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IMAGERY, FAMILIARITY, AND COMPREHENSIBILITY EFFECTS IN MEMORY FOR SIMPLE FACTUAL SENTENCES

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IMAGERY, FAMILIARITY, AND COMPREHENSIBILITY EFFECTS IN MEMORY FOR SIMPLE FACTUAL SENTENCES

by

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STATEMENT BY AUTHOR

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ABSTRACT

This study was performed to assess the effects of imagery, familiarity, and comprehensibility for simple factual sentences. Sixty subjects rated 60 factual sentences thought to vary in imagery and familiarity. The subjects rated each sentence as to its imageability, familiarity, and comprehensibility. Subjects were then given a cued incidental recall task. The results show that the ratings for familiarity and imagery were substantially correlated. The apriori manipulation of imagery and familiarity was not validated by subjects' ratings. Using a multiple regression technique, it was found that rated imagery and familiarity significantly predicted subjects' recall. However, the variance accounted for by these variables are quite low. Suggestions regarding improvements for this type of research are offered. Theoretical accounts of the findings are also discussed.

INTRODUCTION

Perhaps the strongest variable influencing memory for verbal materials is imagery value, the extent to which an item can be visually imagined. The effect of imagery is that high imagery materials are remembered better than low imagery materials. In fact, imagery value appears to be far more important than variables that are more directly related to the properties of the to-be-remembered materials, such as word frequency or association value. This discrepancy has produced a lively debate extending over many years.

Several theoretical explanations have been advanced to account for imagery effects in memory. Paivio's dual-code hypothesis (1971, 1978, 1983) is perhaps the oldest explanation for imagery effects. Other explanations have been offered. Kieras (1978) discusses several alternative explanations in terms of existing prose memory theories. One explanation is that memory for high Imagery sentences is better owing to high imagery sentences being more comprehensible. So that, the semantic representation of the sentence content is derived and stored more easily. A second explanation is that high imagery material is remembered better because of the greater availability of perceptual descriptions with configural content will result in better integrated memory representations. It may also be the case that high imagery sentence meanings are encoded using preexisting perceptual descriptions. Imagery effects could then be due to concrete concepts having a greater number of such higher level encodings available in the form of perceptual

descriptions relative to abstract concepts. Currently, there is still much debate concerning the effect of imagery manipulations on sentence memory. (Anderson, 1978; Anderson, 1983; Pylyshyn, 1979; Yuille, 1983).

The basic paradigm that has been employed in assessing imagery effects investigates memory for materials selected on the basis of rated attributes of single words such as nouns, and complete sentences. The classic and most seminal study using this approach was done by Paivio, Yuille, and Madigan (1968). They had subjects rate 925 nouns for concreteness, imagery and meaningfulness. Imagery was defined as the ability of the word to arouse a nonverbal image. Concreteness was defined in terms of the directness of the word to sense experience, while meaningfulness was defined in terms of the mean number of associations made to the word in 30 seconds.

Subsequent studies have verified the reliability of Paivio et.al.'s ratings. Elmes and Thompson, (1976), using a magnitude estimation procedure, found that their ratings of nouns agreed with those obtained by Paivio et.al. (1968). With regard to other sentence components, Berrian, Metzler, Kroll, and Clark-Meyers (1979) have published imagery, ease of definition, and animateness values for 328 adjectives. Thus, it seems that for nouns and adjectives, which are components of sentences, reliable imagery values can be obtained.

Work soon proceeded from ratings of words to ratings of sentences. The impetus for this work being whether one could obtain effects due to imagery, with such factors as comprehensibility controlled. If imagery effects could be shown to be due to other, verbal factors, rather than perceptual ones, then much of the theoretical

problem would disappear. Subjects in these studies were typically assessed for their ability to recognize semantic or wording changes in concrete and abstract sentences.

