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Object Usage Processing Improves Memory

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OBJECT USAGE PROCESSING IMPROVES MEMORY

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DEDICATION

This work is dedicated to anyone who reads it.

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ABSTRACT

JOSEPH C. TANN: Usage as a Beneficial Method of Encoding

Many psychologists have attempted to find the most effective method of processing information in human memory. For years, the pleasantness method of processing was considered to be among the best methods for enhancing memory performance. One recent theory (Nairne, 2007) has suggested that processing items in terms of their survival value may be an even more proficient method of processing. Another theory (Reysen & Adair, 2008) attempted to prove that survival may not be the reason for the enhanced performance, but the individual's connection with the specific object's usage. My experiment was designed to expand upon the recent research supporting a processing advantage for object usage. In this experiment, participants were presented with thirty words, given a brief distracter task, and then given a free recall test. The only difference between the two conditions was one sentence of the instructions. One group was given instructions that enabled participants to think about items in terms of their uses, while the other group's instructions did not. It was observed that participants fared significantly better when given the set of instructions with a connection to object usage.

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LITERATURE REVIEW

LEVELS OF PROCESSING THEORY

In 2002, Fergus Craik, one of the leading researchers of human memory, published a paper detailing his research and predicting future discoveries in the field (Craik, 2002). Craik begins by detailing a few of the fundamental experiments that have contributed to our current knowledge regarding the performance of the human memory. Most importantly, Craik discusses Treisman's theory of selective attention (Treisman, 1964), which states that the effectiveness of memory encoding and retrieval processes could be correlated to the individual's previous knowledge of the subject and his or her perception and attention. This paper is considered to be one of the most significant studies on human memory, as it has helped to lay the groundwork for the theory of deep processing. Next, Craik discusses some of his research with Endel Tulving, focusing on one particular experiment in which Craik & Tulving controlled the participant's level of processing and observed that deeper processing led to improved retention and better retrieval (Craik & Tulving, 1975).

Craik goes on to address some of the present issues and criticisms with the levels of processing theory. Most relative to my study is the section discussing the reality of the existence of levels of processing. Craik cites his prior research, demonstrating that not only do deeper processing levels provide for enhanced memory performance, but that participants who process items shallowly over longer periods of time do not display the same improvement as participants spending less time while using deeper processing (Craik & Watkins, 1973).

In summary, the level of processing theory suggests that the more time and attention a person gives to encoding information; the better that person will be in the retrieval of such information. The levels of processing theory also suggests that object repetition does not improve memory performance as well as the deep processing of information.

SOCIAL PROCESSING IMPROVES MEMORY

A recent study of particular relevance (Mesoudi, Whiten, & Dunbar, 2006) attempted to support the theory that information may be remembered more readily if it is presented in a social setting rather than a non-social setting. In Experiment 1, the experimenters tested forty individuals. The participants were grouped into ten chains of four. First, one participant was given a small booklet with three paragraphs to read. The paragraphs were classified as either gossip, individual, or physical descriptions. The gossip paragraph represented a social environment, while the other two paragraphs represented non-social environments. The paragraphs were similar in diction and structure, only the method of transmission was altered. The gossip paragraph contained an arousing narrative describing a scandalous affair and unwanted pregnancy. The individual paragraph concerned a person and his or her interaction with another person or the environment. Unlike the other two paragraphs, the physical paragraph contained no people. The physical paragraph described interactions and relationships within the environment.

Once the participant finished reading the paragraphs and had flipped to the next page, they were then instructed to re-write the paragraphs as accurately as possible, without returning to the previous page. The text written by the participant was then measured for accuracy and recorded before being re-typed by a researcher and inserted into the next participant's booklet, creating a within-chain transmission design. This process was repeated until all four members of the chain completed the experiment. As predicted by the experimenters, the participants recalled the gossip paragraph significantly better than the physical or individual paragraphs.

