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Can Memory Blocks Produce a Zeigarnik Effect?

by

Faizal Junus

DEDICATION

This thesis is dedicated, in loving memory, to my older sister, **Nazeem (Beema) Junus**, who passed away April 16, 1995. Beema spent the last six months of her life with my family and during this time she provided love, support, and encouragement for me to continue on with my thesis. Throughout my life, Beema has always taken great pride in my accomplishments. For this reason, I dedicate this accomplishment to her.

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Throughout the years, two individuals have been highly influential in my decision to pursue graduate studies. I would like to thank Dr. Linda Parrott and Dr. Grace Pretty for acknowledging my potential and providing constant encouragement to pursue higher level studies in the field of Psychology. In addition, I would like to thank Dr. Phil Street who has (since 1977) always acknowledged my achievements, provided moral support, and offered words of wisdom during my academic and career pursuits.

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ABSTRACT

Under the assumption that memory blocks are comparable to interrupted tasks since both are deemed to be uncompleted, a series of five experiments investigated if memory blocks would produce a Zeigarnik Effect - the better recall of uncompleted tasks. Questions constructed from a 24-28 stimulus item set (noun category and initial letter) were randomly presented to subjects who had to make a response within a fixed amount of time. If an answer was not produced, then the question was considered uncompleted. Examining item difficulty and completion of recalled items, the first three experiments showed two different patterns: better recall of uncompleted difficult items (Zeigarnik Effect) and better recall of completed easy items (an effect opposite to the Zeigarnik Effect). Experiments 4 and 5 controlled for item difficulty and the results yielded an effect opposite to the Zeigarnik Effect - better recall of completed questions. It was concluded that a higher rate of subsequent recall may have been due to the answers of completed questions acting as retrieval cues.

Can Memory Blocks Produce a Zeigarnik Effect?

Memory is the mental ability of storing past experiences and recalling them. Using an associative model of memory, Ebbinghaus (1885) explained memory as a linear process whereby a chain of associations leads from a cue to the answer contained in memory. Departing from this simple associative model of memory, theorists proposed a structural model which viewed memory as a set of interrelated components. The structural analysis view of memory began as early as 1890 with William James who differentiated between primary memory and secondary memory. According to James, primary memory endured for a short period of time and secondary memory was "the knowledge of a former state of mind after it has already once dropped from consciousness..." (p. 648).

Using an expanded distinction of memory storages, Atkinson and Shiffrin (1971) described memory via an information-processing model whereby information is processed through three memory stores: sensory, short-term, and long-term. Sensory memory can hold a large amount of information in its sensory form but only for a brief period of time, usually under two seconds. Through the process of attention, a small portion of this information can be selected, for longer storage via short-term (STM) or primary memory. The process of encoding allows the selected information to be transformed into a form which may be recorded and registered in memory. Information exists for a brief duration within a limited capacity STM.

However, with rehearsal this information can be permanently stored in secondary or long-term memory (LTM) where large amounts of information can exit for a long period of time. Verbal materials are usually coded phonemically in STM and semantically in LTM (Baddley, 1966). The retrieval of information requires the moving of stored information from LTM to awareness or STM where it can be used. Though difficulties arise at various stages of the memory process, once information is retained, the greatest difficulty is in the retrieval process. For example, a memory block may develop in which there is an inability to recall a known item or an item for which you have some sense of a response.

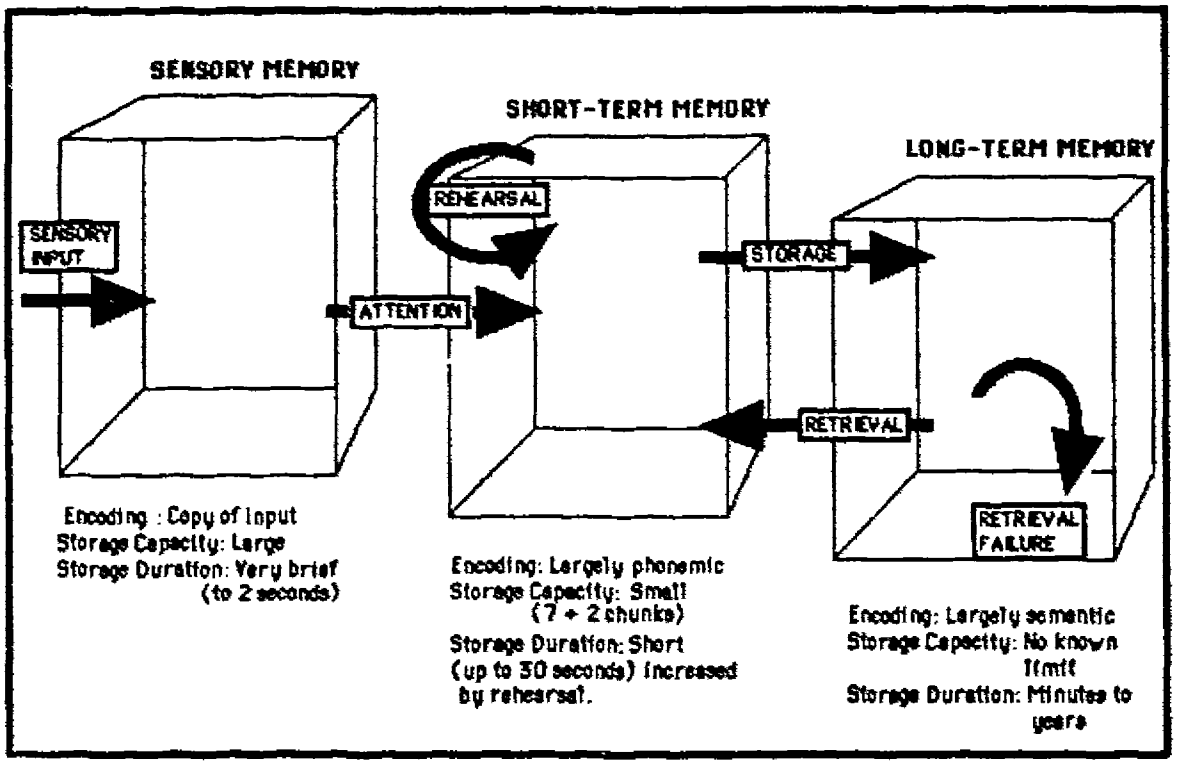

Figure 1: The modal model of memory processing derived from Atkinson and Shiffrin's work (Weiten, 1989, p.260).

While the multi-store models described memory in terms of its structural aspects, other theoretical frameworks (Cermak, 1972; Craik and Lockhart, 1972) focused on the levels of processing involved at the encoding and retrieval stages. Craik and Lockhart (1972) described levels of processing as "a series or hierarchy of processing stages, often referred to as the depth of processing, where greater depth implies a greater degree of semantic or cognitive analysis. After the stimulus has been recognized, it may undergo further processing by enrichment or elaboration. For example, after a word is recognized, it may trigger associations on the basis of the subject's past experience with the word" (p. 675). Similarly, one could say that during retrieval, associations may be triggered before the word is reached. Thus, there is a feeling of knowing the target word and the search continues for it. William James (1890) wrote: "Suppose we try to recall a forgotten name. The state of our consciousness is peculiar. There is a gap therein; but no mere gap. It is a gap that is intensely active. A sort of wraith of the name is in it, beckoning us in a given direction, making us at moments tingle with the sense of our closeness and then letting us sink back without the longed-for term. If wrong names are proposed to us, this singular definite gap acts immediately so as to negate them. They do not fit into its mould. And the gap of one word does not feel like the gap of another, all empty of content as both might seem necessarily to be when described as gaps" (p.251).

Eighty years after James stated his view, Norman and Bobrow (1976) proposed a similar view that information in our memory is collected and interpreted in terms of a 'coherent framework' (Active Memory Schemata).

Past experiences are created into a large number of structural frames or schemata that characterize the knowledge of any experience. When retrieving information, the goal of the search is to find the appropriate schema. A new schema is developed if there are no prior existing schemas. If a schema exists and differences occur then the schema is reorganized. Otherwise the search goes on until the target schema is obtained. Norman and Bobrow (1976) further hypothesized that "processing by memory schemata can take place autonomously, without conscious awareness. Thus we believe that just as the lowest levels of sensory and perceptual processing operate subconsciously, so too do the higher-level schemata form and proceed without conscious direction. Note, however, something must drive the system" (p. 129). Norman and Bobrow (1976) concluded by raising the following questions: "What drives the system? What determines which tasks get performed?" (p. 131)

Bower (1981) stated that it was the nature of the mind to forget and the nature of humans to worry about their forgetfulness. In the multifaceted nature of memory, memory blocks are attributed to deficiencies in processing. In the multifaceted nature of humans, the need to resolve memory blocks varies but there is an underlying search for the forgotten item ('lost state).

Herman Ebbinghaus (1885) in his classic monograph, *Memory*, addressed three effects related to memory blocks: a) one can 'by an exertion of the will' reproduce lost states; b) any one of us can have a spontaneous occurrence of prior states; and c) even without reproducing lost states, these states can still influence our thoughts. Cofer (1976) states that

Ebbinghaus' studies did not directly address the effects he had proposed. Focusing on the level of retention, Ebbinghaus' studies were more concerned with the acquisition of knowledge as opposed to investigating the recovery of 'lost states'. Roediger (1985) states that "despite the great progress in our field [memory], so many of the central problems Ebbinghaus outlined remain unsolved" (p. 413). Read and Bruce (1982) stated that memory blocks occur frequently in everyday life but little is known as to why they occur and are resolved.

A memory block occurs when one cannot produce a response that is known to a given stimulus within a specified period of time. Initially there is a conscious search for the response. As time progresses, the search becomes automated such that little or no conscious attention is required. Reason and Lucas (1983) stated that "on occasions, the retrieval mechanisms fail and we are forced to deploy, at least momentarily, the bulk of our intentional and attentional resources to recover the sought-for memory item (the target). While the search may begin with an acute awareness of our failure to find a given item, it is subsequently carried out in a region beyond the reach of conscious guidance" (p. 54). A change from conscious processing to subconscious processing occurs when the automated search is interrupted by a novel task that demands conscious attention. Thus, it is hypothesized that the automated search to resolve the memory block goes at the level of subconscious processing. The subconscious processing time is referred to as the period of incubation. Norman and Bobrow (1976) stated that a period of incubation is only successful when it is preceded by a period of active ("hard") work on the problem. After seconds, minutes, hours, or days

of incubation, the response may spontaneously appear and the search is terminated.

A number of investigators have theorized about the nature of memory retrieval. Cohen and Faulkner (1986) stated that word retrieval was not an all-or-none process. Without having access to the target word, partial information about the target word is commonly available. Once the search is activated, additional cues and similar 'candidate' words may aid the retrieval of the target word. Using the notion of conceptual and lexicon stores, Cohen and Faulkner described the dual-access model of word retrieval process (Goodglass & Baker, 1976; Jones, 1978; Bowels & Poon, 1985) used to explain semantic memory. Conceptual store (concepts organized in a semantic network) and lexicon store (words stored in phonological and orthographic characteristics) are connected by pathways linking word names to their concepts. Goodglass (1976) hypothesized that when a concept was activated then the process of word retrieval commenced. Activation of a concept can be evoked by a verbal description or when generated in thought. Lexical access to the word can be achieved by direct access to the concept or by indirect semantic and contextual features of the concept.

