in a delayed post-test.

H4c. The high imagery ad will result in more favorable attitudes toward the product than the low imagery ad in a delayed post-test.

Finally, the provision of pictures which are positively evaluated should affect subjects' attitudes toward the advertisement itself. Recent research shows that attitude toward the ad is affected by the manipulation of pictorial contents in the ad (Miniard, Bhatla, and Rose 1988; Mitchell 1986; Mitchell and Olson 1981). For example, Mitchell (1986) manipulated the valence of pictures (positive, negative, and neutral) that accompanied an identical ad copy in a between-subjects design. He found that the valence of pictures had a significant effect on the subjects' attitudes toward the ad. The ad containing a positively valenced picture was rated more positively than the same ad containing a negatively valenced picture.

Therefore, the provision of attractive pictures in an ad should cause the subjects to rate the ad more positively than when the pictures are not present. The more positive evaluation of ads with pictures should not only be found in an immediate post-test, but also after delay. Delayed effects of recall and attitudes toward product
have been hypothesized earlier based on differential availability of information. Since pictures are expected to be more available in delay than words, the greater availability of positively valenced material should result in more positive attitudes. Therefore, ads with positively valenced pictures should be rated as more positive than ads without positively valenced pictures in delayed measures. These arguments will lead to the next two hypotheses.

H5a: The attitude toward the ad, in an immediate post-test, will be more positive when the ad contains pictures.

H5b: The attitude toward the ad, in a delayed post-test, will be more positive when the ad contains pictures.

An experiment that was designed to test the hypotheses 1 through 5 will now be described. The results of the experiment and conclusions follow this discussion.

METHOD

Design

Two independent variables were manipulated in a 2 X 2 factorial design. The first factor represented two levels of imagery - high vs. low - in the copy of an ad for a consumer product. The second independent variable was the presence or absence of pictures. The target ad consisted of four central ideas, and the picture manipulation involved presenting those ideas with or without pictures.

Message

To minimize the effects of prior knowledge, a relatively new product had to be used in the target advertisement. At the same time,
it was felt that the product should be of some interest to the student population to enhance the likelihood that students would process the target ad. Based on these considerations, it was decided that a camcorder would be used as the target product. To minimize the effects of prior experience with established brands, a fictitious name (Digitron) was given to the camcorder.

The high imagery message was developed keeping in mind that the message should provoke visual imagery. This was a key requirement because the hypotheses proposed earlier were predicated upon the formation of similar mental representations for the high imagery ad with and without pictures. With the evidence on the representational equivalence of visual imagery and visual perception (reviewed earlier), it was expected that pictureless ads provoking visual imagery would result in mental representations similar to those ads that had pictures in them.

The high imagery copy consisted of phrases like 'The camcorder weighs less than the Yellow Pages' while the low imagery copy consisted of phrases like 'The camcorder weighs less than 2.5 lbs.' Because imagery was manipulated through the message that promoted the camcorder, it was also important to ensure that only imagery and not other aspects of the message (e.g., its believability) was manipulated. The high and low imagery versions of the ads, developed on the basis of these considerations and used in this study are presented in Appendix C and Appendix D respectively.
A pretest was conducted to ensure that the ads differed on their imagery-provoking ability, but not on other attributes. The questionnaire used in the pretest is presented in Appendix E. There was a total of 15 bi-polar adjective scales in the questionnaire. Eight of these scales were included to measure the imagery provoking ability of the ad copy (Imagery provoking-Not imagery provoking; Sketchy-Detailed; Vague-Explicit; Specific-General; Clear-Ambiguous; Vivid-Dull; Interesting-Boring; Concrete-Abstract). The remaining seven scales were included to ensure that the low and high imagery ads did not differ on other attributes (e.g., Meaningful-Not meaningful).

After subjects finished reading the ad, they evaluated it by completing the scales described above. Four additional questions included in the questionnaire measured the extent of visual imagery experienced by the subjects as they read through the ad. These questions were as follows:
1) The ad brought pictures or images to my mind that helped clarify what was said in the ad
2) As I read the ad, I formed pictures or images about much of what was being discussed in the ad
3) I found myself thinking of images or pictures when I read the ad
4) It was easy to form images or pictures of what was being said in the ad

The responses to these questions were measured on a seven-point Likert scale anchored by Strongly Agree and Strongly Disagree.
The responses to the eight item imagery scale were factor analyzed using principal components factor analysis. The factors were rotated using Oblimin procedure. The factor analysis revealed that the eight-item scale decomposed into three factors. The first factor consisted of the items that measured how imagery provoking, vivid, and interesting the ad was. This factor also accounted for the highest percentage of variance (35%). It has been argued that vivid information is more interesting and imagery provoking (Nisbett and Ross 1980, p.45). Therefore, the items constituting the first factor were combined into a scale that measured the imagery of the ad copy. This scale will be referred to as the imagery index in the rest of this chapter. The second factor comprised the items measuring how sketchy, vague, clear and specific the ad was. These items were combined to form a 'clarity' factor. Interestingly, the item measuring how concrete the ad was loaded on neither factor. Therefore, the concrete-abstract scale was treated as the third factor.

The mean score for each subject on each of the three factors was computed. The scores on the imagery index, clarity factor and message concreteness factor were then submitted to a multivariate analysis of variance with message type (low or high imagery) as the independent variable. The analysis revealed a significant multivariate effect (F = 9.62, p < 0.0001) indicating that the low and high imagery messages were rated differently on the three factors. Further univariate tests on each dependent measure indicated that the effect
observed earlier was due to the imagery index \((F = 19.2, p < 0.0001)\). Neither the clarity factor \((F = 0.15, p > 0.5)\) nor the concreteness factor \((F = 1.48, p > 0.2)\) even approached significance. It was concluded, based on these results, that the imagery index reflected the effect of the manipulation, as expected. Therefore, it was decided to use the three-item scale that comprised the imagery index, as a measure of imagery provoking ability of the target ad in the final experiment. The ads were not significantly different on any other attributes (e.g., believability, understandability, argument strength). This result further supports the discriminant validity of the imagery manipulation.

It was interesting to note that the ad which was rated as more imagery provoking was not rated as more concrete \((p > 0.2\) for the comparison between high and low imagery ads). This may have been due to the difficulty of the subjects in understanding what concreteness of an ad actually meant. It was decided to present the concrete-abstract scale in the final study with a small description preceding it so that subjects would understand the scale.

The four questions used to measure the extent of visual imagery that subjects experienced as they processed the ad were analyzed next. The reliability of the four-item scale was good (Cronbach's alpha = 0.94). Based on this high reliability, subjects' responses to the four questions were combined to form an extent of visual imagery scale. An analysis of variance of the extent of visual imagery scale with message imagery as the independent variable revealed that the
high imagery copy induced more imagery (M = 6.1) than the low imagery copy (M = 4.8). This difference was significant (p < 0.01). These results, coupled with the findings on the imagery index, provided support for the imagery manipulation through the copy of the ad.

Four ideas were presented in the ad for the camcorder. Each idea was contained in a separate paragraph. The following topics were covered: low light performance, ability to capture fast patterns, ability to record games and play back at various speeds, and ability to move from scene to scene without noise (see Appendix C). Four color pictures were chosen to represent these ideas. Each picture illustrated one of these characteristics by showing a situational example. For instance, the ability to perform in low light was depicted using the picture of a child's face in the light of one birthday candle. The ads with pictures are presented in Appendix C and Appendix D.

Procedure. Subjects were 109 undergraduate students recruited from introductory marketing classes. In addition to receiving course credit for their participation, subjects were offered monetary incentives ($4 each). The study was conducted in several sessions, and subjects signed into the sessions they preferred. Only one factor - low imagery or high imagery - was manipulated within a session. The presence or absence of pictures was manipulated between sessions. The picture manipulation was not attempted within a session because of hypothesis-guessing that might occur if any subject accidentally looked at a neighbor's message and saw that it differed from his or
her own message. The presence or absence of picture for the first session was decided randomly, and was varied systematically for the sessions that followed.

Seven ads were used as filler ads in the study. The filler ads ranged from products like yogurt to cars. The target ad was not the only consumer durable in the set of experimental stimuli. So that the target ad did not appear unique, the filler ads were made up of a mixture of some color copies of magazine ads, some black and white copies of magazine ads, one other home-made ad for a fictitious product, and two other pictureless ads. The target ad was the fifth ad in the set of eight ads that were used in this study. All these ads were placed in a closed folder. A second closed folder, placed under the first folder, consisted of the questionnaire that the subjects were to open and complete after exposure to the ads.

The study was conducted in groups of up to eight people each. The experiment room consisted of a large table with chairs on either side. Four subjects were seated on each side of the table. The two folders, one containing the ads, and the other containing the questionnaire, were placed on the table for each subject. Upon entering the experiment room, subjects were asked to seat themselves comfortably at any one of the eight spots. The instructions to process the ads were given verbally. Since Childers and Houston (1984) demonstrated the absence of picture superiority effect when subjects performed semantic processing of ad information, it was decided to have subjects process the information similarly in this
research. This was because one of the purposes of this study was to show that even when subjects processed information to considerable depth, the picture superiority effect would not be eliminated for low imagery information. Therefore, the instructions to the subjects emphasized the importance of their understanding the information presented in the ads. The subjects were told that they would be asked some specific questions about the information in the ads at a later point. They were encouraged, therefore, to take their time and read all the ads carefully. They were also told that by the time they were finished with all the ads, they should understand what each of the products is all about, and what the claims in the ads meant. These instructions differed from the semantic processing manipulation of Childers and Houston (1984) which was achieved through an orienting task and prior exposure of the subjects to the scales on which they would be evaluating each of the ads. However, since the instructions emphasized understanding of the ad messages, creating an expectation that specific questions would be asked about the products at the end of the exercise, it was expected that subjects would focus on the information content of the ad. These instructions may be viewed as similar to other semantic processing instructions because of their emphasis on meaning (cf. Cermak and Craik 1976).

After all the subjects finished reading the ads, they were asked to close that folder and open the next folder. This folder contained the questionnaire (Appendix F). The first question asked the subjects to list all the brands for which they had seen advertisements in this
exercise. This was meant to be a distractor that would clear their short term memories. The next page consisted of instructions on how they should use the scales in the questionnaire.