Begg and Paivio (1969) using complete sentences, found that in concrete sentences, changes in meaning were more often recognized than changes in wording. In abstract sentences, however, the reverse was true; changes in wording were more often recognized than changes in meaning. Begg and Paivio attributed the differences to the way in which concrete and abstract sentences were coded and stored. According to the dual-coding hypothesis, concrete sentences are being coded and stored as nonverbal images. These images retain the meaning but not the wording of the sentences. Abstract sentences, however, are thought to be coded and stored primarily in their verbal form.

Johnson, Bransford, Nyberg, & Cleary (1972) attributed the effects in the Begg and Paivio study to the abstract sentences being more difficult to comprehend. Johnson et. al. had subjects rate a subset of the Begg and Paivio sentences for comprehensibility. Subjects rated the abstract sentences as being more difficult to comprehend than the concrete sentences.

A number of studies were then performed to assess the relationship of rated sentence Imagery and comprehensibility. These include Pezdek & Royer, (1974); Moeser, (1974); Moeser, (1975 a, b); Kuiper & Paivio, (1977). These studies basically employed subsets of the Begg and Paivio sentences in a variety of memory tasks.

Pezdek and Royer (1974), arguing for differential storage of concrete and abstract sentences, found that recognition for changes in

meaning in abstract sentences was higher for sentences embedded in a paragraph than for sentences without the paragraph. Not surprisingly, paragraph embedding increased the comprehensibility of the sentence.

Moeser (1974) used sets of concrete and abstract sentences equated for rated comprehensibility. Subjects were found to be better at identifying meaning and wording changes in concrete sentences than in abstract sentences, which took significantly longer for subjects to encode and decode.

Moeser (1975a) tested subject's ability to recognize words used in study sentences, and to recreate study sentences when presented with a list of words used in the study. The concrete and abstract sentences used were equated in terms of lexical complexity and comprehensibility. Only the second task of recreating study sentences yielded a significant difference between concrete and abstract sentences.

Moeser (1975b) used a recall memory task to assess the independence of comprehensibility and imagery effects. She employed concrete and abstract sentences from the Pezdek and Royer set and embedded them in paragraphs. Concrete sentences scored for word count or gist recall were significantly better recalled than abstract sentences.

Kuiper and Paivio (1977) had subjects rate concrete and abstract sentences for comprehensibility. Subjects were unexpectedly asked to give recognition confidence ratings for the rated set of sentences which were presented embedded within a larger set of sentences. With comprehensibility equated, concrete sentences still exceeded abstract sentences both in terms of correct recognition of rated sentences and correct rejection of distractor sentences.

In summary, given sentences equated for comprehensibility, one may still find imagery effects regardless of the type of memory tasks that the subjects are asked to perform: recognition, reconstruction, or recall. Thus the explanation that memory effects of imagery are actually due to differences in comprehensibility can be ruled out.

However, there are other explanations. Perhaps the usual abstract sentences in these sentences seem bizarre and unfamiliar (e.g. "The alternative version modified an established custom."). Factual sentences provide a more reasonable context for which to assess content familiarity than the fiction-like sentences employed in previous work. Highly meaningful abstract sentences about familiar topics, such as "The economic indicators forecast additional unemployment", should be assigned a context as easily as concrete sentences. (Kieras, 1978). Because content familarity appears to offer an alternative explanation for some of these findings, a controlled study needs to be performed to assess the relationships between rated imagery, sentence comprehensibility, and content familiarity.

In order to do this, however, several issues with regard to sentence memory still remain to be addressed. One such issue is the meaning and reliability of ratings of imagery value, comprehensibility, and familiarity. It may be the case that subjects rate familiarity and comprehensibility on the basis of imagery. Most studies employ a seven point rating scale whereby sentences are rated as being high or low on the attribute in question. Instructions for rating these attributes that stress rating the sentence as a whole, need to be constructed. While imagery value is fairly well defined, comprehensibility is not. Moeser

suggests that in many studies subjects rate only the comprehensibility of the individual words, and not the comprehensibility of the entire sentence.