Burke, MacKay, Worthley, and Wade (1991) offered a broader view of the dual access model in their Node Structure Theory of word retrieval using a network of processing units called nodes. Postulating different processes than the dual access model, Node Structure Theory still examined the connection between a semantic and phonological system. In addition, the theory proposed that word retrieval is not an all-or-none process. Once a

search is activated "to consciously retrieve information a node represents" (Burke et al., 1991, p. 543), it continues even if a memory block occurs.

Why is there a need to resolve memory blocks? One possibility is that there are states of memory tension produced by uncompleted or interrupted tasks. A great number of studies using Zeigarnik's (1927, 1938) method of task interruption (e.g. Atkinson, 1953; Moot, Teevan, & Greenfeld, 1988; Bhavasar, Jha, Joshi, & Kelkar, 1992) have been used to investigate the effects of quasi-needs on memory. "Quasi needs, according to Lewin (1926), derived its name from their close relatedness to real needs" (Van Bergen, 1968, p.254). Zeigarnik's theory stated that when a person intends to perform a task, "a quasi-need (or tension system) is established which presses in the direction of fulfillment of the intention" (Van Bergen, 1968, p. 3). Completion of the task results in the "discharge of the quasi-need" or tension system. On the other hand, quasi-needs remain charged or unsatisfied when tasks are uncompleted. Zeigarnik found that there was better recall of uncompleted tasks ("the Zeigarnik Effect") in comparison to completed tasks. Zeigarnik hypothesized that these charged quasi-needs or tension systems enhance recall.

During the search for information from long-term memory, there are five possible outcomes: 1) The correct target response is retrieved (positive hit), the search is terminated and there is a discharge of the tension system to complete the task. 2) An incorrect word is accepted as the correct target (false positive), the search is terminated and there is a discharge of the tension system to complete the task 3) If a person does not know or does not have a strong feeling that he/she knows the response, the retrieval process

comes to a halt and there is no memory block created even though a response was not found. In addition, there is no tension or quasi need created if one believes that he/she does not know the response because the search is deemed to be completed. 4) A false negative is reached when the correct target word is rejected and the search continues for another word. The tension system is still charged since the task is seen as uncompleted. 5) A need to continue the search develops when one feels that information is available (i.e. Tip-of-the-Tongue (TOT) state, Feeling of Knowing (FOK) state) in his/her memory but at this point the information is not accessible (Tulving, E. and Pearlstone, Z., 1966; Brennen, Baguley, Bright, & Bruce,1990; A. Brown, 1991; Burke et al., 1991). Similar to the Zeigarnik effect for uncompleted tasks, quasi-needs remain charged or unsatisfied since the memory block is not resolved.

Zeigarnik's study involved the presentation of 22 tasks (i.e. thread winding, paper folding, drawing) to subjects (n=32). (See Appendix AA for the list of 22 tasks used by Zeigarnik). Half of the tasks were interrupted before completion. After participating in the 22 tasks, subjects were asked to recall them. Results showed that subjects had better recall of uncompleted tasks than completed tasks. This result (better recall of uncompleted tasks, "The Zeigarnik Effect") "was ascribed to the tensions that had not been discharged because of the interruption, i.e., the continuation of quasi-needs" (Van Bergen, 1968, p. 7).

This interpretation brought forth several criticisms, such as: 1) Better recall of uncompleted tasks could be due to the "shock effect" of the interruption. 2) Better recall of uncompleted tasks could be due to subjects

assuming that these tasks may be resumed later and in turn inducing the subject to remember them. In subsequent studies, Zeigarnik controlled for factors that contributed to the above criticisms, such that subjects received equivalent treatment except for the fact that some tasks would not be completed. Once again, results showed that there was better recall of uncompleted tasks.

Memory blocks may be comparable to interrupted tasks since both are deemed to be uncompleted. If so, then in accordance with the Zeigarnik Effect there should be better recall of uncompleted word retrievals. The present study will investigate the Zeigarnik Effect and other related variables that may have an effect on memory blocks. For instance, one effect of interest is that when simple, continuous, repetitious tasks are interrupted, there does not seem to be any significant recall difference between completed and uncompleted simple tasks (Lewin, 1926; Miller, 1960). Lewin (1926) stated that simple tasks do not create quasi needs or tension and therefore recall is not enhanced. Miller (1960) stated that simple tasks "require little or no record of what has been and what remains to be accomplished, and hence they have no special representation in the subject's working memory" (Van Bergen, 1968, p. 37). Both Lewin and Miller would agree that there has to be a degree of difficulty in tasks before interruption such that subsequent recall of the uncompleted task is enhanced.

In the present studies, subjects will be asked to retrieve common English words that belong to conceptual categories (Landauer and Freedman, 1968). A stimulus-item consisting of a noun category and an

initial letter will be presented to the subject. The subject will be required to produce an item in the category that begins with the initial letter. For example, if presented with the stimulus item *Fruit-P*, peach would be an appropriate item in the category of fruit.

In experiments using this procedure (Loftus, Freedman, and Loftus, 1970; Freedman and Loftus, 1971l Loftus and Suppes, 1972), the dependent measure was latency of recall as opposed to the probability of a correct response. For example the mean retrieval time for the stimulus item Fruit-P was 1.17 seconds while a stimulus item such as Cloth-D took an average of 3.11 seconds to be retrieved. The speed of a response reflects a measure of item difficulty. Loftus and Suppes (1972) found that other variables had an effect on retrieval and degree of item difficulty. Some of these variables include: 1) Category frequency - refers to the frequency (average number of times) that a subject may come in contact with a category name. While the frequency of contact is high for the category of fruit, it is low for the category of navigation tools. 2) Word frequency - refers to the frequency (average number of times) that a subject may come in contact with a word. While the frequency of contact is high for a word like peach, it is lower for a word such as sextant. 3) Within a category, there are numerous items. Dominance refers to the highest rank position of an item in the hierarchy of responses given to a category. For example in the category of fruit, apple is the dominant item (rank 1) and a low ranking item would be fig (rank 25). 4) Higher frequency pool size - refers to the number of high frequency responses in a category. Thus, the category of fruit would have many high frequency responses (apple, orange, pear, banana, peach) and

in the category of weapon the number of high frequency responses is limited to knife and gun. 5) Total pool size of the variable refers to the total number of available correct responses. For example in the category of U.S. states the total number of available correct responses is 50. However, in the category of religious services buildings, there are only 15 responses that fit the category. Taking into consideration the above variables, the present study will use category norms from Battig and Montague's (1969) study to develop easy and difficult stimulus items.

In a study by Gardiner, Craik, and Bleasdale (1973), "Retrieval Difficulty and Subsequent Recall", subjects were initially required to produce target words when definitions were provided. Retrieval difficulty was operationally defined by the latency of retrieving a word once its definition had been presented. Thus, longer latency implied low accessibility and increased retrieval difficulty of the target words. Contrary to their expectations, Gardiner et al. found that the critical factor in subsequent recall was neither latency nor successful retrieval of the target word. The critical factor was the presence of a strong FOK or TOT state of the target word regardless of whether it was retrieved or supplied. Gardiner et al. explained the superior recall of target words with TOT states in terms of the activation of the words' attributes. These attributes are held in 'working memory' while trying to produce the target word (Brown and MacNeil, 1966). Similar to the findings of Hyde and Jenkins (1969), Gardiner et. al (1973) suggested that the activation of a word's semantic attributes enhanced subsequent recall. "The finding that words retrieved easily in the definition session (semantic memory) were least well recalled subsequently (episodic memory) indicates

that the two retrieval tasks differ in some crucial way" (Gardiner et al., 1973, p. 215).

The task developed for the present study involved subjects making responses to simple and difficult stimulus items (formatted into a question) within a fixed amount of time. If the subject provides an answer, the task is deemed to be completed. If the subject is unable to answer, the task is determined to be uncompleted. Given unlimited time, the subject may be able to answer any question. However, the fixed time limit acts as the interruption of the response to the question. Subjects will be shown an equal number of easy and difficult questions, in random order. After the series of questions is presented, the subjects will be asked to recall the noun category and initial letter of each question. Based on the Zeigarnik Effect, it is hypothesized that during recall, uncompleted questions would be better recalled than completed questions, with the effect being more pronounced with difficult items.

Experiment 1

To induce memory blocks, a method similar to that used by Landauer and Freedman (1968) was adopted: Target words were cued by a question consisting of a noun category and an initial letter of a response in the category. Category norms and items based on response frequency from Battig and Montague's (1969) study were used to establish and test easy and difficult stimulus-item combinations. It is hypothesized, that subjects will recall an equal number of completed and uncompleted easy stimulus item questions (Miller 1960). However, drawing inferences from Zeigarnik's studies, within the set of difficult stimulus item questions, there will be a better recall of the category and initial letter of uncompleted word retrievals.

METHOD

Subjects:

Fifteen students enrolled in an introductory psychology course at Saint Mary's University volunteered to be participants. Students received one credit point toward their final grades in the course.

Design:

The experimental design was a 2 (degree of difficulty-- difficult versus easy items) X 2 (completion--finished vs. unfinished questions) within-subjects study.

Apparatus:

A computer generated memory task program, Hemispheres 2.0

(MacLaboratory Inc.), was used to display 28 questions on a Macintosh LC computer with a 14 inch monitor. A stopwatch was used to time the distracting problem task and recall phase.

Materials:

Categories for the questions were selected from Battig and Montague (1969). Twenty-eight categories were selected and a standard question was prepared using each category ("*Category* that begins with the letter... ?"). The question included the first letter of the response of an item in the category. Degree of difficulty (easy or difficult) of the question was based on the items' norms established from frequency of responses in Battig and Montague's study. A frequent response to the category color would be blue, while a less frequent response would be aqua. Therefore, using these items in the category color, a difficult question would be, "Name a color that begins with the letter A?" (Aqua). An easier version would be, "Name a color that begins with the letter B?" (Blue). Two sets of 28 questions (14 easy and 14 difficult) were constructed (see Appendix A and B). The two sets of questions were symmetrical: what was easy on one set was difficult on the other and vice-versa. The selection of initial letter of the responses was balanced such that a high frequency or occurrence of any particular letter was minimized.

Two pencil and paper problem tasks extracted from the Army Beta Tests (1962) (see Appendix C and D) were used to eliminate short-term memory effects in the recall of the finished and unfinished questions. One problem task involved the solving of mazes and the other matching number to symbols.

