Never Published (Submitted but Rejected at JVLVB)

Memory for Level of Category References in Stories

John B. Black

Psychology Department

University of Illinois at Chicago Circle

Chicago, Illinois 60680

and

Gordon H. Bower

Psychology Department

Stanford University

Stanford, California 94305

415-497-2888

Short Title: Memory for Category References in Stories

Send proofs to: John Black

Psychology Department

Stanford University

Stanford, California 94305

Memory for Level of Category References in Stories

John B. Black and Gordon H. Bower[1]

Topic: Memory for prose

Memory for category level

Abstract

A specific bias within reconstructive memory is identified: namely, during recall of a text people prefer to use basic level category terms for referring to an object regardless of the categorization level of its reference in the text. In an experimental demonstration, subjects recalled a story that referred to objects equally often by use of superordinate (e.g., fruit), basic (e.g., apple) and subordinate (e.g., Mackintosh apple) categorization levels. In recall subjects substituted basic terms for references that originally used superordinate and subordinate terms, whereas originally basic level references were recalled accurately. This bias for using basic level terms explains these findings and previous ones concerning abstraction in story memory.

Is text recall abstractive or reconstructive? In other words, is text recall largely a matter of retrieving from memory summary propositions extracted from the text when it was read, or is recall a matter of reconstructing the story from a conceptual memory representation? We hope to illuminate this general question by proposing a specific reconstructive process: namely, that during recall people tend to use "basic level" category terms whenever possible to tell a story, regardless of the category level presented in the original story. If a text uses a very specific term like "Mackintosh apple" with an object array that does not call for this specific a discrimination (see Olson, 1970), then we hypothesize that the readers will tend to abstract that term as "apple". But if the text uses an overly general term like "fruit" when readers know that an "apple" is being referred to, then we suppose that they substitute the more specific term during comprehension and recall. Hence, this "regression towards basic-level terms" will produce word-shifts in recall that can be either more abstract or more specific than the original terms in the text.

Examining story recalls produced by his subjects, Bartlett (1932) observed cases of both abstraction and specification. Their recall of an event often had less detail than the original text (abstraction), but sometimes had more detail than the original (specification). Bartlett considered his observations as evidence for reconstructions, wherein subjects remember a few dominant details from which they reconstruct the story. Gomulicki (1956) and Zangwill (1972) challenged this view: they proposed that story memory is largely an abstractive process. Gomulicki (1956) presented story recall data that apparently showed evidence only of

abstraction, but his experiment used more comprehensible texts than Bartlett's and the retention interval was much shorter than Bartlett's.

More recently, Anderson, Pichert, Goetz, Schallert, Stevens, and Trollip (1976) proposed that "arriving at an appropriate meaning [of generic terms] is usually a matter of instantiation", which is another word for specification. Their experiments demonstrated that a specific instantiation (word) dictated by a sentence context served as a better recall cue for the last phrase in the sentence than did the general term actually stated in the sentence. That is, given "The woman was outstanding in the theatre" subjects could recall the last word better when cued with "actress" than when cued with "woman". Thus memory for a sentence containing general terms may be more specific than the original.

In other story recall experiments, Frederiksen (1975 a & b) reported "pseudodiscriminations" (more specific statements than the original text) and "elaborations" (completely new statements) as well as overgeneralizations of text statements. Frederiksen wanted to determine whether overgeneralizations, pseudodiscriminations, and elaborations were produced during reading or recall testing. He found that overgeneralizations and pseudodiscriminations increased with repeated learning trials, whereas elaborations decreased with trials. From these results, he concluded that overgeneralizations and pseudodiscriminations were created during reading, whereas elaborations were produced during recall. However, Frederiksen offered no hypothesis about when to expect text statements to be overgeneralized, pseudodiscriminated, or elaborated.