After the instructions, subjects' attitude toward the target product was measured. A six-item semantic differential scale was used for this purpose (Good-Bad, Unattractive-Attractive, Awful-Nice, Desirable-Undesirable, Unpleasant-Pleasant, Positive-Negative). Each item was presented as a seven-point scale. In addition to the subjects' attitude toward the product, their attitudes toward the ad and the pictures presented in the ad (only for those who had pictures in their target ad) were also measured. The attitude toward pictures was measured using the same scale that was used to measure the attitude toward the product. The attitude toward the ad was measured by a slightly different set of scales (Good-Bad, Ineffective-Effective, Pleasant-Unpleasant, Favorable-Unfavorable, Easy to read-Difficult to read, Positive-Negative).

After the attitude measures, subjects were asked to write down everything they could remember about the Digitron camcorder ad - all the words, phrases, sentences, and pictures in the ad. For those subjects who were given the ad without pictures, the recall instructions did not mention the word 'pictures'.

Several manipulation checks were included to support the validity of the imagery manipulation. The ad was rated on the three items that constituted the imagery index (Imagery provoking-Not imagery provoking; Vivid-Dull; Interesting-Boring. See discussion on pretest
results). In addition, the ad was rated on two other seven-point semantic differential scales (Concrete-Abstract; Easy to understand-Difficult to understand). Following this, four seven-point Likert items (extent of visual imagery scale; see pretest results) measured whether the ad created mental images in the minds of the subjects. After this series of manipulation checks, one question checked for possible differences in self-referencing produced by the two versions of the ad. This was achieved by asking the subjects if they were reminded of their own experiences as they read through the ad. This question, which was responded to on a seven-point semantic differential scale, was included to argue against the possible alternative explanation that the high imagery ad was better recalled because it produces more self referencing. Finally, the Style of Processing scale (Childers, Houston and Heckler 1985) was included as a possible covariate.

After completing the questionnaire, the subjects were requested to come back two days later for their payment ($4 each). They were told that the money was not available that day due to some technical problems. No subject was told about the delayed measures.

When the subjects returned two days later, a shorter version of the questionnaire given earlier was administered (Appendix G). The attitudes toward the product, the ad, and the pictures (for those subjects who saw the ad with pictures in it) were measured again. The next question asked the subjects to write down as much as they could
remember from the camcorder ad that they had seen two days earlier. Following this, the subjects were paid, debriefed, and dismissed.

RESULTS

**Manipulation Checks.**

The three items constituting imagery index were found to be internally consistent (Cronbach's alpha = 0.81). Therefore, the mean of the three items was computed to form the imagery index.

An analysis of variance of the imagery index with message imagery and presence/absence of picture as factors revealed only one main effect - that of imagery. As expected, the high imagery message was rated higher on the imagery index (M=4.70) than the low imagery message (M=3.77, F=12.28, p < 0.001). The manipulation of imagery in the copy of the ad, was, therefore successful. The messages did not differ on their understandability or self referencing (all p values > 0.2). The mean scores are presented in Table 1.

Interestingly, the scale measuring concreteness of the message did not show any effects of the imagery manipulation. This occurred despite providing the subjects with a brief explanation of what concreteness of a message was. However, this finding is consistent with other research which shows that message concreteness and message imagery are not always related (Paivio 1986, p.159).
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<thead>
<tr>
<th>Measure</th>
<th>High Imagery Picture Absent</th>
<th>High Imagery Picture Present</th>
<th>Low Imagery Picture Absent</th>
<th>Low Imagery Picture Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imagery Index*</td>
<td>4.69</td>
<td>4.70</td>
<td>3.56</td>
<td>3.97</td>
</tr>
<tr>
<td>Understandability</td>
<td>4.84</td>
<td>5.26</td>
<td>4.67</td>
<td>4.73</td>
</tr>
<tr>
<td>Concreteness</td>
<td>4.92</td>
<td>4.78</td>
<td>4.70</td>
<td>4.90</td>
</tr>
<tr>
<td>Self referencing</td>
<td>4.84</td>
<td>5.11</td>
<td>4.22</td>
<td>4.70</td>
</tr>
<tr>
<td>Generation of images*</td>
<td>5.46</td>
<td>5.19</td>
<td>3.83</td>
<td>4.72</td>
</tr>
<tr>
<td>n</td>
<td>25</td>
<td>27</td>
<td>27</td>
<td>30</td>
</tr>
</tbody>
</table>

* Imagery effect significant at p < 0.01
Next, the four items constituting the extent of visual imagery scale were submitted to reliability analysis. All four items were found to contribute to the high reliability of the scale (Cronbach's alpha = 0.89). Therefore, the average of the four items was used in an analysis of variance with message imagery and presence/absence of picture as independent variables. The analysis revealed a significant imagery effect (p < 0.001). The high imagery message was rated as producing more imagery (M=5.32) than the low imagery message (M=4.30). The high imagery message was, therefore, successful in generating more visual images in subjects' minds than the low imagery message. Although unexpected, the interaction between message imagery and picture presence was also significant (p < 0.05). However, simple main effects analysis within each imagery condition revealed no significant differences (both p values > 0.25). Based on the results of these analyses, it was concluded that the high imagery message was more imagery provoking than the low imagery message, and generated more visual images in subjects' minds than the low imagery message.

Recall.

Two judges who were blind to the experimental condition of the subjects coded the verbal recall data. Every meaningful phrase that was recalled was scored as a point. For example, if the subject wrote 'the camcorder can be used to playback in slow motion or freeze-frame', two points were assigned, one for playback in slow motion, and the other for freeze-frame.
Because the pictures represented the central idea of some sentences, there was room for confusion as to whether subjects who had ads with pictures were actually describing the pictures or were recalling information from their verbal memory. For example, if the copy said 'imagine screaming people on a roller coaster' and had a picture of people on a roller coaster, categorizing the recall of a subject who just mentions 'people on roller coaster' would be difficult. This problem has also been described by Houston, et.al. (1987). Because the hypotheses required comparing the recall scores of subjects who were exposed to the ad with pictures and those who were exposed to the ad without pictures, it was important that only the recall of the verbal component of the ad was considered for comparison. Including the recall of picture elements in the recall score of those subjects whose ad contained pictures would artificially inflate their verbal recall score and give them an edge over those subjects whose ad did not contain pictures. While this error works against H1, it works in favor of H2 thus making it a serious problem. However, four mitigating factors reduced the seriousness of this problem in the scoring of recall.

a) In most cases, subjects clearly wrote 'there was a picture of ....' and described it. This reduced the confusion about the source of recall considerably.

b) The pictures provided in the ads were not exact pictorial representations of the words in the ad, except for two pictures in the
case of the concrete message. Thus, over-counting, if any, would only be for the concrete ad with pictures.

c) Over-counting for concrete ad with pictures would actually work against the first hypothesis and hence make the results more conservative.

d) The agreement between the two judges as to the source of recall (picture or claims) was 97%.

The two judges also showed high inter-judge reliability in the scoring of the verbal points recalled by the subjects. The correlations between the recall scores given by the two judges were 0.93, both for the immediate recall data and the delayed recall data. Based on these figures, it was decided to use the average of the two judges' score in the analyses. This average will be called recall score, and is presented for all four groups, in Table 4.

H1 predicts that for the high imagery copy, immediate post-test recall score would not be affected by the presence of pictures in the ad. H4a makes the same prediction for the delayed recall scores. H2 predicts that for the low imagery copy, provision of pictures would enhance the immediate post-test recall. H4b makes the same prediction as H2 for the delayed recall scores. In other words, H1 and H2 predict an interaction between message imagery and picture presence in an analysis of immediate post-test recall scores. H4a and H4b predict a similar interaction between message imagery and picture presence, in an analysis of delayed recall scores. Therefore, hypotheses H1, H2, H4a and H4b together call for an interaction between message imagery
and picture presence in a repeated measures (immediate post-test and delayed recall) analysis of recall scores.

Accordingly, the recall score was analyzed using analysis of variance with imagery and picture presence as the between subjects factors, and recall at the two time points as a within subjects factor. The analysis revealed only one significant interaction between picture presence and message imagery ($F=4.71, p < 0.05$) and one significant main effect of time ($F=14.02, p < 0.001$). No other effects even approached significance. The results of the analysis of variance are presented in Table 5.

The presence of a significant interaction between message imagery and picture presence provided support for the combined prediction of H1, H2, H4a and H4b. A priori contrasts using multiple t-tests (Kirk 1982, p.95) were conducted to further understand the nature of this interaction and examine each of the hypotheses individually.

For the high imagery copy subjects, a t-test between the immediate recall scores of the picture present group and the picture absent group showed that the groups were not different on their recall scores ($t_{45} = -0.67, p > 0.25$). The absence of any effects of pictures on the recall of high imagery information supported H1.

For the low imagery copy subjects, a t-test was again performed on the immediate recall scores of the picture present group and the picture absent group. According to H2, subjects exposed to the ad with pictures should have greater recall scores than subjects exposed to the ad without pictures. This hypothesis, however, was not
supported by the t-test ($t_{47} = 0.99$, $p > 0.25$). The presence of pictures, therefore, did not affect the retrievability of verbal information in the ad in an immediate post-test, for both low and high imagery information.

The analysis of delayed recall scores was then performed using analysis procedures similar to those used on the immediate recall scores. For the high imagery copy subjects, a t-test on the delayed recall scores of the picture present and the picture absent groups revealed that the groups did not differ on their recall scores ($t_{45} = -1.03$, $p > 0.25$). H4a, therefore, was supported. The results of the t-test for the low imagery copy subjects, however, revealed a significant effect of pictures on delayed recall scores ($t_{47} = 1.69$, $p < 0.05$ (one-tailed). Low imagery copy subjects whose ads contained pictures recalled more information ($M = 4.23$) than low imagery copy subjects whose ads did not contain pictures ($M = 2.36$). This finding supported H4b. The interaction between message imagery and picture presence for the delayed recall scores is plotted in figure 5.