Data sheets were used to record subjects' responses to the 28 questions (see Appendix E and F). A piece of paper with 28 blank lines (with headings "category" and "first letter") was used for the subjects to write down the probes during the recall phase of the experiment (see Appendix G).

Procedure:

Subjects were individually tested. First they were given general instructions regarding the experiment (see Appendix H) and then specific instructions on the word retrieval task (see Appendix I). Subjects were informed that a series of questions (total of 28) would appear on the screen. Each question was displayed for 6 seconds (s). Subjects read the question aloud and had to think of an answer. However, an answer was not to be said aloud until the computer presented a prompt. After the 6 s exposure to the question had elapsed, the computer displayed a prompt ("Answer") for 4 s. During the answer prompt, subjects could make an oral response to the question or remain silent if they did not have a response. When 4 s had elapsed, the answer prompt cleared from the screen and another question was displayed for 6 s. After the experimenter demonstrated this procedure subjects had the opportunity to practice the procedure on two sample questions.

After completing the demonstration, subjects began the experiment. At this point, the experimenter sat five feet behind and to the left of the subject. The experimenter recorded the subjects' responses on data sheets. Subjects were randomly given either question set 1 or question set 2; eight subjects received question set 1 and seven received question set 2. The 28

questions in a set were presented in a random order to each of the subjects.

After the 28 item task had been completed, the subjects were instructed (see Appendix J) to complete two pencil and paper problem tasks in four minutes. Specific instructions were provided at the top of each test.

After completion of the problem task, the subjects were asked to recall (see Appendix K) in any order the category and first letter of the 28 questions that had been presented. Four minutes were allotted for this recall phase. The subjects were then debriefed (see Appendix L) and awarded a credit point for participation.

Scoring:

Two methods (strict and lenient) were used to score recall. Under the lenient scoring method, subjects were given credit if they correctly recalled either the noun category or noun category and initial letter. Strict scoring method meant that credit for recall was only given if subjects correctly recalled both the noun category and initial letter. The results section in this and all subsequent experiments refers to the data obtained using the lenient scoring method. Appendix Y shows the scores obtained through strict scoring for this and all subsequent experiments.

RESULTS and DISCUSSION

Question sets 1 and 2 used in Experiment 1 had very similar completion rates for easy and difficult questions. The 14 easy questions had a mean completion rate was 87.1% (12.2 questions) and the 14 difficult questions had a mean completion rate of 39.4% (5.5 questions).

As shown in Table 1-1, easy questions had a higher mean probability of being recalled when solved or finished (.49) than when unsolved or unfinished (.36). On the other hand, difficult questions were better recalled on average when unfinished (.56) than finished (.38).

Table 1-1
Mean Recall of Items by Completion and Degree of Difficulty
(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Item Difficulty				
Easy	M	.49	.36	.42
	(SD)	(.19)	(.37)	(.29)
Difficult	M	.38	.56	.47
	(SD)	(.24)	(.29)	(.27)
	M	.43	.46	
	(SD)	(.21)	(.34)	

An analysis of variance was conducted and as shown in Table 1-2 there was no significant difference in the recall of finished versus unfinished items, $F(1,14) = .207$, $p = .6564$, recall of easy versus difficult items, $F(1,14) = .278$, $p = .6062$, and the interaction between degree of difficulty and completion, $F(1,14) = 3.436$, $p = .085$. Table 1-2 also shows eta, the square root of the proportion of variance accounted for; f, the effect size index associated with the F-test; and the power of the main and interaction effects found with the use of Cohen's (1988) power tables.

Table 1-2
Two-way Analysis of Variance

Within study C = completion (finished/unfinished)
D = degree of difficulty (easy/difficult)

Source	df	MS	F	eta	p	*f*(effect size)	power
Subjects	14	.066					
C	1	.010	.207	.12	.6564	.12	.068
Error	14	.050					
D	1	.025	.278	.14	.6062	.14	.076
Error	14	.091					
C X D	1	.349	3.436	.44	.0850	.49	.397
Error	14	.101					

Since differences in recall by completion and degree of difficulty were hypothesized (a-priori), simple effects analysis were conducted to determine the significance of completion at each level of item difficulty. Table 1-3 shows that the only simple effect that approached significance was completion at the level of difficult items, $F(1,14) = 4.086$, $p = .063$.

Table 1-3
Simple Effects of Completion and Degree of Difficulty

C = completion (finished/unfinished)
D = degree of difficulty (D1=easy; D2=difficult)

Simple Effects	F	probability
C at D1	1.282	.276
C at D2	4.086	.063

Though the results did not yield significant differences, there was a pattern in the recall of items based on degree of difficulty. Category and first letter of response item of easy questions were slightly better recalled when the questions had been finished as opposed to questions that were unfinished. Questions deemed to be easy produced a result opposite to the Zeigarnik Effect. However, a tendency toward a Zeigarnik effect was obtained with difficult questions since there was better recall of unfinished than finished. These results can be explained by either a cognitive processing theory or quasi-need or tension system theory.

Using a cognitive processing perspective, better recall of finished easy questions may have been due to the subject generating single or multiple responses. For example, the easy question - "Color that begins with B?" - could generate multiple responses such as black, blue, and brown. Therefore during the recall phase, the category color and the first letter B are easily recalled because of the cue(s) (black, brown, and/or blue). Thus by remembering the cue(s), subjects can work back to the question or probe.

Using a tension system theory approach, easy tasks do not produce better recall because there is no tension created in finishing the easy task. However, theorists state that difficult tasks produce better recall because tension has been created in the pursuit of finishing the task. After the 6 s incubation period, the subject may still be processing the difficult question even though a new question has been presented on the screen. In the recall phase, unfinished difficult questions were better recalled because of the tension created. However, difficult questions when solved reduce the level of tension and thus the ability to recall is lowered.

The method used in this experiment can simulate task interruption studies because there are several questions (tasks) and when an answer is not found within the 6 s exposure time, the question is deemed to be interrupted by the presentation of another question or task. Degree of difficulty of items produced differences in the recall of finished versus unfinished questions with uncompleted difficult items having the best recall.

Experiment 2

To study the degree of difficulty of items further, Experiment 2 used a larger number of stimulus items and a between-subjects design to investigate the degree of recall of 28 easy questions versus 28 difficult questions. Experiment 1 tested items that were categorized as easy or difficult using norms from Battig and Montague's (1969) study. In Experiment 1, it was found that, easy questions had a higher rate of completion (87.1%) than difficult questions (39.4%). Due to the high rate of easy questions solved in Experiment 1, the presentation time of the question and response time were reduced to 5 s and 3 s, respectively, in Experiment 2. It was hoped that the reduced times would increase the probability of task interruption by lowering the completion rate. On the other hand, the rate of completion of difficult questions was low. In an effort to raise the degree of completion, difficult questions in Experiment 1 that had less than 10% probability of being solved were dropped from the item list in Experiment 2. As in Experiment 1, it is hypothesized that for difficult items, there will be

significantly better recall of cues (category and/or initial letter) for uncompleted word retrievals.

METHOD

Subjects:

The participants were 40 students selected from the same source as in Experiment 1.

Design:

The experimental design was a 2 (degree of difficulty--difficult vs. easy items) X 2 (completion--finished vs. unfinished questions) study. Degree of difficulty was a between-subjects variable and completion was a within-subjects variable.

Apparatus and Materials:

The apparatus was the same as in Experiment 1. Two sets of questions (noun category and initial letter) were constructed from 28 categories selected from Battig and Montague's (1969) study. One set consisted of 28 easy questions, and the other set 28 difficult questions. Based on the data obtained from Experiment 1, the question sets were adjusted to drop items that were expected to be easy or difficult but did not turn out to be so. In addition, questions that were always or never solved by subjects were also dropped. The full set of questions for the difficult and easy conditions are provided in Appendix M. Data sheets were used to record subject's responses to the 28 questions (see Appendix N and O).

Procedure:

An equal number of subjects were randomly assigned to receive easy questions or difficult questions. The procedure was the same as in Experiment 1 except that each question was displayed for 5 s and the computer displayed a prompt ("Answer") for 3 s.

RESULTS and DISCUSSION

The easy questions had a completion rate of 78.6% (22/28 questions) and difficult questions 51.7% (14.5/28 questions).

As shown in Table 2-1, easy questions had a higher mean probability of being recalled when unsolved or unfinished (.52) than when solved or finished (.48). Difficult questions were better recalled when unfinished (.44) than finished (.36). Overall, unfinished items (.48) were better recalled than finished items (.42). The table of means also show that regardless of completion, easy items (.50) were better recalled than difficult items (.40).

An analysis of variance was conducted and as shown in Table 2-2 there was a significant difference in degree of difficulty, better recall of easy versus difficult items, $F(1,38) = 6.333$, $p=.0162$. The effect of task completion, the recall of finished versus unfinished items, approached but did not reach statistical significance, $F(1,38) = 3.412$, $p=.0725$. The interaction between degree of difficulty and completion, $F(1,38) = .503$, $p = .4825$, was not significant. Table 2-2 also shows eta, f (effect size), and power associated with the main and interaction effects.

Table 2-1

Mean Recall of Items by Completion and Degree of Difficulty

(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Item Difficulty				
Easy	**M**	**.48**	**.52**	**.50**
	(SD)	(.09)	(.14)	(.19)
Difficult	**M**	**.36**	**.44**	**.40**
	(SD)	(.26)	(.13)	(.14)
	M	**.42**	**.48**	
	(SD)	(.13)	(.20)	

Table 2-2

Two-way Analysis of Variance

Between variable: D = degree of difficulty (easy/difficult)
Within variable: C = completion (finished/unfinished)

Source	**df**	**MS**	**F**	**eta**	**p**	***f*** (effect size)	**power**
D	1	.2	6.333	.378	.0162	.400	.680
Error	38	1.2	.032				
C	1	.078	3.412	.287	.0725	.299	.429
C X D	1	.012	.503	.114	.4825	.114	.105
Error	38	.023					

Though a significant interaction effect was not obtained, a simple effect analysis was conducted to keep continuity with Experiment 1 and test the differences in recall as initially hypothesized (a-priori). Table 2-3 shows that the only simple effect that approached significance was completion of difficult items , F (1,38) =3.268, p=.079.

Table 2-3

Simple Effects of Completion and Degree of Difficulty

C = completion (finished/unfinished)
D = degree of difficulty (D1=easy; D2=difficult)

Simple Effects	F	probability
C at D1	.647	.426
C at D2	3.268	.079

The results showed that easy items were recalled at a significantly higher rate than difficult items. Though not significant, there was also a pattern of responding based on completion: Unfinished stimulus-items were recalled more than finished stimulus-items for both easy and difficult questions. The findings yielded a pattern of recall similar to the Zeigarnik effect.

Similar to the findings in Experiment 1, lower recall of solved difficult items may be attributed to the lack of tension created by successful retrievals. However, tension system theory would support the view that unsolved difficult items were better recalled because of the tension created by retrieval failure.