In understanding distortions in recall, we should first acknowledge that readers have preconceptions about how story texts should refer to common objects. Thus we may expect substitutions in recall when the expressions referring to an object do not match these preconceptions. Brown (1958) observed that when naming an object, people prefer to use that name with the greatest frequency and utility in the current situation. Hence, one would say "apple" rather than "Mackintosh apple" or "fruit" because "apple" is the equivalence class that is usually appropriate. Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976) expanded this idea by proposing that there is a "basic object" level of categorization which is defined by four converging operations. The basic level is the most inclusive level at which (1) the objects of a category possess many attributes in common, (2) highly similar sequences of motor movements are made with respect to objects in the category, (3) the shapes of the objects in the category show a large gain in objective similarity over the next higher level of abstraction, and (4) the shapes of the objects in the category are similar enough that the shape of an average of several category members is identifiable as a category member. After validating these operational definitions,Rosch, et al. (1976) showed further that the basic level is the most inclusive level for which priming improves signal detection and object recognition, that basic level categories are the first categories learned and used by young children, and that basic level words are the ones normally chosen to refer to concrete objects.

We may assume that a person's knowledge about real world objects is mainly organized in terms of basic level categories. Since story comprehension and memory use this knowledge, basic level categories should also

be an important factor in story recall. Furthermore, a preference for using basic categories has implications about when recall will substitute a more abstract term than the original story and when it will substitute a more specific term. In particular, assuming a general bias to use the basic level, people should tend to recall object references at the basic level regardless of whether the object references in the original story were at the superordinate, basic, or subordinate levels. This prediction holds provided that the text does not require a discrimination at exactly one of the other levels: e.g., if it is not discussing the virtues of Mackintosh versus Delicious apples.

In the present study, subjects read a story in which the same objects were referred to equal numbers of times using superordinate (e.g., "fruit"), basic (e.g., "apple"), and subordinate (e.g., "Mackintosh apple") category terms. The hypothesis predicted that during recall people would tend to transform superordinate and subordinate terms used in the text into corresponding basic terms, whereas the basic terms would be recalled as stated in the text. We expected the basic level references to predominate because that is the level at which the story utilized the referenced objects. For example, when a story character selects an apple to eat from a group of food objects it is immaterial whether the apple is a "Mackintosh apple" or some other kind; but when a character eats a "piece of fruit" and we know it is an apple, then we represent that phrase as though it said "he ate an apple". The basic level of categorization should be the level of meaning at which object references are integrated into the story; therefore, in recall we predict more references at the basic level than at the superordinate or subordinate levels.

Method

Subjects

The subjects were eighteen undergraduates at Stanford University who participated to fulfill an Introductory Psychology course requirement.

Materials

A 1656 word story was written containing 156 target category terms. These terms came from five of the six non-biological taxonomies used by Rosch, et al. (1976): fruits, furniture, clothing, vehicles, and tools. Table 1 gives the terms used in the story, the taxonomies to which they belong, and their category level. For example, the fruit taxonomy has fruit as a superordinate level term; apple, peach, and grapes as basic level terms; and Mackintosh apple, cling peach, and Concord grapes as subordinate level terms.

- - - - - - - - - - - - - -
Insert Table 1 about here
- - - - - - - - - - - - - -

The story referred to objects in each taxonomy several times at each level of categorization. For the clothing and fruit taxonomies there were 11 occurrences of each taxonomy's superordinate term, 11 occurrences of each taxonomy's basic level terms, and 11 occurrences of each taxonomy's subordinate terms. For the furniture, vehicle and tool taxonomies there were 10 occurrences of each taxonomy's superordinate terms, 10 occurrences of each taxonomy's basic level terms, and 10 occurrences of each taxonomy's subordinate terms. Hence the story contained 33 fruit terms and 33 clothing terms (11 at each of the three categorization levels), 30 furniture terms, 30 tool terms, and 30 vehicle terms (10 at each of the three

categorization levels). Thus the story has a total of 156 target terms.

The story's title is "Going Shopping" and it has the following plot outline: Mike gets up in the morning and while getting dressed notices that he needs some new clothing; he then goes to breakfast where he eats fruit, after which he uses some tools to repair some kitchen furniture; then he goes to two stores (encountering various vehicles while enroute) where he shops for clothing, furniture, tools and fruit. (Notice that this plot maximizes the occurrences of the five target taxonomies of clothing, fruit, furniture, tools, and vehicles.)