Familiarity is just beginning to be worked with extensively in the area of sentence comprehensibility and recall. (Anderson, 1981; Graesser, Hauft-Smith, Cohen, and Pyles, 1980; Graesser, Hoffman, and Clark, 1980; Graesser, 1981; Johnson and Kieras, 1983). Generally, the effects of familiarity or prior knowledge are equivocal. Depending on the task, prior knowledge can have a facilitative or detrimental effect on recall. Johnson and Kieras (1983), arguing for the representation-savings principle, found that, in two tasks conditions, familiarity did predict recall.

This study was performed using cued incidental recall rather than recognition memory or forced recall. Forcing subjects to study the sentences would presumeably have distracted subjects from the rating task. Having the subjects recall after rating allows for an assessment of the ability of the ratings to predict recall based on the same subjects.

This study has been performed, therefore, to clarify the role of rated familiarity, imageability and other potential factors in predicting cued sentence recall for factual sentences. Some of the factors such as sentence imagery and familiarity have been manipulated while others, such as sentence comprehensibility and sentence attributes such as the number of syllables in the sentence or the frequencies of the words in the sentence, have been controlled statistically. In order to do this, a set of factual sentences that varied in familarity and imagery were

developed. These sentences served as stimuli in the first section of the experiment. The goal of the first part of the experiment was to obtain reliable ratings of the imageability, familiarity and comprehensibility of a set of 60 factual sentences. In the second phase of the experiment, the same subjects who had initially performed the rating task were asked to recall as much of the sentence as they could. Subjects were cued for this incidential recall task with the subject noun of the sentence they had rated.

METHOD

Subjects

Subjects were recruited through the use of advertisements and drawn primarily from undergraduate basic psychology classes. Sixty subjects participated in the study. Subjects received extra credit points for participating in the study. Approximately equal numbers of males and females participated in the study.

Design

A completely within-subjects design was employed. Sentences varying in imagery and familiarity constituted the experimental manipulation. Sentence attributes such as number of syllables, sentence type, mean content frequency and cue frequency were measured. Content and cue frequencies were obtained by using the Standard Frequency Index (Carroll, Davies, and Richman, 1971). Each subject provided both ratings and recall responses for the sentences.

Materials

A set of 60 sentences of the general form: THE ADJECTIVE NOUN RELATION THE ADJECTIVE NOUN, were used in the study. There were 4 different types of sentences. Type 1, refers to the relation being that of a transitive verb, as in "Prehistoric man used stone tools". Type 2, refers to the relation being that of possession or attribute, as in "African elephants have large ears". Type 3, refers to the relation being that of as "isa" form, as in "Rabies vaccination is a painful procedure".

Type 4, refers to a passive sentence construction, as in "Interstate commerce is regulated by the federal government".

Sentences were constructed to vary strongly in terms of imagery and familiarity. Specifically, 15 sentences were constructed for each of four cofigurations: high imagery-high familarity; low imagery-high familarity; high imagery-low familarity; and low imagery-low familarity. Subject and object nouns were not repeated across the 60 sentences. The actual sentences used in the experiment are presented in Tables 1 through 4.

Procedure

The experiment consisted of two tasks; a sentence rating task and a cued incidental recall task. Subjects were run in groups of 1-15 using paper and pencil materials. Subjects were seated and given the instructions for the first phase of the experiment. They were informed that a second task was required. However, they were not informed as to the nature of the second task.

Rating task. The sentences to be read and rated were presented to subjects on six sheets of paper. Each sheet of paper had each of the scales and the descriptors for each point of the seven point Likert scale printed at the top. This was followed by 10 sentences and the particular order of rating scales to be employed by the subject. Each subject received a different random presentation of sentences. For each subject the order of sentence attribute rating remained constant for all 60 sentences. All the different combinations of the sequence of the three rating scales were represented equally. That is, 10 subjects were represented in each of the 6 attribute rating sequences. The subject read

each sentence, then rated the sentence for each of the three attributes, continuing until all 60 sentences have been rated for each of the attributes. The instructions used stressed that only the rating of the sentence was important and that there was no test as to any capability of the subject.