The only hypothesis on recall scores that was not supported was H2. In immediate post-test measures, the expected effect of pictures on the recall of low imagery copy was not evident. However, increased recall due to the presence of pictures was evident in the delayed recall scores. The absence of recall differences in immediate recall but their presence in delayed recall was also reported by Reyes, et.al. (1980), who tested the recall of concrete vs. abstract
information. One possible reason for the absence of effects in the short term, as argued by Reyes, et al., is the relatively small amount of forgetting that takes place within a few minutes after exposure to information. In this study, there was a small but significant amount of forgetting between immediate and delayed tests of recall. This is reflected as a main effect of time in Table 3. It is possible that forgetting accentuated the delayed recall differences between the low imagery picture present and picture absent groups. However, the interaction between message imagery, picture presence, and time, was not significant (F = 2.37, p = 0.13). Therefore, forgetting must have played a limited role, if any, in masking recall differences in immediate post-test.

Another possible reason for the lack of differences in immediate recall of the low imagery copy is the high response involvement when subjects processed the ad information. It may be recalled that the instructions given to the subjects created an expectation about their being questioned after they finished reading the ads. While this instruction was added to intensify their focus on the information content of the target ad, it might have caused a relatively high level of processing involvement. This high involvement might have temporarily masked differences between groups by producing a ceiling effect on initial learning. Other possible reasons for the lack of immediate post-test recall effects are discussed in the next chapter.
## Table 4
Means for Recall Scores and Attitudes Toward the Product, Ad, and Pictures

<table>
<thead>
<tr>
<th>Measure</th>
<th>High Imagery Picture Absent</th>
<th>High Imagery Picture Present</th>
<th>Low Imagery Picture Absent</th>
<th>Low Imagery Picture Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate Recall</td>
<td>4.50</td>
<td>3.74</td>
<td>3.30</td>
<td>4.46</td>
</tr>
<tr>
<td>Delayed Recall&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3.97</td>
<td>2.88</td>
<td>2.36</td>
<td>4.23</td>
</tr>
<tr>
<td>Immediate Attitude&lt;sup&gt;5&lt;/sup&gt;</td>
<td>5.49</td>
<td>5.39</td>
<td>5.06</td>
<td>5.33</td>
</tr>
<tr>
<td>Delayed Attitude&lt;sup&gt;2,5&lt;/sup&gt;</td>
<td>5.38</td>
<td>5.45</td>
<td>4.88</td>
<td>5.01</td>
</tr>
<tr>
<td>Immediate Att toward Ad&lt;sup&gt;3,5&lt;/sup&gt;</td>
<td>5.49</td>
<td>5.39</td>
<td>5.06</td>
<td>5.33</td>
</tr>
<tr>
<td>Delayed Att toward Ad&lt;sup&gt;3,5&lt;/sup&gt;</td>
<td>4.77</td>
<td>5.17</td>
<td>4.05</td>
<td>4.83</td>
</tr>
<tr>
<td>Immediate Picture Att&lt;sup&gt;5&lt;/sup&gt;</td>
<td>5.51</td>
<td></td>
<td>5.12</td>
<td></td>
</tr>
<tr>
<td>Delayed Picture Att&lt;sup&gt;5&lt;/sup&gt;</td>
<td>5.80</td>
<td></td>
<td>6.27</td>
<td></td>
</tr>
<tr>
<td>n (immediate)&lt;sup&gt;4&lt;/sup&gt;</td>
<td>25</td>
<td>27</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>n (delayed)</td>
<td>22</td>
<td>25</td>
<td>25</td>
<td>24</td>
</tr>
</tbody>
</table>

1: difference between low imagery picture and no picture significant (p < 0.05)

2: difference between low and high imagery significant (p < 0.05)

3: difference between picture and no picture significant (p < 0.05)

4: The analyses reported are after dropping those subjects who missed the delayed measures. Including those subjects did not affect the results reported.

5: All scores are measured on seven-point scales. The larger the score, the more positive the attitude.
Table 5
Source Table for Analysis of Variance on Recall Measure

<table>
<thead>
<tr>
<th>Effect</th>
<th>F</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture</td>
<td>0.27</td>
<td>1</td>
<td>0.604</td>
</tr>
<tr>
<td>Message Imagery</td>
<td>0.11</td>
<td>1</td>
<td>0.740</td>
</tr>
<tr>
<td>Picture X Message Imagery</td>
<td>4.71</td>
<td>1</td>
<td>0.033</td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>14.02</td>
<td>1</td>
<td>0.001</td>
</tr>
<tr>
<td>Picture X Time</td>
<td>0.30</td>
<td>1</td>
<td>0.585</td>
</tr>
<tr>
<td>Message Imagery X Time</td>
<td>0.10</td>
<td>1</td>
<td>0.755</td>
</tr>
<tr>
<td>Picture X Message Imagery X Time</td>
<td>2.37</td>
<td>1</td>
<td>0.127</td>
</tr>
</tbody>
</table>
Figure 5. Plot of Delayed Recall as a Function of Message Imagery and Presence of Pictures
Attitudes

The reliability of the six-item attitude scale was calculated separately for the immediate and the delayed measure of attitude. All items on the scale were highly intercorrelated (Cronbach's alpha = 0.89 for immediate, 0.95 for delayed). Therefore, their average was used as an index of subjects' attitudes toward the camcorder. The mean attitude scores for each experimental group are presented in Table 4.

The only attitude effect hypothesized was that high imagery ad copy would have a positive effect on subjects' attitudes. In other words, H3 and H4c together called for a main effect of message imagery on attitudes. The mean attitude score of the subjects was analyzed using analysis of variance with message imagery and picture presence as the independent between-subjects factors, and time (attitudes were reported twice by the same subjects at two points in time) as a within subjects factor. The analysis revealed no main or interaction effects. The message imagery main effect approached, but did not reach, conventional levels of significance (F=3.7, p < 0.06). The joint prediction of H3 and H4c was, therefore, not supported.

Since the effect of message imagery was hypothesized on both immediately reported attitude (H3) and delayed attitude (H4c), a priori contrasts using multiple t-tests were conducted to examine imagery effects separately for the attitudes reported at different points in time.
When subjects were asked to evaluate the target product immediately after being exposed to the target ad, no effect of imagery manipulation was observed. The subjects were equally favorable to the product, whether they learned about the product from an ad copy that was high in imagery ($M=5.47$) or low in imagery ($M=5.22$, $t_{94}=0.96$, $p > 0.2$). Therefore, the hypothesized imagery effect on attitude toward the product was not supported in an immediate post-test.

When the subjects' attitude toward the product, expressed two days after they were exposed to the ad, was analyzed, a significant ($t_{94}=1.85; p < 0.05$) imagery effect emerged. The target product was rated more favorably ($M=5.42$) when it was presented through high imagery copy than when it was presented through low imagery copy ($M=4.94$). This finding provides support for Hypothesis H4c.

The lack of imagery effects on immediate measures of attitude, but their presence in delayed measures, as found in this study, parallel those of Reyes, et.al. (1980).

**Attitude toward pictures**

The hypotheses H5a and H5b were based on the premise that the pictures provided in the ad were positively valenced. The presence of these positive pictures was expected to enhance subjects' rating of the ad compared to their rating of the ad without pictures. Therefore, before testing for the effect of pictures on subjects' attitude toward the ad, it was required to demonstrate that the pictures were indeed positively valenced. In other words, subjects' rating of the pictures in the ad should fall above the mid-point of
the picture rating scale. In addition, no differences were expected between high and low imagery copy subjects, in their evaluation of the pictures.

It may be recalled that pictures were evaluated only by those subjects whose ad contained the pictures. Therefore, the analyses reported here are based on only the subset of subjects who rated the pictures. An analysis of the six-item scale used to measure the subjects' attitude toward pictures in the ad showed the items to be internally consistent (Cronbach's alpha = 0.96 in immediate condition and 0.95 in the delayed condition). Therefore, the average of the six items was computed and used in the following analyses.

An analysis of variance of the picture evaluation scores with message imagery as the between subjects factor, and time as the within subjects factor, showed only one main effect - that of time (F=14.75, p < 0.002). Unexpectedly, the evaluation of pictures showed a significant increase with time (M_{time 1} = 5.32, M_{time 2} = 6.04). The reason for increased favorability toward pictures after delay is not clear. However, as expected, the pictures were evaluated positively. This is evident from the mean evaluation scores of subjects which are well above the midpoint of four on a seven-point scale. Also, the high imagery and low imagery copy subjects did not evaluate the pictures differently. Therefore, the basis for H5a and H5b that the pictures were positively valenced, was supported.
Attitude toward the ad

The attitude toward the ad scale comprised six items which were first checked for internal consistency. The scale showed good reliability both in the immediate and delayed measures (Cronbach’s alpha: immediate = 0.9; delayed = 0.96). Based on these high reliabilities, the average of the six items was calculated and used as a summary measure of subjects’ attitudes toward the ad, both in the immediate and delayed conditions. The mean attitude toward the ad scores are presented in Table 4.

According to Hypothesis 5a and 5b, subjects’ attitude toward the ad should be positively affected by the presence of positively valenced pictures. This prediction calls for a main effect of picture presence on attitude toward the ad. Therefore, the attitude toward the ad index was subjected to an analysis of variance with message imagery and picture presence as the independent variables. Time was again used as a within subjects variable. The analysis revealed a significant effect of the presence of pictures (F=8.59, p < 0.005). No other effects even approached significance.

A priori multiple t-tests were again conducted to examine the effects separately for immediate and delayed measures. A comparison of the immediate attitude toward the ad scores of the group whose ad contained pictures with the group whose ad did not contain pictures revealed a significant effect of pictures (t_{94} = 2.58, p < 0.01). Subjects exposed to the ad with pictures rated the ad more favorably
(M=5.07) than subjects exposed to the ad without pictures (M=4.14). Hypothesis 5a was, therefore, supported.

A second t-test compared the delayed attitude toward the ad scores of subjects who were exposed to the ad with pictures (M=5.0) and subjects who were exposed to the ad without pictures (M=4.39). The effect of pictures was again significant (t_{94}=1.69, p < 0.05), which supported Hypothesis 5b. The presence of pictures, therefore, had a positive effect on subjects' attitude toward the ad, both in an immediate post-test and after delay.