To illustrate, the following 208-word fragment is the second of the ten paragraphs in the story:

> Mike went into the kitchen and took a cling peach out of the refrigerator. How he loved this type of fruit. He sat down on a chair at the kitchen table munching on the peach. As he sat there he noticed a wobble in the kitchen chair. He was tired of this wobbly chair, so he resolved to fix that piece of furniture right here and now. He went into the garage and started searching for his hammer and hand saw. When he found them he brought the claw hammer and the saw back into the kitchen. "Okay, now to fix that piece of furniture", he thought. First he took the hammer and started pounding a nail into the kitchen chair with the tool to steady the chair's leg. But that wasn't enough; he also needed to even off the leg. Therefore, he set the piece of furniture on its side and started cutting away with the hand saw. Back and forth he moved the tool. Finally the furniture leg was the correct length, so he put away the claw

hammer. However, he looked at the hand saw and thought, "This thing has really had it. I should buy a new tool." So he threw that tool away.

The critical category terms are italicized here for illustration. This paragraph contains examples of three of the five taxonomies--fruit, furniture, and tools. Note that the paragraph refers to a cling peach as a piece of fruit (superordinate level), a peach (basic level), and a cling peach (subordinate level); it also refers to a kitchen chair as a piece of furniture (superordinate level), a chair (basic level), and a kitchen chair (subordinate level); and it refers to a claw hammer as a tool (superordinate level), a hammer (basic level), and a claw hammer (subordinate level).

Procedure

The subjects were tested in groups of from two to eight. They were given typed copies of the story, instructed to read it in their normal manner, and told that they had five minutes to do so. After four minutes they were warned that they had only a minute left; after one more minute the copies were collected. All subjects finished reading the story in the time allowed.

Next the subjects performed an intervening task in which they rated many statements according to how plausible they were as inferences from three stories. The subjects were given copies of the three stories and the three corresponding lists of statements. They wrote a numerical plausibility rating beside each statement while referring to the story texts. These stories were very different in content from the experimental

"Going Shopping" story. This task took approximately 30 minutes. The ratings were collected and then the subjects were instructed to recall the initial story. They were cued with the title, "Going Shopping", and asked to write their recalls as close to the original text as possible.

These recall protocols were scored for the presence or absence of each of the 156 target object references. To help match up object references in the recall protocols with those in the original story text, the text was segmented into propositions. A proposition was defined as a predicate (usually a verb) and its instantiated arguments (e.g., Kintsch, 1974). If a proposition in a recall protocol contained a target category term, then it was matched against a proposition in the segmented text. The primary criterion for this proposition matching was the equivalence of the verbs. Once the recalled statements were matched with story propositions, then it was obvious to which original object references the recalled target terms corresponded. When a given object reference was present in recall, the category level (i.e., superordinate, basic, or subordinate) of that term was noted. Some target category terms were present in the recall protocols which had no corresponding object references in the original text. The category level of these intrusions were also tallied.

Results

We eliminated 4 of the 18 subjects (leaving 14 subjects) from the following analyses because they failed to recall enough of the target category items (i.e., failed to recall any items from more than 2 of the 15 item sets). Eliminating these 4 subjects did not alter the pattern of the means in Table 2, but it did decrease the error variances because many zero-recall entries were eliminated.

Table 2 presents the mean numbers of category terms recalled at the three levels of categorization combining all five of the taxonomies. The rows of the table correspond to the levels of the target category terms in the original story text. The row labeled "None" refers to the category level of recalled terms which had no corresponding terms in the original text (but only the terms given in Table 1 were counted): i.e., they are intrusions. The columns of the table correspond to the levels of the target category terms in the recall protocols. For example, the first row states that subjects recalled an average of 8.85 of the 52 category terms that were originally stated at the superordinate level in the story text. More specifically, the subjects recalled at the superordinate level 1.49 of the 52 originally superordinate terms, recalled 5.29 of them at the basic level, and recalled 2.07 of them at the subordinate level. The other three rows of the table are interpreted similarly. The overwhelming impression from Table 2 is a preponderance of basic level terms in the recall protocols regardless of the category level of the corresponding object references in the original text.