The results in Experiment 2 do not support the cognitive processing perspective (enhanced recall of finished items because the answer acts as an additional recall cue) since there was slightly better recall of unfinished items compared to finished items.

Experiment 3

In Experiment 3, degree of difficulty and completion of tasks was examined using a within- subjects design similar to Experiment 1. Two data sets containing 28 stimulus item questions were developed using the data obtained from Experiments 1 and 2.

To ensure that subjects possessed knowledge to answer all the question in the data sets, a recognition test was developed and administered at the end of the testing session (cf. Brown & MacNeil, 1966). Several choices were given to the stimulus item question and the subject, without any additional training, selected the correct word from the choices. It is hypothesized that subjects hold enough knowledge to answer the 28 questions on the recognition test. As in Experiment 1 and 2, it is hypothesized that for difficult items, there will be significantly better recall of cues for uncompleted word retrievals but not for easy items.

METHOD

Subjects:

The participants were 36 students selected from the same source as in Experiment 1.

Design:

The experimental design was a 2 (degree of difficulty--difficult vs. easy items) X 2 (completion--finished vs. unfinished questions) within-subjects study.

Apparatus and Materials:

The apparatus and most of the materials were identical to Experiment 1. Two sets of 28 questions (14 easy and 14 difficult) consisting of a noun category and a initial letter were constructed using subject data obtained from Experiment 1 and Experiment 2 (see Appendix P and Q). Data sheets were used to record subject's responses to the 28 questions (see Appendix R and S).

A pencil and paper recognition test was developed using the 28 questions that were presented on the computer. Four choices were provided for each question with a fifth option for the subject to write in a response if one could not be selected from the choices provided (see Appendix T and U).

Procedure:

An equal number of subjects were randomly assigned to receive question set 1 or question set 2. The testing procedure was identical to Experiment 1 with the following exception: After the completion of the recall phase, subjects were given the recognition test to complete in five minutes.

RESULTS and DISCUSSION

Easy questions had a completion rate of 82.1% (11.5/14 questions)

and difficult questions, 43.3% (6.1/14 questions).

As shown in Table 3-1, easy questions had a higher mean probability of being recalled when finished (.46) than when unfinished (.40). Difficult questions were better recalled when unsolved or unfinished (.48) than solved or finished (.45).

Table 3-1

Mean Recall of Items by Completion and Degree of Difficulty

(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Item Difficulty				
Easy	**M**	**.46**	**.40**	**.43**
	(SD)	(.17)	(.28)	(.22)
Difficult	**M**	**.45**	**.48**	**.47**
	(SD)	(.44)	(.20)	(.32)
	M	**.45**	**.44**	
	(SD)	(.34)	(.24)	

An analysis of variance was conducted and as shown in Table 3-2 there was no significant difference in the recall of finished versus unfinished items, $F(1,35) = .505$, $p = .450$), recall of easy versus difficult items, $F(1,35) = .069$, $p = .785$, and the interaction between degree of difficulty and completion, $F(1,35) = 1.557$, $p = .2125$. Table 3-2 also shows eta, *f* (effect size), and power associated with the main and interaction effects.

Table 3-2
Two-way Analysis of Variance

Between variables: D = degree of difficulty (easy/difficult)
Within variables: C = completion (finished/unfinished)

Source	df	MS	F	eta	p	*f*(effect size)	power
Subjects	35	.109					
C	1	.047	.505	.119	.4500	.119	.096
Error	35	.093					
D	1	.006	.069	.044	.7950	.044	.050
Error	35	2.859	.082				
D X C	1	.109	1.557	.206	.2125	.211	.220
Error	35	.070					

Though a significant interaction effect was not obtained, a simple effect analysis was conducted to keep continuity with Experiment 1 and test the differences in recall as initially hypothesized (a-priori). Table 3-3 shows that the simple effects of completion on the levels of difficulty were not significant.

Table 3-3
Simple Effects of Completion and Degree of Difficulty

C = completion (finished/unfinished)
D = degree of difficulty (D1=easy; D2=difficult)

Simple Effects	F	probability
C at D1	.067	.795
C at D2	2.820	.222

Though there were no statistically significant effects of the independent variables, there was a a pattern in the recall of questions based on completion and degree of difficult similar to Experiment 1. Easy questions were better recalled when finished then when unfinished, thereby producing an effect opposite to the Zeigarnik Effect. On the other hand, the Zeigarnik Effect was obtained with difficult questions since recall was better for unfinished stimulus-items. Explanations for these findings would be similar to the cognitive processing and tension system theories used in interpreting results in Experiment 1. Unfinished easy tasks neither have an additional recall cue (i.e. target word) nor create enough tension to enhance recall. Unfinished difficult questions produce better recall because tension has been created by retrieval failure and the pursuit of finishing the task. Tension is discharged when questions are solved. Subsequently, unfinished difficult questions are better recalled than finished difficult questions.

Subjects were able to answer correctly 94% of the 28 questions on the recognition test. Twenty-six of the 28 items were consistently recalled by every subject in question set 1 and 27 out of 28 in question set 2. In question set 1, the stimulus items that caused difficulties were: vegetable-K, kitchen utensil -L and in question set 2 a few subjects had difficulty with the stimulus item Ship-T. If subjects have a strong feeling that they do not know an answer then the search may be terminated. Though these three difficult stimulus items are recorded as uncompleted, they could actually be seen as completed since the search was terminated. Overall, however, the recognition test results suggest that participants in the present research know the answers to probes which they were presented.

Experiment 4

The completion rates in the first three experiments differed considerably for easy and difficult items. The first three experiments tended to show a Zeigarnik Effect for difficult items and not for the easy items. One reason for not obtaining the Zeigarnik Effect for easy items may be that there are simply too few unfinished items. Therefore, items selected for Experiment 4 are intended to be more difficult such that the overall rate of completion is 50%. Thus, with a 50% completion rate, the design of the experiment would be in a better position to test the Zeigarnik Effect. The recognition test will not be used in Experiment 4 since the stimulus items chosen had a 94% correct score on the recognition test in Experiment 3 and it may be assumed that subjects have knowledge of the answers to the probe questions. The question is whether with uniformly more difficult items, will there will be better recall of uncompleted tasks than completed tasks?

METHOD

Subjects:

The participants were 53 students selected from the same source as in Experiment 1.

Design:

The experimental design was a within-subjects study focusing on the recall of finished versus unfinished items.

Apparatus and Materials:

The apparatus was the same as that used earlier. Because

Experiment 4 was run before Experiment 3, an item analysis of the data obtained in Experiment 2 was done to construct a 24 category/question set based on rate of completion. The probability of completion ranged from 20% to 80% with the central tendencies (mean,median, and mode) equaling 50%. Categories for the questions had originally been selected from Battig and Montague's (1969) study. The full set of stimulus item questions is provided in Appendix V. Data and recall sheets were the same as in the first three experiments except that they were adjusted for the fewer number of probes.

Procedure:

The procedure was identical to Experiment 2.

RESULTS and DISCUSSION

The 24 stimulus item set had a completion rate of 11.3 items or 47%. Table 4-1 shows that finished items actually had a higher mean probability of being recalled (.46) than unfinished items (.40).

Table 4-1
Mean Recall of Items by Completion and Degree of Difficulty
(M = mean, SD= standard deviation)

	Finished	
	Yes	No
M	**.46**	**.40**
(SD)	(.14)	(.16)

An analysis of variance was conducted and as shown in Table 4-2, there was almost a significant difference in the recall of finished versus unfinished items, $F(1,52) = 3.77$, $p=.055$. Finished items were better recalled than unfinished items. Table 4-2 also shows an f value of .268 depicting a medium effect size and power value of .520 at an alpha level of .05.

Table 4-2

One-Way Analysis of Variance

Completion (C) = Finished/Unfinished

Source	df	MS	F	eta	p	f(effect size)	power
Subjects	52	.0806					
C	1	.248	3.77	.260	.055	.268	.520
Error	52	.066					

The results obtained in experiment 4 are opposite to the Zeigarnik effect - finished items were better recalled than unfinished items.

Gardiner et al. (1973) found that difficult retrieval during the initial session (semantic memory) may be beneficial for later retrieval (episodic memory). At first glance, the findings of Gardiner et. al. would appear applicable to this experiment since the items used in Experiment 4 were deemed to be more difficult. However, opposite to the findings of Gardiner et al., Experiment 4 showed that successful retrieval of the target word to a stimulus item question (using semantic memory) led to a higher rate of subsequent recall (episodic memory) of the question.

Under a cognitive processing perspective, finished items could have been recalled at a higher rate because there is an additional recall cue - the answer to the question which may be remembered. Since the recall phase occurred only four minutes after the questions were presented, the answers could be readily available as cues for recall. The answers as cues seem to be more of a critical factor in recall than the predicted tension states created by uncompleted tasks.

Experiment 5

Results from Experiment 4 suggests that finished items were better recalled that unfinished items because the answer retrieved in the first phase of testing may have acted as a retrieval cue during the recall phase. What would happen if the recall test was delayed? Would the strength of the cues (solved questions) diminish and lower the recall of solved questions, thereby allowing a Zeigarnik effect to become apparent. Experiment 5 was intended to answer this question by using immediate and delayed recall. It is hypothesized that delayed recall may produce a Zeigarnik Effect while immediate recall may result in an effect opposite to the Zeigarnik Effect (based on results from Experiment 4).

METHOD

Subjects:

The participants were 30 students selected from the same source as in Experiment 1.

Design:

The experimental design was a 2 (time--immediate versus delayed recall) X 2 (completion --finished vs. unfinished questions) study. Time was a between-subjects variable and completion a within-subjects variable.

Apparatus and Materials:

The apparatus and most of the materials were the same as in the previous experiments except that the set of materials was changed slightly. Based on an item analysis of the data obtained in Experiment 4, a 26 category/question data set was assembled based on rate of completion. The probability of completion ranged from 10% to 85% with the central tendencies (mean,median, and mode) equaling approximately 50%. Categories for the questions had originally been selected from Battig and Montague's (1969) study. The full set of questions is provided in Appendix W.

Data and recall sheets were the same as in previous experiments adjusted only by the different number of probe questions presented.

Procedure:

Thirty subjects were randomly assigned to either the Immediate Test group or Delayed Test group. The Immediate Test group was given the entire procedure during the first session. The Delayed Test group was given parts of the procedure in session one and returned one week later to complete the remainder of the procedure.

The procedure used was the same as in Experiment 4 except as follows: After completing the 26 question set and the distracting problem

tasks, subjects in the Immediate Test group attempted to recall the category and first letter of the 26 questions. Subjects in the Delayed Test group were asked to return a week later to do another experiment. These subjects were not told that they would be completing the remainder of the experiment (recall phase) that they had just participated in and therefore they were expecting a new experimental procedure.

RESULTS and DISCUSSION

The 26 stimulus item set had a completion rate of 10.2 items or 39.3%.

As shown in Table 5-1, finished items had a higher probability of being recalled (X= .52) than unfinished items (X=.43). Table 5-1 also shows that time was a significant variable with better performance during immediate recall (X =.32) as opposed to delayed recall (X = .26).