However, the experimenters feared that the gossip paragraph may have been remembered more accurately due to its coherent, arousing narration rather than its social setting. They attempted to solve this problem with their second experiment. In Experiment 2, the experimenters added a social non-gossip group with the inclusion of a paragraph containing more common, less arousing, everyday information. To account for primacy and recency effects, the experimenters also reversed the order in which the paragraphs were presented to the participants. All other elements of the design remained constant.

Once again, Mesoudi *et al.* found that the social information was more accurately recalled than the non-social information. The gossip paragraph was still remembered the most accurately. However, the new paragraph, the social non-gossip paragraph, was also recalled significantly better than both the individual and physical paragraphs, the two non-social paragraphs. Therefore, the experimenters were able to support their hypothesis that information is recalled more accurately when presented in a social environment rather than a non-social environment.

Another recent study (Reysen & Adair, 2008) tested the same hypothesis that social processing improves memory performance. In Experiment 1, sixty introductory psychology students from the University of Mississippi were tested in exchange for partial course credit. They were tested alone or in pairs, using personal computers. The participants were told that they were going to be given a number of words to study for a memory test to follow, making this an explicit memory test. They were also told that they either would be working alone or would be working as partners with the other participant that was being tested at the same time. To begin, each participant was shown thirty words, one at a time. Each word was an intangible adjective that would be used to describe an individual's personal characteristics, or traits. After viewing the words, the participants working in pairs were asked to simultaneously type five words that best described themselves. The single participant group was also asked to type the five words that best described themselves. After typing the five words, the participants in both conditions were then given five random words from the remaining twenty-five words of the original list of thirty. However, in the social condition (the group working in pairs), the participants were told that the five words that they were given had been typed by their partner when asked to type the five words that best described themselves. In the nonsocial condition, the individual was told that the words were computer generated. In actuality, all participants were given five words randomly selected by the computer. After studying the words for twenty seconds, the participants were then asked to complete some single-digit addition and subtraction problems. The math was implemented solely as a distracter task. Upon completing the math, the participants were asked to freely recall as many words from the original list of thirty as possible. As predicted, Reysen & Adair observed that the participants in the social group accurately remembered more words than the participants in the nonsocial group.

Experiment 2 was set up in exactly the same manner as Experiment 1, only the stimulus materials were changed. For Experiment 2, the experimenters used unrelated category exemplars instead of using the personal trait words from Experiment 1. This meant that the participants would now be processing nonsocial information in a social environment. Once again, Reysen & Adair observed that participants in the social condition remembered more words than the participants in the nonsocial condition.

Experiment 3 was conducted to extend and clarify their previous findings. In order to dispel the notion that the observed effects could have been due to the mere presence of another person (rather than the participants' social processing), the experimenters added a third condition in which the participants were given the nonsocial instructions in the presence of another person. Adding this third condition increased the number of participants to ninety. Also, to eliminate any possible selection biases, the same five words were held constant throughout each condition. The instructions of the third experiment were altered slightly. In the instructions of Experiment 3, participants were told that they would either be given some random letters to retype, or asked to list the five words that best described themselves. However, contrary to what they had been told, all participants were actually given five 8-letter sequences consisting of random letters to retype. By having each participant type eight random letters, the experimenters were hoping for the subject to believe their partner was actually typing words from the list. Once again, the social condition outperformed both the nonsocial individual and the nonsocial paired conditions. The data produced by these three experiments enabled

Reysen and Adair to conclude that social processing improves recall performance in human memory.

SURVIVAL PROCESSING IMPROVES MEMORY

In a recent study (Sharps, Villegas, Nunes, & Barber, 2002), researchers attempted to prove that memory for hunting, and more specifically animal tracks, was one of the inherited traits possessed by humans that had been acquired over time through evolution. In Experiment 1, the researchers had twenty-five undergraduates view one hundred different stimuli. The stimuli were broken down into five different categories of twenty. The categories were: military armored vehicles (AFV), sea shells, kitchen utensils, trees, and animal tracks. The experimenters hypothesized that the participants would remember the animal tracks the best, because humans had hunted and gathered for such a long period of time prior to the agricultural revolution.