- - - - - - - - - - - - -
Insert Table 2 about here
- - - - - - - - - - - - -

The Totals column on the right in Table 2 shows that subjects recalled significantly fewer of the originally superordinate terms (8.85) than the originally basic terms (14.73), $\underline{F}(1,13) = 22.29$, $\underline{p} < 0.001$. They also recalled significantly fewer of the originally superordinate terms (8.85) than the originally subordinate terms (16.07), $\underline{F}(1,13) = 33.35$, $\underline{p} < 0.001$. However, total use of the basic and subordinate terms in recall did not differ significantly, $\underline{F}(1,13) = 1.20$, $\underline{p} > 0.10$.

To explicitly test our hypothesis of regression to the basic level, we ask whether subjects recall more originally superordinate terms at the basic level than originally basic terms at the superordinate level, and whether subjects recall more originally subordinate terms at the basic level than originally basic terms at the subordinate level. But these questions compare entries from different rows in the table. We cannot compare the raw means across rows, because row totals are unequal. Therefore we need conditional probabilities to compare entries across rows: specifically, we calculated the conditional probability that subjects recalled a category term at a particular level given that they recalled some appropriate term for that "slot" in the story.

- - - - - - - - - - - - - -
Insert Table 3 about here
- - - - - - - - - - - - - -

Table 3 displays these conditional probabilities as percentages, obtained by dividing the entries in Table 2 by the row totals. For example, the first row in Table 3 states that of the superordinate category references in the original text recalled by the subjects, 17% were recalled by use of the superordinate level word, 60% by use of the basic level word, and 23% by use of the subordinate term.

While these percentages reveal the predicted regressions in a striking manner, we must consider proper statistical tests. There is currently a controversy over whether investigators using language materials should use fixed or mixed effect analysis of variance (ANOVA) models (Clark, 1973; Wike & Church, 1976; Clark, Cohen, Smith, & Keppel, 1976). In the present case, the question is whether to treat the five taxonomies as a random sample of all taxonomies and thus as a random effect in the ANOVA model,

or to confine our conclusions to these five taxonomies and thus treat them as a fixed effect in the ANOVA model. We report statistical tests based on both models. Happily, the test used does not influence the pattern of significances. Hence this section reports F tests for the relevant fixed effect model as well as quasi-F (F') tests for the relevant mixed effect model.

Referring to Table 3, we see that when the subjects recalled the objects referred to originally by a superordinate term, 60% of the recalls substituted the basic level term. On the other hand, of reference sites using the basic terms in the text, only 6% of these recalls substituted the superordinate term (fixed model: $F(1,13) = 59.45$, $p < 0.001$; mixed model: $F'(1,13) = 31.39$, $p < 0.001$). The subjects also recalled more of the originally superordinate terms at the basic level (60%) than at the subordinate level (23%; $F(1,13) = 16.64$, $p < 0.01$; $F'(1,8) = 5.47$, $p < 0.05$). Next, comparing the basic and subordinate levels, Table 3 shows that subjects substituted the basic level term into 59% of the originally subordinate sites that were recalled; but substituted the subordinate level into only 27% of the original basic level sites that were recalled ($F(1,13) = 21.70$, $p < 0.001$; $F'(1,16) = 12.89$, $p < 0.01$). Subjects also recalled more of the originally subordinate terms at the basic level (59%) than at the superordinate level (3%; $F(1,13) = 205$, $p < 0.001$; $F'(1,7) = 46.52$, $p < 0.001$). Subjects also stated more of their intrusions at the basic level (73%) than at the superordinate and subordinate levels combined (27%; $F(1,13) = 14.22$, $p < 0.01$; $F'(1,16) = 10.24$, $p < 0.01$).