**Style of processing**

The reliability of the style of processing scale was moderate (Cronbach's alpha = 0.67). The mean of the scale was computed and used in analysis of covariance. Inclusion of the mean of style of processing scale as a covariate and repeating all the analyses did not affect any of the results reported above. Also the covariate was not significant in any of the analyses.

**DISCUSSION**

The experiment reported in this chapter provided a test of two predictions about the picture superiority effect. Both predictions are based on the mode specific view of memory. First, it was argued that providing pictures does not enhance the retrievability of high imagery information. This prediction was supported when it was found that subjects exposed to a high imagery verbal message, with or without pictures, showed no differences in their recall scores. The
lack of differences in recall was observed both in an immediate post-test and a delayed recall task.

A second prediction of the mode specific view pertained to the retrievability of low imagery information. It was argued that when subjects are exposed to low imagery information, they would recall more when the information is accompanied by pictures than when it is not. This expectation was confirmed in a delayed recall task. Subjects who were exposed to low imagery information without pictures recalled significantly less than subjects exposed to the same information with pictures. The recall differences, however, were not evident in an immediate post-test.

The results described above cannot be explained by the redundancy explanation or by the semantic processing explanation. According to the redundancy explanation, providing pictures that contain the same information as words would be equivalent to repeating the verbal information. Therefore, irrespective of the type of information, provision of pictures with verbal information should always enhance recall. The mode specific view, in contrast, would argue that providing information both as pictures and words should enhance recall only when the pictures cause the formation of a second path in memory. For high imagery verbal information, the images spontaneously generated by subjects would form the second path. The second path formed by the subject-generated visual images would be similar to the path formed by externally provided pictures. Therefore, the provision of pictures with high imagery information should not enhance recall.
The results of the experiment provided support for the prediction of mode specific view, because, pictures did not enhance the retrieval of high imagery information.

According to the semantic processing explanation, as long as subjects process verbal information in a semantic processing environment, words and pictures should be recalled to the same extent. The type of verbal information should have no bearing on its retrievability, as long as the information is processed semantically. The mode specific view, however, would suggest that if representational equivalence is not achieved between words and pictures, even semantic processing would not eliminate the picture superiority effect. Low imagery information was used in the present experiment, to contrast the predictions of mode specific view and the semantic processing explanation. When the verbal information is of low imageability, it was expected that even semantic processing would not result in the formation of visual images. Therefore, low imagery information accompanied by pictures was expected to be recalled better than the same information presented without pictures, even under semantic processing conditions. The prediction of the mode specific view received support in a delayed recall task.

The absence of recall effects due to pictures, in an immediate post-test, even when the copy was low in imageability, fails to support the mode specific view. However, as argued earlier, relatively small amounts of forgetting, and enhanced response involvement due to the nature of task instructions might have
contributed to the null effects. Future research could resolve this issue by providing semantic processing instructions similar to Childers and Houston (1984).

The most important implication of this research is that mental representations play a crucial role in determining the retrievability of information. Models of memory that rely on abstract 'meaning' codes for concept representation cannot explain why even semantic processing could not eliminate differences between pictures and words when people were exposed to a delayed recall task, both in this study and in the Childers and Houston (1984) study. The mode specific view, unlike semantic processing models, relies on differences in representation between pictures and words to explain the picture superiority effect. The superior retrieval of pictures is due to the qualitatively superior representations they form in memory, compared to words. The only way to eliminate the picture superiority effect, therefore, is to equate the representations that are formed by pictures and words. Representational equivalence between words and pictures is achieved when words are imaged or when words spontaneously evoke imagery.

Meaning of a stimulus has a limited role in determining the retrievability of the stimulus, when compared to the imagery provoking ability of the stimulus (cf. Paivio 1965). The importance of representational differences and the limited role of meaning has recently been demonstrated in a study by Bryce and Olney (1988). Even after equating the information content in words and pictures, Bryce
and Olney found that visually presented information (TV scenes) was better recalled and recognized than auditorily presented information (audio tapes). Since the messages contained identical information, it must only be the mode of presentation that caused the recall differences. Bryce and Olney (1988) viewed this finding as supportive of the picture superiority effect. The mode specific view can explain this finding based on the differences in representation of the information in two modes. According to the mode specific view, the auditory message might have formed only an auditory verbal code. The visual scenes, on the other hand, might have formed pictorial codes in memory. The picture superiority effect, as argued earlier, is due to differences in the nature of pictorial and verbal codes.

A second implication of this research is that internally produced visual imagery can substitute for externally provided pictures when the verbal information is highly imagery provoking and is processed with a focus on the information content. Consumer researchers have only recently recognized the importance of visual imagery in consumer cognitive processes (Gutman 1988; MacInnis and Price 1987; McGill and Anand 1988; Stern 1988). For example, Gutman (1988) provides a discussion on encoding of information in multiple senses, and the role of imagery in activating multiple senses. The findings of this research provide strong support for the ability of words to evoke visual imagery and the role of images in affecting the retrievability of information. Future research can address the issue of whether words can be used to stimulate other senses, and what the effects of
such multiple sense stimulation are on the retrievability of those words.

This research also provides a resolution between the two alternative explanations provided by Houston, et.al. (1987) for their finding that information provided both pictorially and verbally is recalled better than information provided only verbally. Their first explanation relied on information redundancy when it is presented both as pictures and words. The repetition of information, according to this explanation, contributes to its greater recall. The second explanation proposed by Houston, et.al. relied on the formation of two codes in memory - verbal and nonverbal - when identical information is presented as words and pictures. These two codes enhance the retrievability of the information because of the superiority of multiple paths in memory. The findings in this study, that pictures enhance recall of low imagery verbal information but do not enhance recall of high imagery information, are most consistent with the dual coding explanation.

The finding that pictures enhance recall of verbal information in only some situations has important implications for marketing communications. Marketers have several objectives in using pictures in their advertisements. If the only objective is to enhance message recall, then the results of this research suggest that high imagery verbal information does not need accompanying pictures, assuming that the audience engage in semantic processing.
If the communication is not inherently imagery provoking, it is important to provide pictures to enhance retrievability of the verbal information. The results of this research show that pictures accompanying low imagery information act as salient cues in the retrieval of that information, especially after a time delay between exposure to the message and retrieval.

Sherman (1985), in research on radio vs. television, presented the results of commercial testing of several imagery provoking radio ads. In all cases where results were presented, the radio ads were as effective as television ads in terms of recall. The argument proposed in this research, that high imagery information generates visual images that can compensate for externally provided pictures, can account for Sherman’s results. Sherman provides a similar explanation to his findings, calling the visual imagery caused by the radio ads ‘the eye of the ear’.

However, if persuasion is the main objective of a marketer, the results of this research suggest that the use of attractive and relevant pictures with any type of information results in a positive attitude toward the ad. Even though pictures were found to affect the retrievability differently for high and low imagery information, their positive valence transferred equally to both high and low imagery ads. This was gauged from subjects’ attitudes toward the ad, which were not different whether the ad was high or low in imagery.

Recent research has shown the importance of attitude toward the ad as a mediator of brand attitude formation (Miniard, Bhatla, and
Therefore, while pictures may not aid in the retrieval of high imagery information, they may still be useful in creating positive feelings toward the ad, which may transfer to the product as well. In this study, it was found that pictures affected only subjects' attitude toward the ad, but not their attitude toward the product. It is possible that the effect of pictures on subjects' attitudes toward the product may have been mediated by their attitudes toward the ad. An examination of the correlations between subjects' attitudes toward the ad and the product showed strong correlations both in the immediate ($r = 0.63$, $p < 0.0001$) and the delay conditions ($r = 0.70$, $p < 0.0001$). The correlations between the subjects' evaluation of pictures and their attitude toward the ad were also high ($r = 0.52$, $p < 0.0001$ in immediate measures, $r = 0.77$ in delayed measures). It thus seems possible that pictures affected product attitudes through the subjects' attitude toward the ad. However, this effect might have been relatively weak and due to the attitude toward the ad construct that intervened between pictures and product attitudes, the direct effect of pictures on product attitudes might have been reduced to statistical insignificance. In addition, the effect of pictures on product attitude was probably weaker compared to the effect of subjects' beliefs about the product. The greater effect of subjects' beliefs might have reduced the weaker effect of pictures to statistical insignificance. Unfortunately no measures of subjects' product attribute beliefs were collected to examine this possibility in greater detail. Future research could resolve this issue.
One final observation that can be made from this research is on the importance of capturing delayed measures. In the absence of delayed measures, one would have concluded that the hypotheses proposed in this study were not supported. It may be that despite all the efforts of researchers to clear the short term memories of the subjects, recall measures taken immediately after exposure to a message will still contain material that could have been forgotten with time. This contamination adds to the additional rehearsal that subjects benefit from, when they respond to other measures on the target product, such as attitudes and behavioral intentions. The differences between groups, due to the factors described above, may be artificially suppressed giving null results.

To conclude, this research underscores the importance of focusing on the form of mental representations to understand some interesting memory phenomena like the one explored here. Picture-word differences are not limited to the differences in processing they seem to go through, but are reflected in the mental representations they form. These differences in mental representations will then affect their retrievability. Considering the amount of nonverbal information we are exposed to in daily life, future research in memory will greatly benefit if the representational differences between various modes of input information are recognized.
Chapter IV

SUMMARY AND FUTURE RESEARCH

The main objective of this research was to test the implications of the proposition that memory representations are mode specific. Past research on human memory in consumer behavior literature has paid little attention to the issue of mental representations. Most of that research is based on network theories of memory (Anderson and Bower 1973; Collins and Loftus 1975), which assume that internal representations are abstract codes, independent of the mode of input information. It was argued in this dissertation that internal representations are not independent of the input mode, but are isomorphic with it. This means that the internal representations retain the properties of the mode in which the information is input. For example, an auditory input would be represented as an auditory trace and a visual input would be represented as a visual trace.

Mode Specific Representation

The predictions of the mode specific view of memory and the abstract representation view of memory were contrasted in a learning context in the second chapter. According to the latter view, when a person is exposed to identical information, once visually and once auditorily, the difference in input modes should have no effect on the memory representation. This is because the abstract representation view holds that internal representations are independent of the input
mode. As long as the information in both modes is the same, repetition in the same or different mode will have no differential effects. Therefore, a person exposed to identical information in two modes will have mental representations equivalent to a person exposed to the same information, twice in any one of the two modes.