The instructions used were adapted from those used by Paivio et.al. (1968) to rate imagery values of words. Specifically, subjects were told: "The Imagery rating of a sentence means: How easy or difficult is it to visualize the whole sentence? That is, how easy or difficult is it for you to form a clear mental picture of what the sentence is saying?". High and low imagery sentences were used as examples to mark the end points of the Imagery scale and to familiarilize subjects with the use of the scale.

Similar instruction sets were constructed for the attributes of comprehensibility and familiarity. Comprehensibility rating instructions stressed Moeser's (1974) notion that comprehensibility should be related to how easy or difficult it is to form the complete sentence into one organized presentation; that is, how easy or difficult is the entire sentence to comprehend? Specifically, subjects were told: "The Comprehensibility rating of a sentence means: How easy or difficult is it to understand the whole sentence."

Familiarity rating instructions stressed the subject's prior knowledge of, or exposure to, the material presented in the sentence. Specifically, subjects were told: "The Familiarity scale rating of a sentence means: How much of the information presented in the sentence did you know prior to the experiment?". As before, examples of high and

low familiarity sentences were provided to set the end points of the rating scale.

The instructions also stressed the importance of treating each sentence attribute rating separately. That is, subjects were cautioned against confusing, say, familiarity and imageability. Specifically, subjects were told: "Remember to consider each sentence in terms of only one rating scale at a time, and try not to confuse the meanings of the imagery, comprehensibility, and familiarity scale ratings of the sentences".

Recall task. Subjects were given the instructions for the cued, incidental recall task immediately after completing the ratings' task. The stimulus materials were presented as follows. The subject nouns of the sentences rated in the first phase of the experiment were presented in a list on two sheets of paper. These subject nouns appeared in the same order as did the sentences in the rating task. The subject nouns served as cues for the incidental recall task.

Subjects first read the instructions regarding their task in this phase of the experiment. They then proceeded to recall, in sentence form, as much as they could remember about the to-be-recalled sentence. Although the cues for the sentences were presented in the same order as the sentences appeared in the first phase of the experiment, subjects were free to recall the sentences in any order they cared to employ. Upon completion of the recall phase of the experiment subjects were debriefed. They were given a brief statement as to the purpose of the study and were cautioned to not relay information about the study to potential subjects.

RESULTS

The results of this study can be cast into two subsets. The first set addresses the question of the validity of the apriori manipulation of imagery and familiarity. The second set of results reports predicting subjects' recall.

Sentence attribute ratings

Cell means for the 3 ratings for each of the imagery x familiarity conditions are shown in Table 5. It appears that subjects' ratings do not coincide with the apriori manipulation of familiarity and imagery. While the ratings for the low familiarity-low imagery and the high familiarity-high imagery sentences appear reasonable. The other two cells do not reflect the expected results. This is due to the correlations among the ratings. An intercorrelation matrix of the three ratings and recall is shown in Table 6. It appears that while the 2 x 2 manipulation did introduce some variability it did not provide orthogonality of the factors of imagery and familiarity.

Recall scores

Proportion recall for each cell of the 2 x 2 manipulation is as follows: low familiarity-low imagery .072; low familiarity-high imagery .379; high familiarity-low imagery .282; high familiarity-high imagery .474. The proportion recall for all sentences is .30156.