This bias towards recall at the basic level also occurs for each taxonomy individually. There are 10 comparisons of category level shift probabilities that are critical to the hypothesis (e.g., originally superordinate terms recalled by substituting the basic level versus originally basic terms recalled by substituting superordinates). All 10 critical comparisons favored the regression to the basic level. Also when we divide Table 3 into individual taxonomies, there is a total of 20 rows (4 rows per taxonomy and 5 taxonomies). Within each row there are two comparisons of interest--comparing the probability of recalling terms at the basic level to the probability of recalling them at the superordinate level, and also comparing it to the probability of recalling them at the subordinate level. Of these 40 comparisons, 38 were in the direction predicted by regression to the basic level (the 2 outliers involved larger percentages at the subordinate level). This pattern is highly significant (sign test, $p < 0.001$). The quasi-F tests cited above also indicate that this basic level effect holds across the individual taxonomies.

Subjects also tended to recall more category terms at the subordinate level than at the superordinate level, but this tendency was smaller than the basic level bias. The assymetries in the rows of Table 3 illustrate this effect: the subordinate entries (right column) are usually greater than the corresponding superordinate entries (left column). Subjects recalled 23% of the originally superordinate terms at the subordinate level, but recalled only 3% of the originally subordinate terms at the superordinate level ($F(1,13) = 7.43$, $p < 0.05$; $F'(1,12) = 3.97$, $0.05 < p < 0.10$). Also 27% of the originally basic level terms were recalled by substituting the subordinate level term, while only 6% were recalled by substituting the

superordinate level ($F(1,13) = 11.84$, $p < 0.01$; $F'(1,9) = 6.88$, $p < 0.05$). The slight difference in favor of intrusions being superordinates (19%) rather than subordinate terms (8%) was not significant ($F(1,13) = 1.85$, $p > 0.10$).

Discussion

This experiment has demonstrated a powerful mechanism that is neither a pure abstraction process nor a pure specialization process. Rather, depending upon the referring terms used in the text, the process can lead to recall intrusions of terms that are more abstract or more specific than those in the text. In particular, there is a bias to regress in recall towards using the basic level of categorization. If the text names an object at a more general level than the basic level, then subjects substitute the more specific basic level term in recall. However, if the text names an object more specifically than the basic level, then subjects will tend to substitute the more general basic level term during recall.

When our subjects failed to recall a reference at the basic level, they tended to substitute the subordinate term rather than the superordinate term for it. Here, as in the experiments by Anderson, et al. (1976), the biases operate to produce greater specification in recall rather than abstraction.

Use of the basic level term would seem to follow the conversational postulate of proper quantity (Grice, 1975). This maxim enjoins us to make our assertion appropriately informative (i.e., discriminating) given the likely set of alternatives our listener is considering, and to make our assertion not have an excess of detail beyond what is required to pick out its referent. Being overpracticed in tailoring their normal storytelling

to this maxim, our subjects persist with that style of recitation even when asked to recall a text verbatim.

An unexpected result was the inferior total recall of the reference sites using superordinate terms originally. We might conclude that something about the superordinate terms (perhaps their abstractness) caused the statements containing them to be forgotten more than the others. However, it seems more likely that this result was an unintended outcome of the way the experimental story was written. In this story, the first reference to an object was at the basic or subordinate level; then later references to the object might use the superordinate level. For example, the text fragment displayed in the Method section first refers to a peach as a "cling peach" and then as a "type of fruit"; it first refers to a chair as a "chair" and a "kitchen chair" before it refers to it as a "piece of furniture". The relevance of this observation is that Kintsch and Keenan (1973) and Kintsch, Kozminsky, Streby, McKoon, and Keenan (1975) found that subjects recall the first mention of an object in the text better than later mentions of it. Thus, it may be that greater salience of first-mentions operates in our case to yield poorer recall for the superordinate category terms.