In contrast, the mode specific view of memory predicts that bimodal presentation should result in two mode specific traces in memory. Because the information presented in both modes is identical, one may view the two mode specific traces as two paths leading to the same concept in memory. The presentation of identical information twice in the same mode, however, will result in only one mode specific trace. This single trace will be made stronger due to repetition, but will remain as a single trace in memory.

Thus, the abstract representation view predicts no differences in mental representations for bimodal versus unimodal presentation of information when controlling for the number of exposures. The mode specific view, on the other hand, predicts the formation of two mode specific paths when the presentation is bimodal and one mode specific path when the presentation is unimodal. The implications of these differences in representation for the learning of that information were drawn from the literature on encoding variability.

According to the encoding variability hypothesis (Melton 1970), presenting a stimulus item in multiple contexts enhances the likelihood of that item being recalled later. The reason for the enhanced retrieval is based on the assumption that the context in
which an item is presented forms part of the memory trace for that item. This context will later act as a retrieval cue when the item is being recalled. It is therefore argued that the presentation of an item in multiple contexts will result in the availability of multiple cues or paths in memory that are connected to the representation of that item. The presence of these multiple paths is expected to increase the probability of recall of the stimulus item.

The findings from encoding variability literature were extended to address the differences between the mode specific and abstract representation views of memory. Applying the encoding variability literature findings to this situation, the mode specific view of memory predicts greater recall of information when information is presented once in each of two modes than when it is presented twice in any one mode. This is due to the multiple path superiority in the retrieval of a concept in the two mode case. The abstract representation view predicts no differences in recall between the two types of presentation.

These predictions were tested in two experiments and reported in Chapter 2. In both experiments, subjects were exposed to a message once in each of two modes (auditory and visual), or twice in any one of the two modes. Recall of message content was used as the dependent measure. The findings of both the experiments were supportive of the mode specific view of memory. Subjects exposed to information in two modes recalled significantly more than subjects exposed twice to the same information in just one mode. The increased recall was evident
both in an immediate recall task (experiment one) and a delayed recall task (experiment two).

A potential alternative explanation of differential attention between experimental conditions was ruled out by employing a reaction time secondary task. The differential attention explanation would predict that subjects exposed to information in a different mode the second time would pay more attention to the information due to the novelty of exposure in a different mode. This enhanced attention to the information will result in greater learning. However, when the average reaction time of the subjects in different experimental conditions to the secondary task was examined, no group differences emerged. In addition to this, using the reaction time of each subject as a covariate in all the analyses did not affect the results. It was concluded, based on these analyses, that differential attention was not responsible for the observed effects.

Another finding of interest relates to the confidence with which subjects could answer questions based on what they had learned earlier. The presence of two paths in memory, for subjects exposed to information in two modes, was expected to act as two sources of information. The two sources were argued to contain identical information because the input information was identical in both the modes. Upon being asked a question, a subject would search his/her memory for an answer. Due to the presence of two sources, the subject could get an answer from either source. Because the two sources contain identical information, they would agree with each other. This
agreement between the two sources in memory was hypothesized to result in greater confidence for the subject in his/her answer, compared to another subject who had only one path or source of information in memory. The hypothesis was supported -- subjects exposed to information in two modes expressed greater confidence in their answers than subjects exposed to information in one mode. Importantly, the differential confidence emerged only for those questions that were restatements of parts of the message. For other questions that were only related to the topic but not connected to the message, no differences in confidence were observed between experimental conditions. This finding suggests that the confidence differences were found only when subjects had to use information in the message to answer questions. The hypothesized differences in memory representation of the message information, between experimental conditions, contributed to the confidence differences. To answer message unrelated questions, subjects had to use information other than what was presented to them through the message. The experimental conditions were not expected to differ in the mental representation of message unrelated information. Because the mental representations were the same, the confidence scores of subjects did not differ. Therefore, the differential confidence is related to the memory representation of the message information, and not to other extraneous variables.

The predictions of mode specific view of memory were thus supported in two experiments that were reported in Chapter 2. The
mode specific view was then used in Chapter 3 to address a problem that has spurred much research in psychology and consumer behavior literature. This problem is called the picture superiority effect.

The Picture Superiority Effect

The picture superiority effect refers to the consistent finding in literature that pictures are remembered better than words. Prior to this research, the most satisfactory explanation for the picture superiority effect in the marketing literature is provided by Childers and Houston (1984). According to these authors, pictures access semantic memory spontaneously. That is, a person exposed to a picture understands what the picture means, with little processing effort. On the other hand, a person must process words semantically to understand what they mean. Therefore, when a person is exposed to pictures and words in a processing environment that is not semantic, pictures access semantic memory spontaneously while words do not. According to the levels of processing framework (Craik and Lockhart 1972), information that accesses semantic memory is retrieved better than information that does not. Therefore, pictures are recalled better than words.

According to Childers and Houston, when words and pictures are both processed semantically, the differences in their retrievability should disappear. Using this logic, Childers and Houston (1984) found that when words were processed in a semantic processing environment, retrieval differences between words and pictures disappeared in immediate post-test recall. The picture superiority effect, however,
was found in a delayed recall task. This result with delay is inconsistent with the semantic processing explanation for the picture superiority effect.

The mode specific view of memory was used in this dissertation to explain the picture superiority effect. According to the mode specific view, pictures and words form different mental representations. These representations are isomorphic with external stimuli. The differences in surface characteristics between words and pictures, therefore, are reflected in the representations of words and pictures. The representational differences between pictures and words are argued to cause the picture superiority effect. According to the mode specific view, as long as the representational differences between pictures and words persist, pictures are recalled better than words even under semantic processing conditions.

One way to eliminate the picture superiority effect, according to the mode specific view, is to induce subjects to process words in a manner that creates picture-like mental representations. Some evidence reviewed in Chapter 3 shows that words can be processed to create picture-like representations through the use of visual imagery. Therefore, when a person processes information that is highly imagery provoking, the spontaneously evoked visual images create mental representations that are similar to the representations created by externally provided pictures. This representational equivalence is expected to eliminate the picture superiority effect.
On the other hand, when a person is exposed to information that is not imagery provoking, s/he does not generate images spontaneously. Low imagery verbal information, therefore, forms only a verbal representation in memory. If the low imagery verbal information is accompanied by pictures which contain identical information in them, then a person exposed to that information will have two codes, one verbal and the other nonverbal, form in his/her memory. Based on the results of Chapter 2, it was argued that low imagery information with pictures will be recalled better than low imagery information without pictures. This is because two mental codes for the information enhance its retrievability compared to only one mental code for the same information.

The predictions of the mode specific view were tested in an experiment that presented low or high imagery information with or without pictures in a between subjects design. It was found that pictures did not affect the recall of high imagery information but enhanced the recall of low imagery information. These findings supported the mode specific view, and argued against the semantic processing explanation and the redundancy explanation.

In addition, message imagery was shown to have positively affected subjects' attitudes toward the product. The recall and attitude effects were, however, found only in delayed measures of recall and attitude; no differences due to experimental manipulations were observed in the immediate condition. The lack of immediate differences in recall between concrete and abstract information has
also been reported by Marscharc and Paivio (1977) and Reyes, et al. (1980). The possible reasons for the absence of recall effects in the immediate post-test are discussed in the next section.

The implications of the findings in the three experiments of this dissertation have been discussed at the end of Chapters 2 and 3. The next section presents some unresolved issues and future research that might resolve these issues. Other research that could advance our understanding of the mode specificity of internal representations is also discussed.

**Future Research on Mode Specific Representations**

**Attitudes and behavioral intentions.** This dissertation focused predominantly on memory for information that is presented in one or two modes. As discussed in the introductory chapter, this research fits into other memory research that is being conducted by consumer behaviorists. Therefore, message recall, a valid measure of memory, has been employed as the key dependent measure in all the experiments reported here. An important question that needs to be addressed concerns the relevance of the recall effects found in this dissertation to consumer behavior. Assuming that attitudes and behavioral intentions are acceptable measures of consumer behavior, what predictions can one make from the mode specific view about these measures when a person is exposed to information in one versus multiple modes?

According to the mode specific view, greater retrievability of information presented in multiple modes is because of the multiple
mode specific traces that form in memory. Note that multimodal presentation is not expected to cause any greater elaboration of information than single mode presentation, controlling for the number of exposures. The term elaboration as used here refers to the number of connections or paths that form in memory within a mode specific trace. The reaction time data from experiment two in Chapter 2 support the idea that presenting information in multiple modes does not cause greater elaboration of that information. Therefore, multiple mode presentation does not impact upon attitudes or behavioral intentions through enhanced elaboration of message content. Instead, the effect on attitudes is mediated by the retrievability of target information. That is, subjects' attitudes or behavioral intentions are affected by single versus multiple mode presentation of information only to the extent that the information is differentially retrieved and used to make judgments.

The experiments reported in Chapter 2 incorporated two behavioral intention measures in the questionnaire. Dual mode subjects were expected to show greater willingness to perform the two behaviors than single mode subjects. The expectation of greater willingness of dual mode subjects was based on the assumption that the information relevant to answering the behavioral intention questions would be retrieved better by them compared to single mode subjects. However, the behavioral intentions of single and dual mode subjects did not differ. It is possible that the information required to answer the behavioral intention questions was not differentially available to
single and dual mode subjects. Detailed analysis of recall protocols in experiment one showed that this indeed was the case - subjects did not differ on their recall of the information that was required to answer the behavioral intention questions.

One situation when judgments made by individuals are based on the information they retrieve from memory is when they are exposed to product information in an 'offline' mode (cf. Hastie and Srull 1986; also see Chattopadhyay and Alba 1988). In an 'offline' mode, a person processes information but does not make judgments at the time of exposure. Therefore, only information about the product is stored in the person's memory. If the person is asked to make a judgment about the product after a time delay, s/he has to rely on the information that can be retrieved from memory to make the judgment. It is in these situations that multiple mode presentation is expected to exert its greatest influence on judgments because the information that can be retrieved by the subject is affected by single versus multiple mode presentations. Future research should examine this issue by collecting measures of attitudes and behavioral intentions after a time delay from the time of exposure to information. The important point is that according to the mode specific view, any effects of multiple mode presentation on attitudes and behavioral intentions are completely mediated by memory.