All of the images used in the experiment were created with either black-and-white imaging or a uniform gray-scale, and were presented at approximately the same size. Each of the one hundred stimuli had been rated as unfamiliar by a group of graduate students who were asked to rate the familiarity of the items before the experiment. Each item was presented in order of an animal track, a utensil, a shell, a tree, and an AFV. This order remained constant throughout the first experiment. Sharps *et al.* used an intentional memory test, meaning that the participants were told in advance that they were going to be shown a number of pictures with titles, and would later be asked to recall the titles. After the participants viewed all one hundred images with titles, they were then given a ten minute arithmetic exercise as a distracter task to prevent internal rehearsal.

After the math, the participants were shown all of the pictures again, and asked to correctly label as many of the pictures as possible. On average, the participants remembered 5.44 animal tracks, 1.12 AFV's, 1.12 seashells, 2.08 trees, and 10.08 cooking utensils. So, the experimenters were correct in predicting that the participants would remember the animal tracks significantly better than the AFV's, the seashells, and the trees. However, the cooking utensils were recalled nearly twice as often as the animal tracks, and the experimenters were unable to provide an explanation for this result.

The second experiment was an altered version of the first experiment. Three items of which the experimenters had particular trouble were deleted from the experiment. Now, each of the five groups of stimuli was narrowed to seventeen. Also, the experimenters used a different order of presentation. The new order of display was: a cooking utensil, an animal track, a shell, an AFV, and then a tree. The pattern remained constant throughout the experiment. Even with the modifications, the experimenters still found similar results. The participants remembered 3.96 animal tracks, 1.61 AFV's, 1.50 seashells, 2.68 trees, and 9.71 cooking utensils.

The third experiment was a replication of the second experiment; but the overall order of stimuli presented was reversed. Now, the first item presented from the second experiment was the eighty-fifth item presented in the third experiment. The second item from the second experiment was now the eighty-fourth item in the third experiment, and the pattern continued. The experimenters continued to get similar results. On average, the participants recalled 4.32 animal tracks, 1.50 AFV's, 0.82 seashells, 3.14 trees, and 8.00 cooking utensils.

It is difficult to explain the substantial difference in the number of items recalled by the participants in the cooking utensils condition compared to the number of items recalled by the participants from the other conditions. One possibility is that the words in the cooking utensils condition were more familiar than the words from the other conditions. It is also possible that these drastic results occurred because the participants, either intentionally or unintentionally, were able to connect a usage for each item in the cooking utensils condition. Also, the cooking utensils condition was the only condition in which each object possessed a different usage than the other objects within the group.

In another survival processing study, (Nairne, Pandeirada, & Thompson, 2007) researchers set out to demonstrate that survival processing was the best method of processing in human memory. They supported this idea by conducting four separate experiments. In Experiment 1, Nairne *et al.* had one hundred and fifty college undergraduates sit at personal computers and rate the relevance of thirty words in one of three particular conditions. In one of the conditions, the subjects were asked to imagine that they were stranded in the grasslands of a foreign land. Then, they were presented with the stimuli and asked to rate the importance of the stimuli in terms of the individual's survival. In the second condition, the subjects were told that they would be moving to a new home in a foreign land. Once again, the stimuli were presented and the participants were asked to rate the relevance of each item in helping the participant relocate to a new land. In the third condition, participants were given the same list of words as the other two groups and asked to rate the pleasantness of each word. In all three groups, the subjects were asked to rate the stimulus 1-5, with 1 meaning totally irrelevant (or unpleasant) and 5 being extremely relevant (or pleasant). Besides the different instructions, all other aspects of the design remained constant. After rating the stimuli, the participants were given a short digit-recall task, and then asked to freely recall as many of the words as possible. Nairne *et al.* found that participants in the survival group were able to recall a significantly greater proportion of words than the participants from the moving group or the participants from the pleasantness group. The participants in the moving group and the participants in the pleasantness group both recalled about the same number of words. Also, the ratings (once again on the scale of 1-5) of the survival group and the moving group were about the same, with the pleasantness group rating their words slightly higher. The response times for the participants in the survival condition were the longest of the three groups, with participants in the moving condition taking more time than the participants in the pleasantness condition.