A possible alternative explanation for our results on basic-level regression is that in recall people tend to use the most common or frequent category term for an object reference. There are actually two frequency hypotheses: one hypothesis is that the words mentioned most frequently in the text are recalled the best, and the other hypothesis is that there is a recall bias towards the terms that occur most frequently in the language.

The text frequency hypothesis will not produce our regression to the basic level results because the text mentions any given superordinate term more frequently than any particular corresponding basic or subordinate term. It is an unfortunate aspect of most of the terms used in this experiment that the actual basic term words are a subset of the subordinate term words. For example, the basic term apple is a subset of the subordinate term Mackintosh apple. Thus the text mentioned the single words that were the basic terms twice as frequently as the two word noun phrases that were the subordinate terms. However, the superordinate term words were the most frequent of all because there were always three basic (e.g., apple, peach, and grapes) and three corresponding subordinate terms (e.g., Mackintosh apple, Cling peach, and Concord grapes), but only one superordinate term (e.g., fruit). The text mentioned a superordinate word 10 or 11 times; but even though the text mentioned basic words 10 or 11 times as basic level terms and 10 or 11 times as subordinate level terms, there were three such words per taxonomy so the text only mentioned a given basic word an average of seven times. Hence the frequency of superordinate words was 10 or 11 whereas the average frequency of basic words was seven, so this frequency hypothesis would predict better recall of superordinate than basic terms. Since the basic terms were recalled better than the superordinate, we can reject this hypothesis.

The second frequency hypothesis claims that there is a recall bias towards the terms that occur most frequently in the language. Fortunately, the basic level and language frequency hypotheses give contrasting predictions for two of the taxonomies used in this experiment. We cannot compare the frequencies of the subordinate and basic levels, because the subordinate

level terms are usually two words. However, using the Kucera and Francis (1967) frequency norms we can compare the single word superordinate and basic terms. Comparing the superordinate and basic terms (combining the frequencies of singular and plural words) for the five taxonomies, we discover that at least one of the three basic terms used in each of the furniture, vehicle, and tool taxonomies has a greater frequency than the superordinate; but the superordinate terms for the fruit and clothing taxonomies have a greater frequency than any of the basic terms we used for these taxonomies. Hence for the fruit and clothing taxonomies the frequency hypothesis predicts a recall bias towards the superordinate level whereas the basic level hypothesis still predicts a recall bias towards the basic level. For the clothing taxonomy, there are more originally superordinate terms recalled at the basic level (34%) than originally basic terms recalled at the superordinate level (3%; $F(1,13) = 12.67$, $p < 0.001$). For the fruit taxonomy, there are more originally superordinate terms recalled at the basic level (53%) than originally basic terms recalled at the superordinate level (5%; $F(1,13) = 27.86$, $p < 0.001$). Hence, the basic-level regression hypothesis predicts the results far better than does the frequency hypothesis.

Regression of recall to basic category terms provides a way to organize some of the findings described at the outset. The proposal implies that the abstractions seen by Gomulicki (1956) and Zangwill (1972) and the overgeneralizations seen by Frederiksen (1975 a & b) will occur whenever the original story contains many unnecessarily subordinate object references. The hypothesis also implies that the instantiations seen by Anderson, et al. (1976) and

the pseudodiscriminations seen by Frederiksen (1975 a & b) will occur whenever the story contains many unnecessarily superordinate level object references. In addition, the hypothesis implies most accurate recall when the text contains basic level object references.

A question that this experiment does not answer is whether this transformation to the basic level category occurs while subjects read a story or later while they recall it. One possibility is that the shift from the superordinate to the basic occurs primarily during reading, whereas the transformation of the subordinate into the basic does not occur until recall. These issues are questions for future research.

REFERENCES

Anderson, R. C., Pichert, J. W., Goetz, E. T., Schallert, D. L., Stevens, K. V., and Trollip, S. R. Instantiation of general terms. Journal of Verbal Learning and Verbal Behavior, 1976, 15, 667-679.

Bartlett, F. C. Remembering. Cambridge: Cambridge University Press, 1932.