Multiple senses. Another important issue that needs to be addressed in future research deals with other senses that were not included in the present research. Specifically, the two experiments
reported in Chapter 2 included auditory and visual modes of presentation of information. Will the findings reported here generalize to other senses as well? That is, if encoding information in two modes enhances its retrievability compared to encoding the same information in one mode, will encoding information in three modes enhance recall compared to encoding the same information in two modes? Future research should examine the encoding that takes place in other modes (e.g., olfactory, tactile) and see whether the addition of each mode specific trace would enhance the retrievability of information independently. Based on the encoding variability literature, and the findings of the present research, one can hypothesize a direct relationship between the number of modes in which information is represented and the retrievability of that information.

This hypothesis can be tested in the following experiment. In condition 1, subjects would be made to process verbal information about a brand of perfume. Each subject would be exposed to the information three times. Condition 2 would present the same information three times, but not just in one mode. A combination of two modes (choosing from 'scratch-and-sniff' enclosure, pictures, or words), both containing identical information, would be used for the three exposures in this condition. Finally, subjects in Condition 3 would receive one exposure in each of three modes (words, pictures, and the 'scratch-and-sniff' enclosure). According to the hypothesis proposed earlier, subjects in Condition 3 should recall more
information than subjects in Condition 2, and the latter should recall more than the subjects in Condition 1.

**Interconnections between codes.** A third issue of importance is the nature of integration of multiple mode specific traces in memory. That is, how are the various mode specific traces that represent the same concept interconnected? For example, in the experiment reported in Chapter 3, identical information was presented simultaneously through pictures and words in two experimental conditions. According to the mode specific view, the words and pictures form different traces that contain identical information. The two traces may remain independent and not be connected to each other. Alternatively, the verbal trace may be connected to the nonverbal trace at various points of content-overlap. This type of interconnection should be of interest to a marketer because, for example, a consumer can encode his television ad as a visual and verbal trace. A strong link between these two traces suggests two strategies: 1) that the marketer can revive the visual traces by cueing the consumer with just the verbal portion of the ad. This implies that once the TV ad is seen by the consumer, the marketer can obtain similar effects whether the ad is shown again on TV or played again on the radio. 2) the visual portion of the ad may be used to cue the consumer to retrieve the verbal portion. Thus, if a picture shown in the TV ad is also present, say, at the point of purchase, the consumer may be able to retrieve the verbal portion of the ad. Since the verbal portion usually contains
the information on the differentiating attribute, it is to the advantage of the marketer to have the consumer retrieve it.

Recall effects in immediate post-test tasks. The results of the experiment in Chapter 3 show that the expected differences in recall were not found in immediate post-tests. The absence of recall differences in immediate post-test was unsupportive of the mode specific view of memory. However, there are several factors that might have contributed to these null effects in immediate post-test.

First, the mode specific view suggests that the formation of two paths aids in the retrieval of the target information. That is, the hypothesized recall effect is based on retrieval differences between subjects who had the low imagery copy with pictures and those who had the low imagery copy without pictures. It is possible that the verbal information could be retrieved in the immediate post-test without the use of picture cues. Therefore, subjects in both picture and no picture conditions might have retrieved message copy based only on their verbal memory. The non-use of the picture memory by subjects whose ad contained pictures might have thus equated their recall with that of subjects whose ad did not contain pictures.

Second, the message contained some phrases that were not pictorially represented. For example, phrases like "1/1000 second shutter speed" and "weighs less than 2.5 lbs." did not have their pictorial counterparts in the target ad. For all these phrases, the picture and no picture conditions did not differ on the information they were presented. Therefore, the picture and no picture conditions
should not differ on their recall of these phrases because both groups were presented the same information. The recall protocols of the subjects, however, were summed across all phrases that they recalled from the message. The presence of these phrases that were presented similarly for both picture and no picture conditions might have added error variance to the recall data. The recall protocols were not coded separately for picture-represented phrases and words-only phrases because the focus of this research was on the total recall of ad copy. Future research should examine this issue by coding recall scores separately for those phrases that were presented both as pictures and words.

Finally, the nature of the instructions might have affected the results in the immediate post-test. The instructions given to the subjects as they began processing the ads emphasized the questions that were to follow their examination of the ads. This heightened response involvement might have caused ceiling effects to operate in the immediate post-test, and, therefore, suppressed differences between conditions.

To conclude, research on human memory has traditionally limited itself to learning of word lists or passages. A major portion of the information processed by consumers, however, is nonverbal. It has been demonstrated through three experiments in this dissertation that memory encoding is mode specific. The implications of mode specific view of memory, especially for learning, have been discussed at the end of Chapters 2 and 3. This view of memory is different from the
existing views of memory. It represents the beginning of a new stream of research that does not limit human learning to the learning of words and sentences.
Introduction: AIDS is an epidemic that has already killed thousands of people, mostly young, productive Americans. In addition to illness, disability, and death, AIDS has brought fear to the hearts of most Americans -- fear of disease and fear of the unknown. Fear can be useful when it helps people avoid behavior that puts them at risk for AIDS. On the other hand, unreasonable fear can be as crippling as the disease itself. This report is intended to help you understand the facts about AIDS.

What is Acquired Immune Deficiency Syndrome?

*Acquired* means that the disease is not inherited or genetically caused, although a woman infected with AIDS can pass the AIDS virus to her unborn child.

*Immune* refers to the body's natural means of protecting itself from disease and infection.

*Deficiency* indicates that the immune system is diminished in its ability to protect the body.

*Syndrome* indicates a pattern of symptoms which tend to develop because of the acquired immune deficiency

*AIDS caused by virus:*

When a person is sick with AIDS, he/she is in the final stages of a series of health problems caused by a virus (germ). Scientists have
named the AIDS virus "HIV" (Human Immunodeficiency Virus). The HIV virus is particularly difficult to combat because, in addition to its ability to lie dormant in cells, it also is able to alter itself. The virus then hides itself in the body's cells making it difficult to spot and attack it. Because the virus changes with time, it will be difficult to develop an effective vaccine. Even if a vaccine is found to attack its present form, the HIV virus may mutate to another, not yet preventable, form.

The process:
When the AIDS virus enters the bloodstream, it begins to attack certain white blood cells (T-lymphocytes). An individual infected with the AIDS virus will produce antibodies to combat it, but the antibodies will be ineffective. The blood test now commonly available in the United States reveals the presence of these antibodies and thus the potential of developing AIDS. Once an individual is infected, there are several possibilities. Some people may remain well but even so they are able to infect others. In some people, who develop the classic AIDS, the protective immune system may be destroyed by the virus and then other germs (bacteria, protozoa, fungi and other viruses) and cancers that ordinarily would never get a foothold cause what are called "opportunistic diseases". Some of the most common are pneumonia and tuberculosis. Classic AIDS victims may also develop certain types of cancers such as Kaposi's sarcoma (a type of skin cancer). A small percentage of the people testing positive on the AIDS test may develop a disease that is less serious than classic AIDS referred to as AIDS Related Complex (ARC). A person with ARC suffers several diseases like fever, skin rashes, tiredness, lack of resistance to infection, etc. However, the immune system does not collapse altogether like in the classic AIDS.

The present situation:
The number of persons afflicted with AIDS has climbed dramatically. In the United States alone, 22,000 out of the 38,000 people known to have contracted classic AIDS have already died. These numbers are as of July, 1987. Since there is no cure, the others are expected to
also eventually die from their disease. The number of people estimated to be infected with the AIDS virus in the U.S. (that is people who have tested positive on the AIDS test) is about 1.5 million. Scientists predict that 20 to 30 percent of these will develop an illness that fits an accepted definition of classic AIDS within five years.

Symptoms of AIDS:
Many symptoms associated with AIDS are present in minor illnesses such as colds and stomach flu. However, in AIDS, these symptoms are usually persistent or recurrent. The general symptoms may include the following:
* persistent diarrhea
* unexplained, persistent fatigue
* unexplained fever, shaking chills lasting longer than several weeks
* swollen glands (usually in the neck, armpits or groin) that last several weeks
* persistent white spots or unusual blemishes in the mouth.

How AIDS is contracted and passed.
Although the AIDS virus is found in several body fluids, most people acquire the virus during sexual contact with an infected person's blood or semen and possibly vaginal secretions. Thus, the risk of infection increases according to the number of sex partners one has. Drug abusers who inject drugs into their veins form 25% of the cases of AIDS throughout the country. The AIDS virus is carried in the contaminated blood left in the needle, syringe, or other drug related implements and the virus is injected into the new victim when these syringes and needles are reused.

Some people had a blood transfusion prior to March 1985 before we knew how to screen blood for safe transfusion and therefore may have become infected with the AIDS virus. Transfusion procedures are far safer today and all blood that has been donated goes through automatic AIDS tests. New laser technology developed recently makes these tests 100% effective.
AIDS: What is safe?

Everyday living does not present any risk of infection. You cannot get AIDS from casual social contact such as shaking hands, hugging, social kissing, crying, coughing or sneezing. AIDS is not contracted from sharing bed linens, towels, cups, straws, dishes or any other eating utensils. AIDS has not been contracted from swimming in pools, bathing in hot tubs or using toilets, office machinery and telephones. **Summary:** AIDS no longer is the concern of any one segment of society; it is the concern of us all. We cannot yet know the full impact of AIDS on our society. From a clinical point of view, there may be new manifestations of AIDS - for example, mental disturbances due to the infection of the brain by the AIDS virus in carriers of the virus. From a social point of view, it may bring to an end the free-wheeling sexual lifestyle which has been called the sexual revolution. Economically, the care of AIDS patients will put a tremendous strain on our already overburdened and costly healthcare delivery system.

The most certain way to avoid getting the AIDS virus and to control the AIDS epidemic in the U.S., is for individuals to avoid promiscuous sexual practices, to maintain mutually faithful monogamous sexual relationships and to avoid injecting illicit drugs.