In Experiment 2, the experimenters replicated Experiment 1, but used a within-subjects design. Thirty-eight undergraduates rated thirty-two words. Two new words were added to the original thirty words used in Experiment 1, and the words were divided into four blocks of eight. The participants were asked to rate half of the words using the survival scenario and half of the words using the moving scenario. In all other respects, the methods were the same as those used in Experiment 1. Once again, the experimenters found that the participants were able to recall the most words when using the survival scenario.

Experiment 3 was nearly an exact replication of Experiment 2. The only difference was the method of recall. While free recall had been used in the first two experiments, memory retention was assessed using a recognition test in Experiment 3. Forty undergraduates, using personal computers, were tested. The experimenters selected one hundred and twenty-eight words from the Clark and Pavio (2004) norms. Half of the words were used as stimuli, and the other half was used as distracters in a recognition test. The participants rated thirty-two words using the survival scenario and thirty-two words using the moving scenario. After ten minutes of digit recall, the participants were shown one hundred and twenty-eight words and asked to label them as either new or old. The participants correctly recalled more words in the survival condition than in the moving condition. Also, the participants gave higher ratings to the words in the survival condition. Response times were about the same in both conditions.

In Experiment 4, the experimenters compared survival processing with a self-reference processing task, which is widely accepted as an effective method of processing (Symons & Johnson, 1997). In this experiment, the researchers used a within-subjects design. Fifty undergraduates were tested using personal computers. The same words that were used in Experiment 3 were used again. The procedure from Experiment 2 was replicated in this experiment, with a slight modification made to the instructions in order to test how easily the word was able to stimulate a memory of a personal experience. First, the participants rated words for both survival relevance and self-reference. Next, the participants were asked to rate how easily each word brought to mind an important personal experience. After a digit recall test, a free recall design was once again implemented. The participants correctly recalled the words of the survival condition much more frequently than they recalled the words from the self-reference condition. The ratings were slightly lower for the words in the survival condition and response times were slightly longer.

Due to the data compiled from the four experiments, the experimenters were able to state that survival-based processing enhances retention more effectively than processing based on moving, pleasantness, or self-reference. The method of recall was not a factor. Both free recall and recognition produced significant results.

OBJECT USAGE PROCESSING IMPROVES MEMORY

A word bank of familiar words was used in both of the following experiments that focus on object usage. For this, the researchers turned to a recent study (Van Overschelde, Rawson, & John Dunlosky, 2003) which updated and expanded upon the findings of Battig & Montague in 1969. Van Overschelde *et al*. used three geographically different locations: the University of Colorado at Boulder, the University of Maryland at College Park, and the University of North Carolina at Greensboro. Participants numbered at least three hundred in each condition from the University of Colorado at Boulder, and at least one hundred and fifty from the University of Maryland at College Park and the University of North Carolina at Greensboro. All participants were undergraduate students enrolled at one of the aforementioned universities. They participated in the experiment in exchange for course credit.

After sitting at a personal computer, each participant was given seventy prompts, each regarding a specific category (a precious stone, a unit of time, a relative, etc.). The participants were given thirty seconds to list as many appropriate responses as they were able. The data was then compiled and recorded by the researchers. This updated version of the Battig & Montague norms is a very useful tool for researchers in many different educational fields and has been cited in numerous scientific articles and scholarly journals.

With the exception of the Nairne paper, no article proved more vital to my research than a recent paper based on the theory of object usage (Reysen, Adair, & Tann, 2008). In Reysen *et al.*'s first experiment, ninety undergraduate psychology students from the University of Mississippi were given the same test, but each test had one of three different sets of instructions. In one condition, the participants were instructed to rate each of thirty words on a scale from 1-5 (with one being the least and 5 being the greatest) in terms of pleasantness. In the second condition, the participants were instructed to rate each term from 1-5 on how important the term would be for the participant's survival in a foreign land. The final group was instructed to rate each term 1-5 on how useful the object would be against a suspicious person climbing through a window of a friend's house.