Even though the manipulation of imagery and familiarity was not effective, an ANOVA by Multiple Regression was performed to assess the

role of subjects' ratings in predicting recall. The question being can any unique variability could be accounted for by the imagery and familiarity ratings? Subjects' recall was scored against a propositional analysis of the sentences (Bovair and Kieras, 1981). The propositional analysis of the sentences yielded three propositions termed; P1, P2, P3. The P1 proposition represents the relation between the object noun and the subject noun. The P2 proposition represents the subject noun and its modifier. The P3 proposition represents the object noun and its modifier. This type of scoring analysis, developed in prose memory work, allows a finer grain and more reliable evaluation of the type and amount of material that the subject recalls than do the methods typically used in the memory studies reviewed above.

The dependent variable used in the regression analysis was the proportion of propositions recalled (PRO) per sentence, for each subject. Thus, N=60 sentences x 60 subjects, for a total of 3600. Possible values were .000, .333, .667 and 1.00, depending upon whether 0, 1, 2, or 3 propositions were recalled. Independent variables include SUBX, each subjects' mean recall, the imagery (I), familiarity (F), and comprehensibility (C) ratings, and the interactions formed by imagery x familiarity (IMFAM), by imagery x comprehensibility (IMCOM), by familiarity x comprehensibility (FAMCOM) and by imagery x familiarity x comprehensibility (IFC).

The results of the regression analysis are shown in Table 7. The Table shows the steps at which each predictor variable was entered and the R2 at each step. The coefficients shown are those from the final regression equation including all the entered variables. The reported F

values represent the "F-to-remove", which provides a test for the signifigance of the variable under the condition where it was the last variable to enter the equation. The standardized regression coefficients allow comparisons of the relative importance of each variable.

As shown previously, I and F are substantially correlated (r=.6739). However, the regression analyses allows one to assess any effects for F and to assess the variance accounted for by F, given the presence of the other factors.

As shown in Table 7, approximately 22 of the variance in subjects' recall in accounted for by the final equation. The most important factor being I, followed by F and C. I accounts for 8 of the variance, while F and C uniquely account for less than 1 of the variance. None of the interactions were significant. Thus, while there are significant effect due to F and C, neither variable adds much by way of unique variance.

In an effort to see more clearly the separate effects of imagery and familiarity in predicting subjects' recall, an additional ANOVA by Multiple regression was performed. This analysis forms the beginning of what is termed a commonality analysis. The regression analysis is shown in Table 8. This regression is identical to the one reported above with the exception of the order in which the variables I, F, C were entered into the equation. For this analysis, F was entered into the equation, followed by C and I. All three effects were significant. Again none of the interactions were significant. Entering F first accounts for 6 of the variance, C and I enter to account for less than 1 of unique variance. Thus, the results indicate that for these sentences, there is probably no

difference between imagery and familiarity and so one would not expect to find differences for C because the correlations between C and the other ratings are also high.

An unsuccessful attempt was made to use subjects' ratings of the sentences to orthogonalize imagery and familiarity. Mean ratings of imagery and familiarity for the 60 sentences were plotted. The hope was that the sentences, as they were rated by subjects, could be used to form a subset of sentences that would serve to orthogonalize imagery and familiarity. Again, imagery and familiarity were so confounded that the quadrants on the negative diagonal (high imagery-low familiarity and low imagery-high familiarity) are essentially empty.

DISCUSSION

One question that this study sought to answer had to do with how subjects would rate simple factual sentences for imageability, familiarity, and comprehensibility. Specifically, the question had to do with whether subjects could rate one of the above attributes separately from the other two. The results show that 3 ratings are substantially correlated. At least four possibilities are involved here. One is that imagery, familiarity, and comprehensibility are very subject-specific and that apriori, essentially intuitive notions of how to orthogonalize imagery and familiarity are doomed to failure. Another possibility is that subjects rated something other than imagery, familiarity, and comprehensibility, or rated familiarity and comprehensibility relative to imagery. Alternatively, familiarity and imagery may, in fact, behave this way. One interesting fact is that all sentences, whether high or low in imageability or familiarity, were rated as being reasonably comprehensible. As shown in Table 5, all cells are along the midpoint of the comprehensibility scale.