Table 5-1

Mean Recall of Items by Completion and Degree of Difficulty

(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Time				
Immediate	**M**	**.52**	**.43**	**.47**
	(SD)	(.18)	(.16)	(.17)
Delayed	M	**.32**	**.26**	**.29**
	(SD)	(.11)	(.19)	(.15)
	M	**.42**	**.35**	
	(SD)	(.22)	(.16)	

The analysis of variance in Table 5-2 shows that the difference in time of recall was significant ($F(1,28) = 13.372$, $p=.001$). Recall was better when it was immediate as opposed to a seven-day delay. There was no statistical difference between the levels of completion ($F(1,28) = 3.10$, $p=.0892$). There was no significant interaction between the variables of completion and time of recall ($F(1,28) = .198$, $p=.6596$). Table 5-2 also shows eta, f (effect size), and power associated with the main and interaction effects.

Table 5-2

Two-way Analysis of Variance

Between variables: T = Time of Recall (Immediate/Delayed)
Within variables: C = completion (finished/unfinished)

Source	df	MS	F	eta	p	f(effect size)	power
T	1	1.58	13.372	.569	.0010	.691	.942
Error	28	.118					
C	1	.215	3.10	.315	.0892	.330	.370
T X C	1	.014	.198	.084	.6596	.084	.070
Error	28	.069					

Although there was no significant difference in the recall of completed and uncompleted questions, the same pattern was obtained as in Experiment 4, namely finished questions tended to be better recalled than unfinished questions. This pattern is opposite to the Zeigarnik effect. The

same explanation used in the previous experiments can be used here that finished items could be recalled at a higher rate because the answer to the question is remembered and acts as a cue. However, Experiment 5 went one step further looking at immediate versus delayed recall. The results showed that there was a significant difference between immediate and delayed recall. Delaying recall reduced both the recall of finished versus unfinished questions but the pattern remained with finished questions being better recalled than unfinished questions.

In summary, the results from Experiment 5 (and Experiment 4) are constant with the notion that the critical factor in subsequent recall may be retrieval cues (answers to the stimulus item questions).

GENERAL DISCUSSION

The purpose of the study was to investigate if memory blocks can produce a Zeigarnik Effect. The overall tenor of these experiments is that they can not. Still, the first three experiments did show that unfinished items were slightly better recalled than finished items. Though there were no statistical significance, Experiments 1 and 3 showed two patterns: better recall of uncompleted difficult items (Zeigarnik Effect) and better recall of completed easy items (an effect opposite to the Zeigarnik Effect). In Experiment 2 (between-subjects design), the results showed a slightly better recall of unfinished items compared to finished items. This Zeigarnik Effect-like trend was found for both easy and difficult items. Experiments 4 and 5 controlled for item difficulty and examined rate of completion of recalled items. The results did not yield a

Zeigarnik Effect but a pattern showing better recall of finished items. This was true whether the recall test was administered immediately (Experiment 4 and 5) or delayed by a week (Experiment 5). Two theories, cognitive processing and tension system, were used to explain the above patterns.

Cognitive Processing Theory

Miller (1967) suggested that when a person is interrupted in doing a task, such as painting a wall, the task becomes a strong cue as to whether it should be resumed. Memory limitations become apparent when the environment fails to define the re-entry point. Thus, cued subjects have better recall than noncued subjects because they have a better retrieval plan defined by the experimental context. Miller's analysis may explain the better recall of finished stimulus item questions in the present study. When a task is completed, the answer becomes a cue for subsequent recall. Patterson (1972) stated that the difference between cued and noncued conditions is that there is a greater demand on the information processing capacity of the noncued person. Subjects in both cued and noncued conditions need to develop retrieval strategies within each category. However, noncued subjects needed to keep track of the categories that were recalled and those yet to be recalled.

Craik and Tulving's (1975) study, "Depth of Processing and the Retention of Words in Episodic Memory", may offer another explanation as to why on occasion finished stimulus items were better recalled in the present five studies. In Craik and Tulving's study, subjects had to provide a yes or no responses to various questions depicting levels of processing (see Appendix Z). For example, when shown the word *Shark*, subjects were either asked: 1) Is the

word a type of fish? (answer = yes) or 2) Is the word a type of bird? (answer = no). Results showed that there was better recall of words associated with yes or positive responses. Craik and Tulving (1975) offered the explanation that "positive responses would be integrated with the question, and, thus arguably, formed more elaborate encodings which supported better retention [and retrieval] performance" (p.283). This explanation was adopted from Schulman's (1974) principle of congruity which states that "memory performance is enhanced to the extent that the context, or encoding question, forms an integrated unit with the word presented. A congruous encoding yields superior memory performance because a more elaborate trace is laid down and because in such cases the structure of semantic memory can be utilized more effectively to facilitate retrieval" (Craik and Tulving, 1975, p.268). In the present study, finished items may have been better recalled because the category and response or exemplar forms an integrated unit which would facilitate retrieval.

Craik and Tulving's (1975) level of processing study can be of further benefit in offering an explanation for the Zeigarnik Effect when it is obtained: Uncompleted questions may be processed at a deeper level, thereby enhancing their subsequent recall.

In general, the five experiments in this project did not reliably produce the predicted Zeigarnik effect--the better recall of uncompleted tasks. Unlike Zeigarnik's studies which incorporated different tasks into the experimental design, the five experiments in this study used one type of task--solving stimulus item questions. This study made an assumption that each stimulus-item question would represent a separate task that could be interrupted when a target word was not produced within a specified period of time. Therefore, this

assumption may have not been valid and hence a Zeigarnik effect was never found. In fact, when controlling for degree of difficulty, Experiment 4 and 5 produced an effect that was opposite to the Zeigarnik Effect--better recall of finished stimulus items than unfinished stimulus items.

Quasi-need or System Tension Theory

Completion of a task results in the "discharge of the quasi-need" or tension system. On the other hand, quasi-needs remain charged or unsatisfied when tasks are uncompleted. Lewin (1926) stated that easy tasks do not create quasi needs or tension and there does not seem to be any significant recall difference between completed and uncompleted easy tasks. The pattern of subsequent recall of easy cues for the first three experiments was similar to Lewin's hypothesis.

Difficult tasks produce tension when the task is uncompleted, thus enhancing subsequent recall. The poorer recall of finished difficult tasks may have been due to discharged tension system which may lower subsequent recall. Subsequent recall of difficult uncompleted tasks for the first three experiments tended to be better than completed difficult tasks.

Using only difficult stimulus-items that had a mean completion rate of 50%, Experiment 4 and 5 results showed better recall of finished questions, a result at odds with the prediction of the tension system theory. Therefore a preferable conclusion is that the critical factor in determining a higher rate of subsequent recall was retrieval cues (in the form of remembered answers to probes) as opposed to the predicted tension states produced by uncompleted tasks.

Perhaps other factors may have an influence on the tension created by uncompleted tasks. Studies have shown that factors such as achievement and fear of failure (e.g. Atkinson, 1953; Moot, Teevan, & Greenfeld, 1988; Bhavsar, Jha, Joshi, & Kelkar, 1992) can have an influence on the Zeigarnik Effect. Atkinson (1953) found that when completion was perceived as success and incompletion as failure, subjects with low achievement levels had better recall of finished tasks. On the other hand, high achievers had better recall of unfinished tasks. Referring to the subjects' perception of failure and success as fear of failure, Moot et al. (1988) replicated the study and found a similar relationship between achievement level and recall of completed versus uncompleted tasks. Although the present study used university students as subjects, the assumption that they had similar achievement levels may not be appropriate. Hence, in future studies of the present type, it may be advisable to measure achievement levels.

Conclusion

The current results indicate that memory blocks that occurred under the conditions of Experiments 1-5 do not produce a Zeigarnik Effect. The subsequent recall of the probe questions leading to retrieval failures was not reliably better than those leading to successful retrievals.

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APPENDIX AA

The Twenty-two Tasks Used in the Task Interruption Study by Zeigarnik*

1. Monogram
2. Pentagram
3. Thread winding
4. Beads
5. Poem
6. Spiral
7. Paper-folding
8. Crosses in ellipse
9. Matches
10. Box
11. Triangles
12. Counting backwards
13. Drawing a vase
14. Flag at angles
15. Honeycomb pattern
16. Multiplication
17. Mending a chair from a match box
18. Straightening wire
19. Pattern of a carpet
20. Crochet
21. Riddle
22. Printing

* Extracted from Van Bergen, 1968, p.4.

APPENDIX A

Questions will consist of a category with either the first letter of the easy or difficult response.

Difficult question: Name a **flower** that begins with **G**?
Easy question: Name a **flower** that begins with **D**?

(**Note**: After each target item, the number in brackets represents the rank of the item found in Battig and Montague's (1969) study - "Category Norms for Verbal Items in 56 Categories".)

QUESTION SET 1

EASY ITEMS:

CATEGORY	First Letter	Target Item (rank)
FLOWER	D	Daisy (4)
METAL	C	Copper (3)
COUNTRY	M	Mexico (9)
CLOTH	S	Silk (3)
COLOR	B	Blue (1)
U.S. STATE	N	New York (1)
SNAKE	C	Cobra (3)
MUSICAL INSTRUMENT	T	Trumpet (3)
SPORT	G	Golf (7)
TOY	T	Truck (5)
FRUIT	P	Pear (3)
TREE	P	Pine (3)
TYPE OF SHIP	S	Sailboat (1)
WEAPON	B	Bomb (4)

Appendix A (continued)

DIFFICULT ITEMS:

CATEGORY	First Letter	Target Item (rank)
BIRD	M	Mockingbird (32)
INSECT	H	Hornet (19)
TOOL	F	File (17)
ALCOHOLIC BEVERAGE	V	Vermouth (12)
KITCHEN UTENSIL	L	Ladle (24)
FOOTWEAR	C	Cleats (23)
SCIENCE	R	Radiology (25+)
ANIMAL	O	Ox (40+)
PRECIOUS STONE	A	Amethyst (19)
CRIME	P	Perjury (22)
FISH	A	Angelfish (34)
OCCUPATION	W	Writer (36)
VEGETABLE	K	Kale (24)
ARTICLE OF CLOTHING	R	Raincoat (33)

APPENDIX B

Questions will consist of a category with either the first letter of the easy or difficult response.

Difficult question: Name a **flower** that begins with **G**?
Easy question: Name a **flower** that begins with **D**?

(**Note**: After each target item, the number in brackets represents the rank of the item found in Battig and Montague's (1969) study - "Category Norms for Verbal Items in 56 Categories".)