**MESSAGE ON THE U.S. TRADE DEFICIT**

The so-called alliance between Japan and the United States is rapidly becoming a mutual exasperation society. The two nations are linked more closely than ever economically, but those links are causing irritation on both sides of the Pacific to grow, not diminish. The immediate issues are familiar: Tokyo sees a deliberate attempt by the United States to devalue the dollar and punish Japan for economic sins the Japanese believe are Washington's own - its budget and trade deficits. The dollar has recently plunged below 122 yen, a record postwar low, and took stock prices down with it.
With the bilateral trade deficit yawning ever wider, Washington sees Japan as a mercantilist fortress, invulnerable to exchange-rate fluctuations. In December 1987, trade imbalance soared to a new high, leading to renewed cries in Congress for legislation aimed at reducing the deficit by restricting Japanese imports. Neither side, of course, believes the other is doing much to solve the problems. So the two nations that produce more than one-third of the noncommunist world's output are careering toward what may be called a 'crisis of confidence'.

The frustration level is rising on both sides not only because of a sinking dollar and an unsinkable trade deficit, but because neither country is able to do much to force the other to change its policies. In the United States, the impulse to bash Japan is as strong as it has been in decades. But as tempting as it might be to lash out, the United States can't - simply because it can't afford to. By punishing Japan, it frequently punishes itself.

The Japanese, in fact, have become expert in the art of judo economics. Because of their huge presence in the United States market, Japanese companies can often deflect protectionist pressure. Indeed, they can usually rely on customers to scream whenever specific proposals are enacted that hurt Japanese suppliers. Twice in the last nine months, the United States has sought retribution against Japanese companies for violations of international trade. Each time, the original retaliatory response was toned down when it became clear that it was hurting the United States as well as Japan.

The links between the two economic superpowers are now so vast and complex that some economists argue that policymakers should pay less attention to trade statistics. The day may come, when that will happen. But not anytime soon. As long as currency traders continue to focus on trade statistics, the dollar will continue to decline against the yen. Like the two biggest kids on the block, Japan and the United States will keep fighting - each with one hand tied behind its back.
This part of the research project is aimed at obtaining your opinions about the issues to which you have just been exposed. Please answer the questions in the following pages as best as you can. It is very important that you carefully consider and answer each question. Please feel free to clarify any doubts you may have at this point. The research assistant will also be available to answer any questions you may have while you are answering the questions. Thank You.
Please write down in the lines below and on the next page everything you remember from the AIDS message which you read/heard the other day. You may take as much time as you need for this task. Try to reproduce as much of the entire passage as you can. You can also use paragraphs, subheadings and so on to make your essay clear. Please take your own time and try to do your best. Remember that you can use both this page and the next page for this task.
Now, please answer the following questions. We want to know how much you personally agree or disagree with each of the following statements. That is, we want your own personal feelings. All your answers will be kept confidential.

Please mark an 'X' on the line that corresponds most closely to how you feel. It is important that you answer all questions.

1) AIDS is caused by a type of bacteria called lymphocytes.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

How confident are you that your answer above is correct?

Very Confident _____:____:____:____:____:____ Not at all confident

2) Everyone who is infected with the AIDS virus will die.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

How confident are you that your answer above is correct?

Very Confident _____:____:____:____:____:____ Not at all confident

3) AIDS can be a hereditary disease.

<table>
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<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

How confident are you that your answer above is correct?

Very Confident _____:____:____:____:____:____ Not at all confident
4) The symptoms of AIDS are not very different from those of minor illnesses like fever and diarrhea except that they are persistent.

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<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

How confident are you that your answer above is correct?

Very Confident:___:___:___:___:___:___:___ Not at all confident

5) Drug abusers get AIDS by sharing needles infected with the AIDS virus.

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<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

How confident are you that your answer above is correct?

Very Confident:___:___:___:___:___:___:___ Not at all confident

6) AIDS can be spread through sneezing or coughing.

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<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
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</table>

How confident are you that your answer above is correct?

Very Confident:___:___:___:___:___:___:___ Not at all confident

7) All types of condoms available in the market offer adequate protection from AIDS.

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<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
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How confident are you that your answer above is correct?

Very Confident:___:___:___:___:___:___:___ Not at all confident
8) Sex is the second most important mechanism through which AIDS spreads.

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<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Strongly Disagree</th>
</tr>
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How confident are you that your answer above is correct?
Very Confident ___:____:___:___:___:___:____ Not at all confident

9) Sharing bed linen with an AIDS victim is not dangerous.

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<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Strongly Disagree</th>
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How confident are you that your answer above is correct?
Very Confident ___:____:___:___:___:___:____ Not at all confident

10) The number of people infected with classic AIDS in the U.S. is about two million.

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<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Strongly Disagree</th>
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How confident are you that your answer above is correct?
Very Confident ___:____:___:___:___:___:____ Not at all confident

11) The U.S. ranks second in the world in the number of AIDS victims per thousand of population.

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<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Strongly Disagree</th>
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How confident are you that your answer above is correct?
Very Confident ___:____:___:___:___:___:____ Not at all confident
12) Some cases involving cancer of genital organs have been linked to the AIDS virus.

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<tr>
<th>Strongly Agree</th>
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<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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How confident are you that your answer above is correct?

Very Confident ___:___:___:___:___:___:___ Not at all confident

13) Women appear to be more resistant to the AIDS virus than men.

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<tr>
<th>Strongly Agree</th>
<th>Agree</th>
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<th>Disagree</th>
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How confident are you that your answer above is correct?

Very Confident ___:___:___:___:___:___:___ Not at all confident

14) Even if a cure for the AIDS virus as it exists today is found, the virus may change its form and become uncontrollable again.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How confident are you that your answer above is correct?

Very Confident ___:___:___:___:___:___:___ Not at all confident
Now, please answer the following questions.

1. I paid as much attention to the AIDS message the second time as I did the first time.

   | Strongly Agree | Neither | Disagree | Strongly Agree |
   | Agree nor Disagree | Strongly Disagree |

2. I put as much thought into evaluating the AIDS message the second time as I did the first time.

   | Strongly Agree | Neither | Disagree | Strongly Agree |
   | Agree nor Disagree | Strongly Disagree |

3. I put as much effort into evaluating the AIDS message the second time as I did the first time.

   | Strongly Agree | Neither | Disagree | Strongly Agree |
   | Agree nor Disagree | Strongly Disagree |

4. Given that blood transfusion procedures are nearly 100% safe today, how likely are you to accept blood from an unknown donor if you need blood?

   | Very Likely | Neither | Unlikely | Very Likely |
   | Likely nor Unlikely | Unlikely |

5. Given that AIDS cannot be spread through casual contact, will you agree to work with your colleague if you know s/he has AIDS?

   | Strongly Agree | Neither | Disagree | Strongly Agree |
   | Agree nor Disagree | Strongly Disagree |
APPENDIX C
HIGH IMAGERY ADVERTISEMENT USED IN CHAPTER III

Picture a child's shiny face, happy smile, and dancing eyes as he blows out his first birthday candle. The light of that one candle is enough for the Digitron PV-320 Camcorder.

Imagine screaming people on a roller coaster plunging down the steep track. The excitement on their faces can be captured clearly only with the high-speed shutter (1/1000 of a second) of the PV-320.

It helps improve your tennis. As your feet pound back and forth on the tennis court, under the hot sun, you know that every split second of every stroke you played has been captured forever by your PV-320. To be analyzed later, to the minutest detail, using slow motion and freeze-frame.

Makes a professional out of anyone! Ordinary camcorders produce rainbow "noise" between scenes. With the PV-320, whether you are making a tape of the Statue of Liberty, a speeding fire-truck, or a fast-paced basketball game, it goes from scene to scene cleanly.

The choice is yours. There’s a full range of digitron camcorders. From the sophisticated PV-320 that records home movies and plays back Hollywood movies. To a compact camcorder that weighs less than the Yellow Pages!

Nobody gives you more ways to catch the action than Digitron.
A Digitron PV-320 camcorder performs very well under low light conditions. With its new filters and lenses, a light as dim as a candle is enough.

The PV-320 captures even rapid movement with its 1/1000 of a second high-speed shutter. The shutter speed is controlled by a direct current motor. Because of the high shutter speed, no matter how fast something moves, you can get a clear picture.

The PV-320 can help you in several sports too. It records all your movements with great accuracy. And plays them back at different speeds. Its freeze-frame feature on playback helps you analyze your mistakes. Or you could choose the slow motion facility to playback everything you recorded at 1/15 the speed.

Make professional videotapes. This camera does not create noise patterns between scenes when shooting some activity with a lot of scenes. Like games. The PV-320 erase head produces clean, clear transitions between scenes. Everything you shoot looks professional.

You have many choices. You can select the sophisticated PV-320 or the light-weight compact, that weighs as little as 2.5 pounds, or any of the many camcorders in between.

Nobody gives you more ways to catch the action than Digitron.
APPENDIX E

QUESTIONNAIRE USED IN PRETEST OF CHAPTER III

Please rate the ad you just read on the following scales:

Very Imagery Provoking: Not at all Imagery Provoking

Very Sketchy: Very Detailed

Very Vague: Very Explicit

Very Specific: Very General

Very Clear: Very Ambiguous

Very Vivid: Very Dull

Very Interesting: Very Boring

Very Meaningful: Not at all Meaningful

Very Easy to Understand: Very Difficult to Understand

Very Believable: Not at all Believable

Very Informative: Not at all Informative

Very Distinctive: Not at all Distinctive
The arguments presented in the ad were:

Very _____:_____:_____:_____:_____:_____:_____ Very
Strong Weak

Very _____:_____:_____:_____:_____:_____:_____ Not at all
Persuasive Persuasive

You will now have to tell us whether you think the ad you just read is 'concrete' or 'abstract'. To give an example, concrete words and sentences are those which refer to objects, materials, or persons, while abstract words and sentences are those that refer to an abstract concept that cannot be experienced by the senses. An example of a concrete sentence is "The farmer cut the wood", while an example of an abstract sentence is "The lesson inspired devotion". Based on this distinction, please rate the ad that you just read on the following scale. The ad was:

Very _____:_____:_____:_____:_____:_____:_____ Very
Concrete Abstract
Please answer the following questions.