The participants listened to the instructions read aloud by the research assistant as they simultaneously viewed the instructions on the monitor. Next, the participants were given a list of thirty familiar words from the updated category norms (Van Overschelde *et al.*, 2004), one at a time. After ranking each word, the participants were then given some simple math problems as a distracter task. Upon completing the math, the participants were asked to type as many of the thirty words as they could recall.

Reysen *et al.* (2008) found that participants from the burglar condition were able to recall more words than the participants from the pleasantness condition and about the same number of words as participants from the survival condition. Participants in the pleasantness condition rated items higher than participants from the other two conditions, demonstrating that the difference in ratings did not contribute to the improved memory performance. The researchers also observed significant differences in the amount of time it took the participants to rate the words in each condition. The participants responded quickest in the pleasantness condition, with the response time being about the same for the burglar and survival conditions. With participants from the burglar condition recalling about the same number of words as participants from the survival condition, this experiment supports the theory that processing objects in terms of their usage can enhance memory performance. One limitation of this experiment is the possibility that the participants' improved memory could be attributed to the potential arousal of the participant in the burglar condition. My experiment is an attempt to expand upon the findings of the first experiment of the Reysen *et al.* (2008). I was searching for an effective way to test the object usage theory with little or no arousal and the same general interest of content.

METHODS

PARTICIPANTS AND APPARATUS

Sixty undergraduates from the University of Mississippi participated in the experiment. In exchange for their participation, the students were given partial credit in an introductory psychology course. The students were tested either individually or in groups of two. The sessions lasted approximately thirty minutes. All stimuli were presented and controlled by personal computers.

MATERIALS AND DESIGN

Each of the thirty stimuli used in the experiment was the most common, or number one ranked word in its specific category, in an updated and expanded version of the Battig & Montague (1969) norms (Van Overschelde, Rawson, & Dunlosky, 2004). A simple between-subjects design was used. The participants were presented with a word for five seconds and were then asked to rate the word in terms of its usefulness. The rating task was immediately followed by a simple math exercise. After the math, the participants were given a free recall test, meaning that the participants were asked to recall the words with no hints or clues. All aspects of the design remained constant regardless of which set of processing instructions the participants received from the research assistant.

PROCEDURE

Upon arrival to the laboratory, each participant was asked to sign an informed consent document and assigned to a personal computer. After signing the form, the participants listened to the instructions that were read aloud by a research assistant as a copy of the instructions was presented on the monitor directly in front of them. The participants were given one of two sets of processing instructions:

Moving Instructions (object usage)

1. In this task, we would like you to imagine that you are planning to move to a new home in a foreign land. Over the next few weeks, you will need to pack and transport your belongings. We are going to show you a list of words, and we would like you to rate how useful each of these words would be to either help you pack your belongings or load them on to a moving truck. Some of the words may be useful and others may not - it's up to you to decide. The rating scale will range from 1 (totally irrelevant) to 5 (extremely relevant). Each word will appear on the screen for several seconds. After considering each word, please type a 1, 2, 3, 4, or 5. The number that you type will appear on the screen beneath the rating scale. Then after a brief delay, the next word will be presented. Please be sure to make your decisions quickly and try to use the entire rating scale. If you do not have any questions, please press the ENTER key now to complete a few practice trials before beginning to rate the real list items.

Moving Instructions (without object usage)

2. In this task, we would like you to imagine that you are planning to move to a new home in a foreign land. Over the next few weeks, you will need to locate and purchase a new home and transport your belongings. We are going to show you a list of words, and we would like you to rate how useful each of these words would be for you in accomplishing this task. Some of the words may be useful and others may not - it's up to you to decide. The rating scale will range from 1 (totally irrelevant) to 5 (extremely relevant). Each word will appear on the screen for several seconds. After considering each word, please type a 1, 2, 3, 4, or 5. The number that you type will appear on the screen beneath the rating scale. Then after a brief delay, the next word will be presented. Please be sure to make your decisions quickly and try to use the entire rating scale. If you do not have any questions, please press the ENTER key now to complete a few practice trials before beginning to rate the real list items.