QUESTION SET 2

DIFFICULT ITEMS:

CATEGORY	First Letter	Target Item (rank)
FLOWER	G	Gardenia (11)
METAL	B	Brass (9)
COUNTRY	T	Turkey (34)
CLOTH	B	Burlap (12)
COLOR	A	Aqua (22)
U.S. STATE	S	South Carolina (21)
		South Dakota (43)
SNAKE	K	King(cobra) (15)
MUSICAL INSTRUMENT	M	Marimbas (40+)
SPORT	J	Jai Alai (36) Judo (39)
TOY	R	Rattle(21)
FRUIT	F	Fig (25)
TREE	R	Redwood (10)
TYPE OF SHIP	T	Tugboat (12) Tanker (21)
WEAPON	D	Dagger (40)

Appendix B (continued)

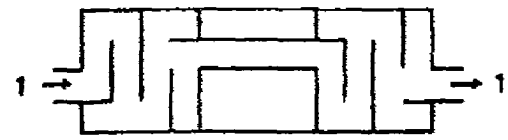
EASY ITEMS:

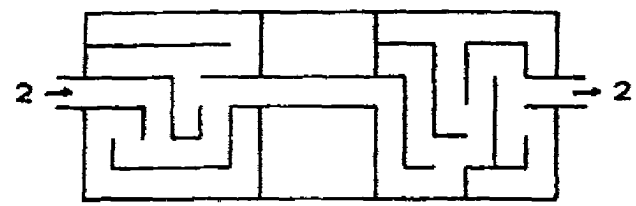
CATEGORY	First Letter	Target Item (rank)
BIRD	E	Eagle (5)
INSECT	M	Mosquito (4)
TOOL	W	Wrench (9)
ALCOHOLIC BEVERAGE	W	Whisky (2)
KITCHEN UTENSIL	F	Fork (3)
FOOTWEAR	B	Boots (2)
SCIENCE	B	Biology (4)
ANIMAL	E	Elephant (7)
PRECIOUS STONE	R	Ruby (2)
CRIME	R	Rape (2)
FISH	S	Shark (3)
OCCUPATION	T	Teacher (3)
VEGETABLE	B	Beans (4)
ARTICLE OF CLOTHING	C	Coat (7)

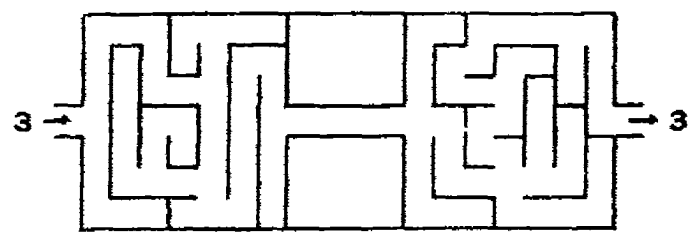
APPENDIX C

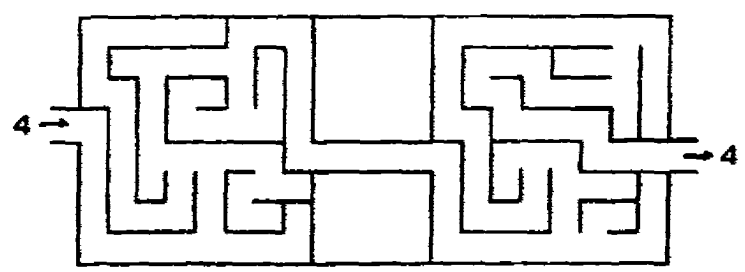
Extracted from the Army Beta Test (1962)

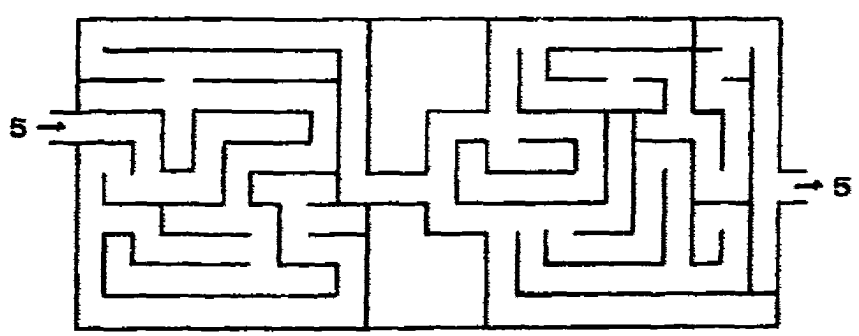
TEST 1 In each problem, mark the shortest path from the arrow at the left to the arrow at the right, but do not cross any lines.









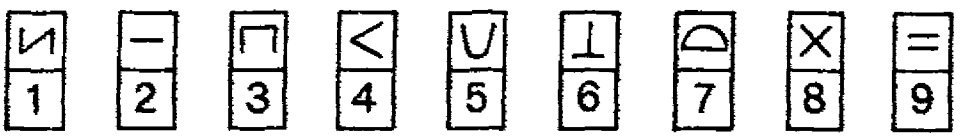


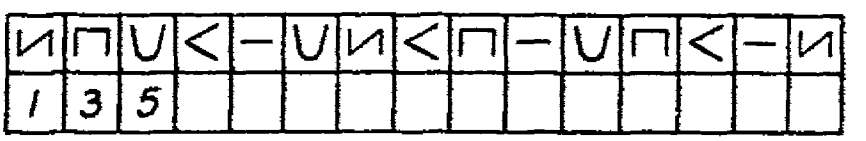
END OF TEST.

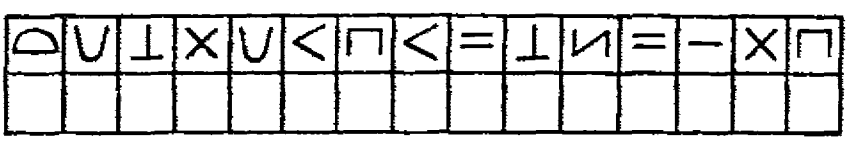
APPENDIX D

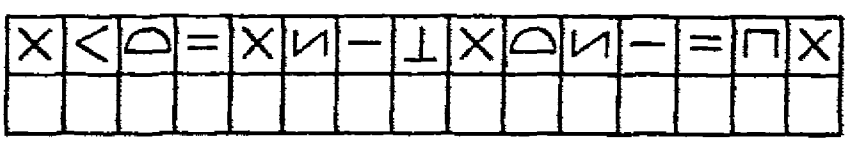
Extracted from the Army Beta Test (1962)

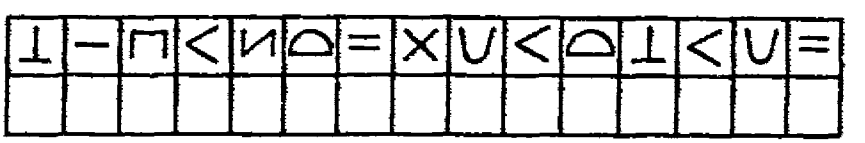
TEST 2 Put the right number under every mark.

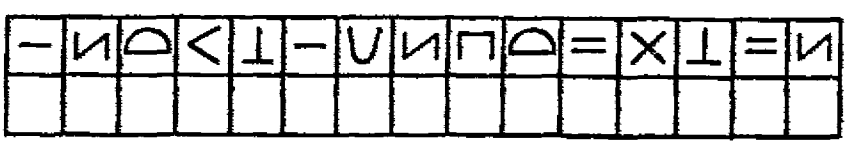


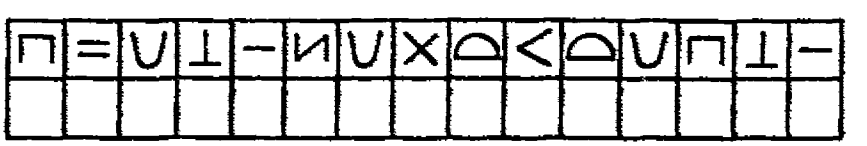












END OF TEST.

APPENDIX E

DATA SHEET (Question Set 1)

Order	Recall	Easy Category	(First Letter)
		FLOWER	D
		METAL	C
		COUNTRY	M
		CLOTH	S
		COLOR	B
		U.S. STATE	N
		SNAKE	C
		MUSICAL INSTRUMENT	T
		SPORT	G
		TOY	T
		FRUIT	P
		TREE	P
		TYPE OF SHIP	S
		WEAPON	B

Order	Recall	Difficult Category	(First Letter)
		BIRD	M
		INSECT	H
		TOOL	F
		KITCHEN UTENSIL	L
		ALCOHOLIC BEVERAGE	V
		FOOTWEAR	C
		SCIENCE	R
		ANIMAL	O
		PRECIOUS STONE	A
		CRIME	P
		FISH	A
		OCCUPATION	W
		VEGETABLE	K
		ARTICLE OF CLOTHING	R

APPENDIX F

DATA SHEET (Question Set 2)

Order Recall	Difficult Category	(First Letter)
	FLOWER	G
	METAL	B
	COUNTRY	T
	CLOTH	B
	COLOR	A
	U.S. STATE	S
	SNAKE	K
	MUSICAL INSTRUMENT	M
	SPORT	J
	TOY	P
	FRUIT	F
	TREE	R
	TYPE OF SHIP	T
	WEAPON	D

Order Recall	Easy Category	(First Letter)
	BIRD	E
	INSECT	M
	TOOL	S
	KITCHEN UTENSIL	F
	ALCOHOLIC BEVERAGE	W
	FOOTWEAR	B
	SCIENCE	B
	ANIMAL	E
	PRECIOUS STONE	R
	CRIME	R
	FISH	S
	OCCUPATION	T
	VEGETABLE	B
	ARTICLE OF CLOTHING	C

APPENDIX G

	CATEGORY	FIRST LETTER
Example	University	S
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		

APPENDIX H

General Instructions to Subject

You will be participating in a response task, whereby a series of individual questions will be displayed to you and you will be prompted to answer. At any time during the experiment if you do not wish to continue, you may withdraw from the experiment and still receive credit points for participation.

APPENDIX I

Instructions: Question/Answer

You will be shown a set of 28 questions. Each question will be displayed for 6 seconds on the computer screen. During these 6 seconds read the question aloud and think of an answer. However, do not say the answer until the computer prompts you for one. After the 6 seconds have elapsed, the computer will display a prompt that says "Answer". Now, you will have four seconds to tell me your answer.

A question will consist of a category and the first letter of the answer. For example: If the question was - University that begins with the letter S? University would be the category and S would be the first letter of the answer. When the question is displayed, you will read it aloud: University that begins with the letter S? When the answer prompt is displayed, you will tell me your answer. The answer could be Saint Mary's University.

After the four second answer prompt, the computer screen will clear and another question will be displayed. Stop working on the previous question and work on the question that is displayed. Please, do not revert back to solving previous questions.

To summarize: Each question will be displayed for 6 seconds on the computer screen. During these six seconds read the question aloud and try to think of an answer. When the computer prompts you for an answer, only then should you respond. Any questions?

APPENDIX J

Instructions: Problem Task

(After completion of task in Appendix I)

Please do the following problem tasks. Instructions are provided on the top of each test. You will have four minutes to complete both tests.