1. The ad brought pictures or images in my mind that helped clarify what was said in the ad.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree

2. As I read the ad, I formed pictures or images about most of what was being discussed in the ad.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree

3. I found myself thinking of images or pictures when I read the ad.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree

4. It was easy to form images or pictures in my mind of what was being said in the ad.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree

5. The ad seemed to relate to me personally.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree

6. The ad seemed to be written with me in mind.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree

7. I was reminded of some of my own experiences as I read the ad.

   Strongly _____:_____:_____:_____:_____:_____:_____ Strongly Agree
   Disagree
As you read through the ad, you may have visualized some of the information presented in the ad in the form of pictures or mental images. In the lines below, please describe the images that might have come to your mind as you read through the ad. Please try to describe each image in about one sentence. Also, use a separate line for each image that you describe. Please try to describe all visual images or pictures that may have come to your mind when you read the ad.
APPENDIX F

FINAL QUESTIONNAIRE USED IN CHAPTER III

Name .................

SS # .................

You will now be asked some questions about the ads and the advertised products that you have just seen. Please work through the questionnaire at your own pace. It is important that you answer all the questions - do not leave any part of the questionnaire unanswered. Also, please answer the questions in the order as provided. DO NOT turn back to your answers on previous pages at any point in this exercise. Thank you.
1. Please list below the brand names of all the products whose ads you have just seen.

1.

2.

3.

4.

5.

6.

7.

8.
2. One of the advertised products was the Digitron camcorder. We now would like to know your feelings about the product. Please respond to each of the scales below by placing an 'X' on the scale that corresponds most closely with how you feel.

**The Digitron camcorder is:**

<table>
<thead>
<tr>
<th>Good</th>
<th>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unattractive</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Attractive</td>
</tr>
<tr>
<td>Awful</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Nice</td>
</tr>
<tr>
<td>Desirable</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Undesirable</td>
</tr>
<tr>
<td>Unpleasant</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Pleasant</td>
</tr>
<tr>
<td>Positive</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Negative</td>
</tr>
</tbody>
</table>

3. We are also interested in your feelings about the advertisement itself. How would you evaluate the Digitron camcorder ad?

**The Digitron camcorder ad is:**

<table>
<thead>
<tr>
<th>Good</th>
<th>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ineffective</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Effective</td>
</tr>
<tr>
<td>Pleasant</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Unpleasant</td>
</tr>
<tr>
<td>Favorable</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Unfavorable</td>
</tr>
<tr>
<td>Easy to read</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Difficult to read</td>
</tr>
<tr>
<td>Positive</td>
<td>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:<em><strong>:</strong></em>:___</td>
<td>Negative</td>
</tr>
</tbody>
</table>
4. Now, consider only the verbal copy of the ad for the Digitron camcorder (verbal copy means all the non-pictorial material). Please ignore the pictures for the moment. We would like you to evaluate only the verbal material presented in the ad for the Digitron camcorder.

The verbal copy in the ad for the Digitron camcorder is:

Very ____:____:____:____:____:____:____ Very Boring
Interesting

Very Vivid ____:____:____:____:____:____:____ Very Dull

Very Easy to ____:____:____:____:____:____:____ Very Difficult
Understand
to Understand

4b) Some advertisements are vague, and talk about the product in only general terms. Such ads can be rated to be abstract. On the other hand, some ads are quite specific and detailed and make the reader almost ‘feel’ the product. Such ads are normally rated to be concrete. Based on this distinction, how would you rate the verbal copy in the Digitron camcorder ad?

Highly ____:____:____:____:____:____:____ Highly
concrete

abstract

5. Advertisements differ in their capacity to arouse mental images of things or events. Some ads arouse a sensory experience, such as a mental picture or sound, very quickly and easily, whereas others may do so only with difficulty (i.e., after a long delay) or not at all. The purpose of this question is to have you rate the Digitron ad as to the ease or difficulty with which it arouses mental images. If the copy in the ad quickly and easily arouses a mental image, it should be given a high imagery rating; if the copy in the ad does not arouse images easily and quickly, it should be given a low imagery rating. For example, ‘apple’ may arouse an image relatively easily while the word ‘fact’ may not arouse an image at all, or do so with difficulty. Thus, apple would be rated as high imagery while fact would be rated as low imagery. Please rate the copy of the Digitron ad on how easily it provokes images.

The copy in the Digitron ad is:

High in ____:____:____:____:____:____:____ Low in
imagery

imagery
6. Now consider only the pictures in the Digitron camcorder ad. Ignore all the verbal material in the ad, for the present. We would like for you to give us your evaluation of the pictures in the Digitron camcorder ad.

The pictures in the Digitron camcorder ad are:

7. At this point, we are interested in what you remember about the Digitron camcorder ad. In the space below, please list everything you can remember - words, phrases, sentences, pictures, etc. Please write down as much as you can remember from the Digitron camcorder ad.
8. At this point, we are interested in any visual images or mental pictures that you might have created for yourself as you read through the Digitron camcorder ad. For example, as one reads a sentence like 'The cat jumped over the table', one may form a mental picture of a cat jumping over a table. In the lines below, we would like you to describe to us all such images or pictures that the ad might have created in your mind. Please describe the images in as much detail as you can.
9. Now please answer the following questions about the Digitron camcorder ad.

a) The ad brought pictures or images to my mind that helped clarify what was said in the ad.

Strongly ___:____:____:____:____:____:____ Strongly Agree
Disagree

b) As I read the ad, I formed pictures or images about much of what was being discussed in the ad.

Strongly ___:____:____:____:____:____:____ Strongly Agree
Disagree

c) I found myself thinking of images or pictures when I read the ad.

Strongly ___:____:____:____:____:____:____ Strongly Agree
Disagree

d) It was easy to form images or pictures of what was being said in the ad.

Strongly ___:____:____:____:____:____:____ Strongly Agree
Disagree

e) I was reminded of some of my own experiences as I read the ad.

Strongly ___:____:____:____:____:____:____ Strongly Agree
Disagree

f) How appropriate were the pictures in the camcorder ad?

Very ___:____:____:____:____:____:____ Very appropriate
inappropriate

g) How relevant were the pictures to the copy of the camcorder ad?

Very ___:____:____:____:____:____:____ Very relevant
irrelevant
INSTRUCTIONS: The aim of this exercise is to determine the style or manner you use when carrying out different mental tasks. Your answers to the questions should reflect the manner in which you typically engage in each of the tasks mentioned. There are no right or wrong answers, we only ask that you provide honest and accurate answers. Please answer each question by circling one of the four possible responses. For example, if I provided the statement, "I seldom read books," and this was your typical behavior, even though you might read say one book a year, you would circle the "ALWAYS TRUE" response.

<table>
<thead>
<tr>
<th>Item</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I enjoy doing work that requires the use of words.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>2. There are some special times in my life that I like to relive by mentally 'picturing' just how everything looked.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>3. I can never seem to find the right word when I need it.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>4. I do a lot of reading</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>5. When I'm trying to learn something new, I'd rather watch a demonstration than read how to do it</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>6. I think I often use words in the wrong way</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>7. I enjoy learning new words</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>8. I like to picture how I could fix up my apartment or a room if I could buy anything I wanted</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>9. I often make written notes to myself</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>10. I like to daydream</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>11. I generally prefer to use a diagram rather than a written set of instructions</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Item</td>
<td>Response</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>12. I like to &quot;doodle&quot;</td>
<td></td>
</tr>
<tr>
<td>13. I find it helps to think in terms of mental pictures when doing many things</td>
<td></td>
</tr>
<tr>
<td>14. After I meet someone for the first time, I can usually remember what they look like, but not much about them</td>
<td></td>
</tr>
<tr>
<td>15. I like to think of synonyms for words</td>
<td></td>
</tr>
<tr>
<td>16. When I have forgotten something I frequently try to form a mental 'picture' to remember it</td>
<td></td>
</tr>
<tr>
<td>17. I like learning new words</td>
<td></td>
</tr>
<tr>
<td>18. I prefer to read instructions about how to do something rather than have someone show me</td>
<td></td>
</tr>
<tr>
<td>19. I prefer activities that don't require a lot of reading</td>
<td></td>
</tr>
<tr>
<td>20. I seldom daydream</td>
<td></td>
</tr>
<tr>
<td>21. I spend very little time attempting to increase my vocabulary</td>
<td></td>
</tr>
<tr>
<td>22. My thinking often consists of mental &quot;pictures&quot; or images</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX G

QUESTIONNAIRE USED IN DELAY CONDITION OF CHAPTER III

1. One of products you saw an ad for the other day is Digitron camcorder. We now would like to know your feelings about the product. Please respond to each of the scales below by placing an 'X' on the scale that corresponds most closely with how you feel.

The Digitron camcorder is:

Good: Unattractive
Awful: Desirable
Desirable: Attractive
Unpleasant: Nice
Unfavorable: Pleasant
Positive: Undesirable
Negative: Difficult to read

2. We are also interested in your feelings about the advertisement itself. How would you evaluate the Digitron camcorder ad?

The Digitron camcorder ad is:

Good: Ineffective
Pleasant: Favorable
Favorable: Easy to read
Positive: Negative
3. Now, consider only the verbal copy of the ad for the Digitron camcorder (verbal copy means all the non-pictorial material). Please ignore the pictures for the moment. We would like you to evaluate only the verbal material presented in the ad for the Digitron camcorder.

The verbal copy in the ad for the Digitron camcorder is:

Very ______:____:____:____:____:____ Very Boring
Interesting
Very Vivid ______:____:____:____:____:____ Very Dull
Very Easy to ______:____:____:____:____:____ Very Difficult
Understand ______:____:____:____:____:____ to Understand
4. Now consider only the pictures in the Digitron camcorder ad. Ignore all the verbal material in the ad, for the present. We would like for you to give us your evaluation of the pictures in the Digitron camcorder ad.

The pictures in the Digitron camcorder ad are:

5. At this point, we are interested in what you remember about the Digitron camcorder ad. In the space below, please list everything you can remember - words, phrases, sentences, pictures, etc. Please write down as much as you can remember from the Digitron camcorder ad.
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Hastie, Reid and Bernadette Park (1986), "The Relationship Between Memory and Judgment Depends on Whether the Judgment Task is Memory-Based or On-Line", *Psychological Review*, 93 (June), 258-268.