From the ratings analyses it would appear that the familiarity-imagery manipulation, while not orthogonal, did provide a range of variability across the sentences. The cell means for the familiarity rating show that subjects did change their estimate of how familiar a sentence was depending upon the apriori manipulation of imagery.

Differential recall was found for the various combinations of imagery and familiarity. However, given the confounding of imagery and

familiarity it is difficult to see what to make of this. That is, one cannot tell from these results if a sentence is remembered better the sentence is more imageable or that the words in the sentence are more familiar, or both.

This study casts serious doubt on the feasibility of manipulating imagery and familiarity in simple factual sentences. The problems found here may be reflective of the field of investigating imagery effects in recall for sentences. Katz (1983), reports that even when an attempt is made to assess subjects' ability to image on an individual level using imagery tests, these measures fail to predict cognitive task performance. Katz attributes this failing to researchers not considering such questions as the theoretical nature of the construct being used and not applying the needed techniques to ensure item homogeneity, construct content saturation, and control of response bias.

Theoretical notion regarding the interplay of imagery and familiarity are not available. However, one can believe that sentences can be constructed that are high in imagery and very familiar. Likewise, one can believe that it would be difficult to have highly imageable sentences about words or concepts one is not familiar with. High familiarity-low imagery sentences are probably possible, but it is problematic whether one can have highly imageable sentences that are not familiar. One would also have to distinguish between the familiarity of words and the familiarity of the facts conveyed by the sentence.

The question then becomes, how would one validate constructs such as imagery and familiarity? It seems from the results of this study that one can not validate subjects' ratings against apriori manipulations

of sentences thought to vary in imagery and familiarity. For example, subjects may be familiar with every word in a particular sentence and not be familiar with the concept communicated by the sentence (e.g. Sand wasps build sleeping burrows). In addition, it may be that subjects use differential strategies with regard to imagery and familiarity in performing rating and recall tasks.

Given that one is reasonably certain that something is to be gained theoretically from trying to separate the effects of familiarity and imagery for sentences, the following may be the way to procede. A pool of sentences that samples a broad range of content areas could then be constructed. Familiarity ratings could be validated in some respect using the Standard Frequency Index. This index would provide, for each word in the sentence, how frequently such a word appears in print. It would not address the question as to how familiar is the concept conveyed by the sentence.

Sentences could then be rated by a large number of subjects. Subjects would rate separately the imageability, or familiarity of the sentence. Such ratings would have to be gathered with appropriate controls to eliminate response bias and to better ensure item homogeneity. Selection could then be made from the pool of rated sentences to form the orthogonal imagery, familiarity manipulation. Subjects not involved with the ratings task could then be run using either a cued incidental or forced recall task. Even given such a scenario, it is difficult to see how one would generalize the findings to other sentences.

In conclusion, several points can be made. One point is that what is meant by imagery, familiarity, and comprehensibility needs to be clarified theoretically. Secondly, apriori manipulations of such aspects of sentences as imagery and familiarity need to be based on reliable and psychometrically sound subject ratings. Thirdly, attempts should be made to validate ratings on the basis of other aspects of the sentences, or by some independent procedure. The nature of such validation procedures would presumeably hinge on theoretical notions as to the meaning and function of imagery, familiarity, and comprehensibility in the comprehending and recall of sentences.

Table 1

Sentences used in Experiment

Low Familiarity-Low Imagery sentences

The economic indicators forecast additional unemployment.
The British Empire relied on naval strength.
Subjective contours contain incomplete figures.
Loan words aid linguistic reconstruction.
Natural selection explains biological diversity.
Population genetics studies phenotypic frequencies.
Maritime activities established the Hanseatic League.
An emotional disturbance may cause childhood stuttering.
Cognitive Psychology studies concept formation.
Quantum mechanics utilizes differential equations.
Structural anthropology studies folklore variants.
Factorial designs provide for hypothesis testing.
Microwave transmission extends broadcast coverage.
Disease taxonomies improve diagnostic accuracy.
Predicate calculus is a form of symbolic logic.