APPENDIX K

Instructions: Recall Task

(After completion of task in Appendix J)

You were shown 28 questions, each consisting of a category and the first letter of the answer. Please recall the category and the first letter of the answer. You do not have to recall your answer, only the category and the first letter of the answer as displayed on the computer. You will have 4 minutes to recall, in any order, as many (category and first letter) as you can. *(provide recall sheet)*

APPENDIX L

Debriefing Form:

You have just participated in a study that was looking at recall of easy versus difficult questions. Would answered questions be recalled better than questions that were unanswered. The problem task was used to disrupt short term memory, such that recall would be based on long term memory. Any questions? For your participation in this experiment, you will be awarded one credit (1 credit per 45 minutes of test time).

Thank you for your participation.

APPENDIX M

Questions will consist of a category with either the first letter of the easy or difficult response.

Difficult question: Name a **flower** that begins with **G**?

Easy question: Name a **flower** that begins with **D**?

(**Note**: After each target item, the number in brackets represents the rank of the item found in Battig and Montague's (1969) study - "Category Norms for Verbal Items in 56 Categories".)

Category	Easy (rank)	Difficult (rank)
FLOWER	Daisy (4)	Gardenia (11) Geranium (16)
BIRD	Eagle (5)	Mockingbird (32)
INSECT	Mosquito (4)	Hornet (19)
TOOL	Saw (2)	File (17)
KITCHEN UTENSIL	Fork (3)	Ladle (24)
METAL	Copper (3)	Brass (9)
COUNTRY	Mexico (9)	Turkey (34)
CLOTH	Silk (3)	Burlap (12)
COLOR	Blue (1)	Aqua (22)
U.S. STATE	New York (1)	South Carolina (21) South Dakota (43)
SNAKE	Cobra (3)	King(cobra) (15)
MUSICAL INSTRUMENT	Trumpet (3)	Marimbas (40+)
SPORT	Golf (7)	Jai Alai (36) Judo (39)
TOY	Truck/Train (5)	Rattle(21)
ALCOHOLIC BEVERAGE	Whisky (2)	Vermouth (12)

Appendix M (continued)

Category	Easy (rank)	Difficult (rank)
FRUIT	Pear (3)	Fig (25)
TREE	Pine (3)	Redwood (10)
TYPE OF SHIP	Sailboat (1)	Tugboat (12) Tanker (21)
WEAPON	Bomb (4)	Dagger (40)
FOOTWEAR	Boots (2)	Cleats (23)
SCIENCE	Biology (4)	Radiology
ANIMAL	Elephant (7)	Opossum (42+)
PRECIOUS STONE	Ruby (2)	Amethyst (19)
CRIME	Rape (2)	Perjury (22)
FISH	Shark (3)	Angelfish (34)
OCCUPATION	Teacher (3)	Writer (36)
VEGETABLE	Beans (4)	Kale (24)
ARTICLE OF CLOTHING	Coat (7)	Raincoat (33)

APPENDIX N

DATA SHEET

Order	Recall	Category	(Easy Letter)
		FLOWER	D
		BIRD	E
		INSECT	M
		TOOL	S
		KITCHEN UTENSIL	F
		METAL	C
		COUNTRY	M
		CLOTH	S
		COLOR	B
		U.S. STATE	N
		SNAKE	C
		MUSICAL INSTRUMENT	T
		SPORT	G
		TOY	T
		ALCOHOLIC BEVERAGE	W
		FRUIT	P
		TREE	P
		TYPE OF SHIP	S
		WEAPON	B
		FOOTWEAR	B
		SCIENCE	B
		ANIMAL	E
		PRECIOUS STONE	R
		CRIME	R
		FISH	S
		OCCUPATION	T
		VEGETABLE	B
		ARTICLE OF CLOTHING	C

APPENDIX O

DATA SHEET

Order	Recall	Category	(Difficult Letter)
		FLOWER	G
		BIRD	M
		INSECT	H
		TOOL	F
		KITCHEN UTENSIL	L
		METAL	B
		COUNTRY	T
		CLOTH	B
		COLOR	A
		U.S. STATE	S
		SNAKE	K
		MUSICAL INSTRUMENT	M
		SPORT	J
		TOY	R
		ALCOHOLIC BEVERAGE	V
		FRUIT	F
		TREE	R
		TYPE OF SHIP	T
		WEAPON	D
		FOOTWEAR	C
		SCIENCE	R
		ANIMAL	O
		PRECIOUS STONE	A
		CRIME	P
		FISH	A
		OCCUPATION	W
		VEGETABLE	K
		ARTICLE OF CLOTHING	R

APPENDIX P

Questions will consist of a category with either the first letter of the easy or difficult response.

Difficult question: Name a **flower** that begins with **G**?
Easy question: Name a **flower** that begins with **D**?

(**Note**: After each target item, the number in brackets represents the rank of the item found in Battig and Montague's (1969) study - "Category Norms for Verbal Items in 56 Categories".)

QUESTION SET 1

CATEGORY	Easy (rank)
FLOWER	Daisy (4)
METAL	Copper (3)
COUNTRY	Mexico (9)
CLOTH	Silk (3)
COLOR	Blue (1)
U.S. STATE	New York (1)
SNAKE	Cobra (3)
MUSICAL INSTRUMENT	Trumpet (3)
SPORT	Golf (7)
TOY	Truck (5)
FRUIT	Pear (3)
TREE	Pine (3)
TYPE OF SHIP	Sailboat (1)
WEAPON	Bomb (4)

Appendix P (continued)

CATEGORY	Difficult
BIRD	Mockingbird (32)
INSECT	Hornet (19)
TOOL	File (17)
ALCOHOLIC BEVERAGE	Vermouth (12)
KITCHEN UTENSIL	Ladle (24)
FOOTWEAR	Cleats (23)
SCIENCE	Radiology
ANIMAL	Ox (40+)
PRECIOUS STONE	Amethyst (19)
CRIME	Perjury (22)
FISH	Angelfish (34)
OCCUPATION	W iter (36)
VEGETABLE	Kale (24)
ARTICLE OF CLOTHING	Raincoat (33)

APPENDIX Q

Questions will consist of a category with either the first letter of the easy or difficult response.

Difficult question: Name a **flower** that begins with **G**?

Easy question: Name a **flower** that begins with **D**?

(**Note**: After each target item, the number in brackets represents the rank of the item found in Battig and Montague's (1969) study - "Category Norms for Verbal Items in 56 Categories".)

QUESTION SET 2

CATEGORY	Difficult Item (rank)
FLOWER	Gardenia (11) Geranium (16)
METAL	Brass (9)
COUNTRY	Turkey (34)
CLOTH	Burlap (12)
COLOR	Aqua (22)
U.S. STATE	South Carolina (21)
	South Dakota (43)
SNAKE	King(cobra) (15)
MUSICAL INSTRUMENT	Marimbas (40+)
SPORT	Jai Alai (36) Judo (39)
TOY	Rattle(21)
FRUIT	Fig (25)
TREE	Redwood (10)
TYPE OF SHIP	Tugboat (12) Tanker (21)
WEAPON	Dagger (40)

Appendix Q (continued)

CATEGORY	Easy item (rank)
BIRD	Eagle (5)
INSECT	Mosquito (4)
TOOL	Wrench (9)
ALCOHOLIC BEVERAGE	Whisky (2)
KITCHEN UTENSIL	Fork (3)
FOOTWEAR	Boots (2)
SCIENCE	Biology (4)
ANIMAL	Elephant (7)
PRECIOUS STONE	Ruby (2)
CRIME	Rape (2)
FISH	Shark (3)
OCCUPATION	Teacher (3)
VEGETABLE	Beans (4)
ARTICLE OF CLOTHING	Coat (7)

APPENDIX R

DATA SHEET (Question Set 1)

Order	Recall	EasyCategory	(First Letter)
		FLOWER	D
		METAL	C
		COUNTRY	M
		CLOTH	S
		COLOR	B
		U.S. STATE	N
		SNAKE	C
		MUSICAL INSTRUMENT	T
		SPORT	G
		TOY	T
		FRUIT	P
		TREE	P
		TYPE OF SHIP	S
		WEAPON	B

Order	Recall	Difficult Category	(First Letter)
		BIRD	M
		INSECT	H
		TOOL	F
		KITCHEN UTENSIL	L
		ALCOHOLIC BEVERAGE	V
		FOOTWEAR	C
		SCIENCE	R
		ANIMAL	O
		PRECIOUS STONE	A
		CRIME	P
		FISH	A
		OCCUPATION	W
		VEGETABLE	K
		ARTICLE OF CLOTHING	R

APPENDIX S

DATA SHEET (Question Set 2)

Order Recall	Difficult Category	(First Letter)
	FLOWER	G
	METAL	B
	COUNTRY	T
	CLOTH	B
	COLOR	A
	U.S. STATE	S
	SNAKE	K
	MUSICAL INSTRUMENT	M
	SPORT	J
	TOY	R
	FRUIT	F
	TREE	R
	TYPE OF SHIP	T
	WEAPON	D

Order Recall	Easy Category	(First Letter)
	BIRD	E
	INSECT	M
	TOOL	S
	KITCHEN UTENSIL	F
	ALCOHOLIC BEVERAGE	W
	FOOTWEAR	B
	SCIENCE	B
	ANIMAL	L
	PRECIOUS STONE	R
	CRIME	R
	FISH	S
	OCCUPATION	T
	VEGETABLE	C
	ARTICLE OF CLOTHING	C

APPENDIX T

Select the correct answer from the four choices provided. If you have another response (besides choices a,b,c, and d) to the question, write this answer in choice "e" (Other :_____).

1) Sport that begins with G?

a. Grenoble
b. Gudao
c Garball
d. Golf
e. Other:_____

2) Toy that begins with T?
a. Tattle
b. Tassel
c. Teewee
d. Truck
e. Other:_____

3) Type of Ship that begins with S?
a. Shaneboat
b. Sailboat
c. Sinker
d. Sallowest
e. Other:_____

4) Occupation that begins with W?
a. Wailer
b. Waiter
c. Wincher
d. Walloper
e. Other:_____

5) Alcoholic Beverage that begins with V?
a. Vongola
b. Vordal
c Vintner
d. Vodka
e. Other:_____

6) Snake that begins with C?
a. Capsian
b. Cattle
c Cobra
d. Cariole
e. Other:_____

7) Country that begins with M?
a. Malfavia
b. Menon
c Malaysia
d. Majaca
e. Other:_____

8) Footwear that begins with C?
a. Creepers
b. Carobs
c. Clogs
d. Collins
e. Other:_____

9) Tree that begins with P?
a. Purple Nix
b. Parkway
c. Pine
d. Pansy
e. Other:_____

10) Article of clothing that begins with R?
a. Ruggers
b. Revelo
c. Reendow
d. Raincoat
e. Other:_____.