Brown, R. How shall a thing be called? Psychological Review, 1958, 65, 14-21.

Clark, H. H. The language-as-fixed-effect fallacy: A critique of language statistics in psychological research. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 335-339.

Clark, H. H., Cohen, J., Smith, J. E. K., and Keppel, G. Discussion of Wike and Church's comments. Journal of Verbal Learning and Verbal Behavior, 1976, 15, 257-266.

Frederiksen, C. H. Acquisition of semantic information from discourse: Effects of repeated exposures. Journal of Verbal Learning and Verbal Behavior, 1975, 14, 158-169. (a)

Frederiksen, C. H. Effects of context-induced processing operations on semantic information acquired from discourse. Cognitive Psychology, 1975, 7, 139-166. (b)

Gomulicki, B. G. Recall as an abstractive process. Acta Psychologica, 1956, 12, 77-84.

Grice, H. P. Logic and conversation. In P. Cole and J. L. Morgan (Eds.) Syntax and semantics, Vol. 3: Speech Acts. New York: Seminar Press, 1975.

Kintsch, W. The representation of meaning in memory. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1974.

Kintsch, W. and Keenan, J. W. Reading rate and retention as a function of the number of propositions in the base structure of sentences. Cognitive Psychology, 1973, 5, 257-274.

Kintsch, W., Kozminsky, E., Streby, W. J., McKoon, G., and Keenan, J. M. Comprehension and recall of text as a function of content variables. Journal of Verbal Learning and Verbal Behavior, 1975, 14, 196-214.

Kucera, H., and Francis, W. N. Computational analysis of present-day American English. Providence, Rhode Island: Brown University Press, 1967.

Olson, D. R. Language and thought: Aspects of a cognitive theory of semantics. Psychological Review, 1970, 77, 257-273.

Rosch, E. R., Mervis, C. B., Gray, W. D., Johnson, D. M., and Boyes-Braem, P. Basic objects in natural categories. Cognitive Psychology, 1976, 8, 382-439.

Wike, E. L., and Church, J. D. Comments on Clark's "The language-as-fixed-effect fallacy". Journal of Verbal Learning and Verbal Behavior, 1976, 15, 241-255.

Zangwill, O. L. Remembering revisited. Quarterly Journal of Experimental Psychology, 1972, 24, 123-138.

Table 1

The Five Taxonomies Used as Stimuli

Superordinate Level	Basic Level	Subordinate Level
Fruit	Apple	Mackintosh Apple
	Peach	Cling Peach
	Grapes	Concord Grapes
Furniture	Table	Kitchen Table
	Lamp	Desk Lamp
	Chair	Kitchen Chair
Clothes	Pants	Levis
	Socks	Ankle Socks
	Shirt	Knit Shirt
Vehicles	Car	Sports Car
	Bus	City Bus
	Truck	Pick-up Truck
Tools	Hammer	Claw Hammer
	Saw	Hand Saw
	Screwdriver	Phillips Screwdriver

Table 2

Mean Numbers of Target Words Recalled at Each Category Level

		Level of Category Recalled			
		Superordinate	Basic	Subordinate	Total
Level of Category Read	Superordinate	1.49	5.29	2.07	8.85
	Basic	0.93	9.79	4.01	14.73
	Subordinate	0.57	9.42	6.08	16.07
	(None)	0.86	3.29	0.35	4.50

Table 3

Mean Percentage of Total Recalled Target Words Recalled at Each Category Level

		Level of Category Recalled		
		Superordinate	Basic	Subordinate
Level of Category Read	Superordinate	17	60	23
	Basic	6	67	27
	Subordinate	3	59	38
	(None)	19	73	8

Footnote

1. We thank Eleanor Rosch for discussions during the initial stages of this research and Herbert Clark for valuable comments on an earlier version of this manuscript. This research was supported by a research grant, MH-13950, to the second author from the National Institutes of Mental Health. Reprints may be obtained from Dr. Gordon H. Bower; Department of Psychology; Stanford University; Stanford, California 94305.