The stimuli were presented one at a time for five seconds each. Each word was displayed in the center of the screen, with the numbers 1-5 below it. The participants were asked to rate the words on the 5-point scale, with 5 being extremely useful and 1 being extremely not useful. The participants selected each number by pressing a key on the keyboard. Each participant had up to five seconds to rate each item. The participants were blind to purpose of the study, as there was no mention of the recall test to come.

After the participants rated the 30th and final word, they were given instructions to complete some simple math problems. In this task, the participants were asked to solve simple single-digit addition and subtraction problems. This exercise lasted for sixty seconds. Upon the completion of the math, the participants were then asked to type as many of the thirty words as they could remember. When the participants were finished recalling as many words as possible, they were thanked for their participation, given the appropriate credit, and dismissed from the study.

RESULTS

This experiment supports the conclusion that memory for objects can be enhanced by connecting a usage with the object. The results were consistent with our predictions. The participants in the usage condition recalled a greater proportion of words (M=.44) than the participants in the non-usage condition (M=.37). Participants recalled more words in the moving condition that provided for object usage $t(58) = 2.48$, $p < .05$. Also, there were no statistically significant differences in the response time (M = 2.25 seconds in the usage condition and M = 2.12 seconds in the non-usage condition) or the ratings (M = 3.06 in the usage condition and M = 2.90 in the non-usage condition) of the two groups, both p's > .05. Furthermore, the simplicity of the experiment reduces all known extraneous variables, including issues with arousal that may have been present in earlier experiments of similar nature (Reysen *et al.*, 2008).

DISCUSSION

The experiment proved the hypothesis that object usage processing can enhance memory. However, participants in the Nairne experiment (who were given the same instructions as the non-usage group in this study) recalled more words than the participants in this experiment. There were a few minor differences that may have contributed to the higher proportion of words recalled by Nairne's participants. Most importantly, we allowed the participants to leave the lab as soon as they felt they had recalled as many words as possible. In Nairne's experiment, the participants were instructed to remain in front of the computer for ten minutes, regardless of whether or not they felt they had recalled as many of the words as they were able. While sitting in front of the computer for a longer period of time, it is possible that the participants were able to recall an additional word or two. This extended period of time used by Nairne *et al.* may have contributed to the higher percentage of words correctly recalled by their subjects.

However, it is important to realize that, although the totals were higher in the Nairne study, the difference between the conditions within each experiment is what is being measured, not the figures between different experiments. Also, the participants used a mouse to rate the words in the Nairne study, while the participants in this study used a keyboard to type the appropriate number.

This experiment does nothing to disprove or discredit Nairne's research. If anything, it can be seen as an expansion on the theory of survival processing. There is no arguing that survival is an effective method of processing. But why? Perhaps survival is an effective method of processing because it implements the principles behind the object usage theory. In fact, each participant would need to *use* each of the objects that they were rating in terms of survival. Thus, even in the survival condition, participants are still connecting uses to each object that they rated.

One of the most encouraging aspects of the study was the significant difference observed in the results with only a slight alteration in the instructions. Because there was only one different sentence in the two sets of instructions, and all other factors of the design remained constant throughout both conditions, the observed differences can only be attributed to the different method of processing used by the participants. Obviously, these findings can have many practical applications as we are constantly looking for new ways to improve and enhance human memory.

TABLE

Condition	Mean % Recall	Mean Rating (1-5)	Mean Time (seconds)
Moving (Usage)	43.89%	3.06	2.25
Moving (Non-Usage)	37%	2.90	2.12

WORDLIST

Apple
Beer
Carrot
Chair
Church
Cotton
Diamond
Doctor
Dog
Dollar
Drum
Eagle
Football
Gasoline
Gun
Hammer
House
Magazine
Mountain
President
Priest
Salt
Sandal
Shirt
Shovel
Steel
Tornado
Uncle
Water
Window

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