11) Crime that begins with P?
a. Pestilence
b. Perjury
c. Paranoia
d. Petalody
e. Other:_____

12) Bird that begins with M?
a. Myobird
b. Mockingbird
c Magella
d. Migen
e. Other:_____

13) Flower that begins with D?
a. Daisy
b. Dipfern
c Dansetta
d. Denturra
e. Other:_____

14) Color that begins with B?
a. Base
b. Blue
c Brush
d. Bloom
e. Other:_____

15) Science that begins with R?
a. Renology
b. Rockology
c Rosteniology
d. Radiology
e. Other:_____

16) Weapon that begins with B?
a. Basset
b. Bucknell
c Barge
d. Bomb
e. Other:_____

17) Kitchen utensil that begins with L?
a. liquefier
b. lapoon
c ladle
d. lifter
e. Other:_____

18) Precious stone that begins with A?
a. Amherst
b. Amethyst
c Auburn
d. Agora
e. Other:_____

19) Metal that begins with C?
a. Cagnesium
b. Copper
c. Citron
d. Caduceum
e. Other:_____

20) Tool that begins with F?
a. Fulcrum
b. Fister
c. File
d. Fidget
e. Other:_____

21) Musical Instrument that begins with T?
a. Taoist
b. Trainolin
c. Teeter
d. Trumphet
e. Other:_____

22) U.S. state that begins with N?
a. Newbury
b. Navaho
c. New York
d. North Hampton
e. Other:_____

23) Fish that begins with A?
a. Aurfish
b. Axerra
c Anchovy
d. Anark
e. Other:_____

24) Fruit that begins with P?
a. Pamento
b. Pistachio
c. Pine
d. Pear
e. Other:_____

25) Cloth that begins with S?
a. Silk
b. Seflon
c. Skinee
d. Selestien
e. Other:_____

26) Vegetable that begins with K?
a. Kauri
b. Kale
c. Kapok
d. Kumquat
e. Other:_____

27) Animal that begins with O?
a. Orenden
b. Otter
c. Oalfin
d. Ortenga
e. Other:_____

28) Insect that begins with H?
a. Henspeck
b. Hyrenia
c. Hester
d. Hornet
e. Other:_____

APPENDIX U

Select the correct answer from the four choices provided. If you have another response (besides choices a,b,c, and d) to the question, write this answer in choice "e" (Other :_____).

1) Sport that begins with J?

a. Jaipai
b. Judo
c Jostery
d. Jainism
e. Other:_____

2) Toy that begins with R?
a. Raven
b. Robot
c. Render
d. Raffle
e. Other:_____

3) Type of Ship that begins with T?
a. Trestle
b. Tailfin
c Trawler
d. Twister
e. Other:_____

4) Occupation that begins with T?
a. Tenure
b. Trentman
c. Triller
d. Teacher
e. Other:_____

5) Alcoholic Beverage that begins with W?
a. Wanino
b. Wordal
c Whisky
d. Willow
e. Other:_____

6) Snake that begins with K?
a. King Capsian
b. King Cattle
c King Cobra
d. King Cariole
e. Other:_____

7) Country that begins with T?
a. Talfavia
b. Tenon
c Turkey
d. Tajaca
e. Other:_____

8) Footwear that begins with B?
a. Boots
b. Barbs
c. Benders
d. Boplins
e. Other:_____

9) Tree that begins with R?
a. Riserenden
b. Poaroak
c Redwood
d. Ringline
e. Other:_____

10) Article of clothing that begins with C?
a. Capstle
b. Crevet
c. Cap
d. Cleeve
e. Other:_____.

11) Crime that begins with R?
a. Retirement
b. Raising
c. Rape
d. Redundancy
e. Other:_____

12) Bird that begins with E?
a. Everett
b. Eagle
c Edsle
d. Eigen
e. Other:_____

13) Flower that begins with G?
a. Galatea
b. Glasellia
c Grand Pyre
d. Geranium
e. Other:_____

14) Color that begins with A?
a. Aura
b. Apex
c Aqua
d. Azelle
e. Other:_____

15) Science that begins with B?
a. Biosphere
b. Biology
c Bosteniology
d. Biosphemy
e. Other:_____

16) Weapon that begins with D?
a. Dhoti
b. Diaconal
c Dagger
d. Divan
e. Other:_____

17) Kitchen utensil that begins with F?
a. Fastener
b. Fixer
c. Fetter
d. Fork
e. Other:_____

18) Precious stone that begins with R?
a. Raven
b. Rena
c Ruburn
d. Ruby
e. Other:_____

19) Metal that begins with B?
a. Bagnesium
b. Brass
c Biron
d. Baduceum
e. Other:_____

20) Tool that begins with S?
a. Saw
b. Sadler
c. Shawbuckle
d. Saginaw
e. Other:_____

21) Musical Instrument that begins with M?
a. Mutalina
b. Mandolin
c. Misset
d. Minotaur
e. Other:_____

22) U.S. state that begins with S?
a. Syracuse
b. San Francisco
c. South Dakota
d. South Hampton
e. Other:_____

23) Fish that begins with S?
a. Surfish
b. Sayana
c Shollock
d. Shark
e. Other:_____

24) Fruit that begins with F?
a. Frappe
b. Fuccus
c. Fife
d. Fig
e. Other:_____

25) Cloth that begins with B?
a. Brundy
b. Burlap
c. Britska
d. Besten
e. Other:_____

26) Vegetable that begins with C?
a. Cauri
b. Cuppa
c. Carrot
d. Cumquat
e. Other:_____

27) Insect that begins with M?
a. Medfly
b. Mosquito
c. Metise
d. Manatee
e. Other:_____

28) Animal that begins with L?
a. Laplin
b. Lapeau
c. Lion
d. Lezzel
e. Other:_____

APPENDIX V

Note: After each question, the mean rate of completion is enclosed within the brackets.

Toy that begins with **R**? (80%)
Type of Ship that begins with **T**? (75%)
Animal that begins with **E**? (75%)
Alcoholic Beverage that begins with **V**? (71.4%)
Snake that begins with **C**? (70%)
Country that begins with **M**? (70%)
Footwear that begins with **C**? (61%)
Tree that begins with **R**? (60%)
Article of clothing that begins with **C**? (58.3%)
Crime that begins with **P**? (53.6%)
Bird that begins with **E**? (50%)
Flower that begins with **G**? (50%)
Color that begins with **A**? (50%)
Science that begins with **R**? (50%)
Weapon that begins with **D**? (50%)
Kitchen utensil that begins with **L**? (43%)
Precious stone that begins with **A**? (43%)
Metal that begins with **M**? (40%)
Tool that begins with **F**? (36%)
Musical Instrument that begins with **M**? (30%)
U.S. state that begins with **S**? (30%)
Fish that begins with **A**? (25%)
Fruit that begins with **F**? (20%)
Cloth that begins with **B**? (20%)

Statistics on probability of completion of the 24 question set:

Count = 24 questions	Minimum= 20%	Maximum= 80%	Range = 60
Mean = 50.67	Median = 50	Standard Dev. = 18.17	

APPENDIX W

Note: After each question, the mean rate of completion is enclosed within the brackets.

Sport that begins with **J**? (85%)
Toy that begins with **R**? (80%)
Type of Ship that begins with **T**? (75%)
Occupation that begins with **W**? (75%)
Alcoholic Beverage that begins with **V**? (71.4%)
Snake that begins with **C**? (70%)
Country that begins with **M**? (70%)
Footwear that begins with **C**? (61%)
Tree that begins with **R**? (60%)
Article of clothing that begins with **C**? (58.3%)
Crime that begins with **P**? (53.6%)
Bird that begins with **E**? (50%)
Flower that begins with **G**? (50%)
Color that begins with **A**? (50%)
Science that begins with **R**? (50%)
Weapon that begins with **D**? (50%)
Kitchen utensil that begins with **L**? (43%)
Precious stone that begins with **A**? (43%)
Metal that begins with **M**? (40%)
Tool that begins with **F**? (36%)
Musical instrument that begins with **M**? (30%)
U.S. state that begins with **S**? (30%)
Fish that begins with **A**? (25%)
Fruit that begins with **F**? (20%)
Cloth that begins with **B**? (20%)
Vegetable that begins with **K**? (10%)

Statistics on probability of completion of the 24 question set:

Count = 26 questions	Minimum= 10%	Maximum= 85%	Range = 75
Mean = 49.39	Median = 50	Standard Dev. = 18.17	

APPENDIX Y

DATA OBTAINED USING STRICT METHOD OF SCORING.

Under the strict scoring method, credit for recall was only given if subjects correctly recalled both the noun category and initial letter.

Table 1-1a
Mean Recall of Items by Completion and Degree of Difficulty

(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Item Difficulty				
Easy	M	.48	.36	.42
	(SD)	(.18)	(.37)	(.29)
Difficult	M	.37	.55	.46
	(SD)	(.23)	(.29)	(.27)
	M	.42	.46	
	(SD)	(.20)	(.34)	

Table 2-1a
Mean Recall of Items by Completion and Degree of Difficulty

(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Item Difficulty				
Easy	M	.48	.51	.49
	(SD)	(.09)	(13)	(.19)
Difficult	M	.35	.44	.40
	(SD)	(.25)	(.13)	(.14)
	M	.42	.47	
	(SD)	(.13)	(.20)	

APPENDIX Y (continued)

DATA OBTAINED USING STRICT METHOD OF SCORING.

Under the strict scoring method, credit for recall was only given if subjects correctly recalled both the noun category and initial letter.

Table 3-1a

Mean Recall of Items by Completion and Degree of Difficulty

(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Item Difficulty				
Easy	M	.46	.39	.42
	(SD)	(.17)	(.28)	(.23)
Difficult	M	.44	.48	.46
	(SD)	(.45)	(.20)	(.32)
	M	.45	.44	
	(SD)	(.34)	(.24)	

Table 4-1a

Mean Recall of Items by Completion

(M = mean, SD= standard deviation)

	Finished	
	Yes	No
M	.46	.39
(SD)	(.14)	(.15)

APPENDIX Y (continued)

DATA OBTAINED USING STRICT METHOD OF SCORING.

Under the strict scoring method, credit for recall was only given if subjects correctly recalled both the noun category and initial letter.

Table 5-1a
Mean Recall of Items by Completion and Time
(M = mean, SD= standard deviation)

		Finished		
		Yes	No	
Time				
Immediate	M	.51	.43	.47
	(SD)	(.17)	(.16)	(.17)
Delayed	M	.28	.26	.27
	(SD)	(.10)	(.19)	(.14)
	M	.40	.36	
	(SD)	(.20)	(.16)	

APPENDIX Z

Typical Questions and Responses Used in the Experiments conducted by Craik and Tulving (1975)*

Levels of Processing	Questions	Answer Yes	Answer No
Structural	Is the word in capital letters?	TABLE	table
Phonemic	Does the word rhyme with WEIGHT?	crate	MARKET
Category	Is the word a type of fish?	SHARK	heaven
Sentence	Would the word fit the sentence: "He met a _____ in the street." ?	FRIEND	cloud

*(Table extracted from Craik and Tulving, 1975, p. 272)