Table 2

Sentences used in Experiment

Low Familiarity-High Imagery sentences.

The DNA molecule is depicted as a double helix.
Atmospheric dust often produces spectacular sunsets.
Rabies vaccination is a painful procedure.
Playing cards are made of pressed cardboard.
Light bulbs have tungsten filaments.
Keyboard instruments have different mechanisms.
The ancient Hellenes used bronze swords.
X-ray stars may be black holes.
The camera obscura uses a pinhole aperture.
The largest mollusk is the Giant Clam.
Carnivorous plants can catch aquatic insects.
Sand wasps construct sleeping burrows.
Wild bobcats have a reclusive nature.
Potato leaves contain a deadly poison.
Target archers use fiberglass arrows.

Table 3

Sentences used in Experiment

High Familiarity-Low Imagery sentences

Modern agriculture increased food production.
Food processing increases consumer costs.
The Italian Renaissance encouraged intellectual curiosity.
Many people oppose nuclear power.
Computer programming is a skilled occupation.
Electron microscopy reveals minute details.
Weather forecasting is a developing science.
Intelligence quotients predict scholastic achievement.
High school classes include American history.
State senates enact local legislation.
Legal gambling includes state lotteries.
Primitive Christanity was a persecuted religion.
Political beliefs are assessed with opinion polls.
Interstate commerce is regulated by the federal bureaucracy.
Democratic traditions foster personal freedoms.

Table 4

Sentences used in Experiment

High Familiarity-High Imagery sentences

Annual flooding occurs in the Nile Valley.
Rainbow features include multiple arcs.
Placental mammals bear live young.
Pickup trucks carry large payloads.
Modern zoos are protecting endangered animals.
Hard candy is largely processed sugar.
Modern factories use assembly lines.
India ink is a black pigment.
Hiking boots have thick soles.
Vehicle emissions contribute to air pollution.
African elephants have large ears.
Spaghetti sauce is made from ripe tomatos.
Prehistoric man used stone tools.
Drive-in theatres have concession stands.
Track events include marathon running.

Table 5

Cell means for sentence ratings

	Low Imag Low Fam	Low Imag High Fam	High Imag Low Fam	High Imag High Fam
Comprehensibility	4.14	5.89	5.38	6.41
Familiarity	3.27	4.90	5.02	6.28
Imageability	3.20	5.09	3.90	5.88

Table 6

Correlation matrix for sentence ratings and recall
N=3600

	I	F	C	Recall
I	1.00	.6739	.6953	.2667
F		1.00	.6812	.2668
C			1.00	.2933
Recall				1.000

Table 7

Regression analysis of Subjects' recall (N=3600)

Variable	Step	final coeff.	final std. coeff.	R2	F	
SUBX	1			.133		
I	2	.027	.145	.212	361.96	#
F	3	.035	.189	.218	29.14	#
C	4	.021	.013	.2217	15.29	#
IMFAM	5	-.00042	-.184	.2220	1.30	
IMCOM	6	.00031	.013	.2220	1.00	
FAMCOM	7	-.00428	-.184	.2223	0.20	
IFC	8	.0008	.002	.2224	0.69	

# $p < .01$

Table 8

Regression analysis of Subjects' recall (N=3600)

Variable	Step	final coeff.	final std. coeff.	R2	F	
SUBX	1			.133		
F	2	.035	.189	.1949	277.57	#
C	3	.021	.013	.2094	65.91	#
I	4	.027	.145	.2217	56.88	#
IMFAM	5	-.00421	-.184	.2220	1.30	
IMCOM	6	.00031	.013	.2220	1.00	
FAMCOM	7	-.00428	-.184	.2223	.20	
IFC	8	.00082	.002	.2224	.69	

# $p < .01$

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