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Word Meanings in Semantic Memory: Separating, Defining and Characteristic Features

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WORD MEANINGS IN SEMANTIC MEMORY:
SEPARATING, DEFINING AND
CHARACTERISTIC FEATURES

BY

AGELIKI NICOLOPOULOU

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
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ABSTRACT

Three experiments were conducted to obtain some empirical generalizations about the structure of semantic memory. In the first experiment subjects were asked to give features for five category names as well as four instances per category. Instances varied on degree of relatedness to the category. In the second experiment subjects were asked to separate the features that they had given into (a) those that were essential for the meaning of a word (defining), and (b) those that were not absolutely necessary for the word (characteristic). In the third experiment a new set of subjects were given the same five category names and 2 instances out of the previous four, each word followed by a common pool of features that were generated by its category and instances in experiment 1, and were asked to separate these features into essential, non-essential and not a property for each stimulus word. The predictions tested were that (1) subjects would produce a greater number of defining than characteristic features, (2) the first feature generated would be more frequently a defining than a characteristic feature, (3) defining features of the category would be fewer in number than defining features of the instances, and (4) the degree of relationship between the defining and characteristic features of the instance and the defining and characteristic features of its category would vary with the degree of relatedness of the instance to the category. Prediction 1 was not supported. Rather, it was found that characteristic features were more prevalent than defining features

for both categories and instances. Prediction 2 was confirmed: there were more defining than characteristic features given as first response. Prediction 3 did not receive any support. Prediction 4 was confirmed for defining features, where it was found that decreasing levels of relatedness lowered the overlap between the instance and its category; however, the relationship between the characteristic features of the instance and its category remained at about the same high level at all degrees of relatedness.

These findings, along with the fact that the categorization of features for instance words was not altered when Ss were given the category names¹ features first, argue against the view that category names function as superordinates for instance in semantic memory and in favor of the view that natural language categories possess an analog structure and that category names act as "best exemplars" of each category.

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To my mother and to the memory of my father I dedicate this work.

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INTRODUCTION

In recent years psychologists have become concerned with the nature of semantic memory, which deals with word meanings and their structural representations. As aptly described by Tulving (1972), semantic memory is

"the memory necessary for the use of language. More explicitly, it is a mental thesaurus, organized knowledge a person possesses about words and verbal symbols, their meaning and referents, about relations among them, and about rules, formulas, and algorithms for the manipulation of these symbols, concepts and relations" (p.386).

The term "semantic memory" was first introduced in psychology by Quillian (1967) in his dissertation (cited by Tulving, 1972). It originated from the necessity of assuming semantically organized material for the memory bank of the computer in an attempt to simulate a language comprehender. Subsequently, hypotheses and models of how humans might retrieve the meaning of words and facts from "semantic memory" were proposed by psychologists of the information processing approach who viewed the individual as an active agent, processing available linguistic information and possessing a highly organized permanent memory (Landauer and Freedman, 1968; Collins and Quillian, 1969; Meyer, 1972; Smith, Shoben and Rips, 1974; Glass and Holyoak, 1974, 1975, etc.).

Although the information processing approach represents one class of attempts to delineate the intricacies of semantic memory, this has not been the only approach undertaken in the history of American

psychology. Earlier approaches originated with psychologists involved in the investigation of words and their associations (Bousfield, 1953; Osgood, 1952; Deese, 1962, 1965; Cofer, 1963; and Jenkins, 1964). The major research focus of this tradition has been to describe word meanings and, subsequently, to represent the organization of such meanings through constructing a network of associated words. Another approach has been a purely empirical one that attempts to describe the organization of the mental dictionary (Brown and McNeil, 1966; Miller, 1969, 1972; and Fillenbaum and Rapoport, 1971). A variety of tasks, like tip-of-the-tongue phenomenon and semantic sorting techniques were employed to describe some of the regularities of storage and the semantic variables that categorize words as similar or dissimilar.

These research traditions share in common a view of memory as an organized body of knowledge. Semantic memory must represent an organized structure. Facts are connected to other facts in a non-random way. One word is connected to other words related to it in meaning. Accessibility and reconstruction of linguistic information is achieved without much effort, though not without error, as can be observed in human communication. Meaning of words and their relations or referents must be organized in a structure that makes their accessibility as well as their reconstruction highly possible.

A critical problem, according to the present author, that needs to be answered before any formal attempt to describe semantic memory can be undertaken is that of the representation of meaning in memory. Knowledge of how meanings of words are represented in memory will facilitate the difficult task of describing the structure of memory and

the processes of retrieval from such a structure.

The various semantic memory models proposed in recent years are divided into network and set-theoretic models due to their different representations of word meanings. (For a detailed presentation of these models, see Appendix I.) In set-theoretic models (i.e. Meyer, 1970, 1973; Schaeffer and Wallace, 1970; Kintsch, 1972, 1974; Smith, Shoben and Rips, 1974) concepts are represented by a set of elements which might be exemplars, attributes, subsets or supersets of the concept. Semantic relations are defined in terms of operations, such as set inclusion and set exclusion. For example, the statement "a car is a vehicle" is verified by determining that the set of features defining "car" contains the set of features defining "vehicle". Furthermore, natural language concepts are assumed to have fuzzy edges whose boundaries are not sharply defined. Thus, the relation of category membership is assumed as a matter of degree. Instances show various degrees of relatedness to the category and some instances are better members of the category than others.

Network models (i.e. Collins and Quillian, 1969; Landauer and Freedman, 1968; Conrad, 1972; Glass and Holyoak, 1974, 1974/1975) assume that words, or their counterparts, exist as independent units in semantic memory connected by a network of labeled relations. Class inclusions and exclusions are specified by the graphic presentation of networks. For example, if an instance is connected to a superordinate, it signifies that the instance is contained in the category that the superordinate belongs to. However, if there is no connection between an instance and a superordinate, it is assumed that the instance is not

contained in the category of that particular superordinate. In contrast to the set-theoretic models, semantic relations are all-or-none. A semantic component either dominates another or it does not, and a component either contradicts another or it does not. This type of representation leads to absolute rather than continuous notions of truth and falsity of semantic relations. For example, a person might be uncertain as to the truth value of "a bat is a bird", due to his ignorance or the sentence's ambiguity; but, nevertheless, an absolute dichotomy between the notions of truth and falsity is assumed.

In addition to the question of meaning representation, other empirical questions about the processes and variables affecting retrieval have been raised. Specifically, the question has been raised as to whether retrieval processes are simultaneous or parallel (Landauer and Freedman, 1968; Homa, 1973; and Meyer, 1973). There is also the question of what the nature of these processes is. More specifically investigators have asked whether retrieval of an inference that is repeated twice facilitates this retrieval step (Collins and Quillian, 1970a), what are the directional effects of inclusion relations (Loftus and Bolton, 1974), whether subjects use differential processing for various categories (Freedman and Loftus, 1974), whether the search for adjectives involves a different process than search for nouns (Grober and Loftus, 1974; and Loftus and Cole, 1974) and, lastly, what are the processes underlying rejection of false but meaningful sentences. The effect of a number of structural variables related to semantic memory findings have been investigated. Attention has been directed towards the frequency with which a particular

instance is produced when a category name is presented (known as instance dominance) and the frequency of a category name when an instance is presented (known as category dominance) (Wilkins, 1971; Loftus and Freedman, 1972; Loftus and Suppes, 1972; Loftus, 1973; Shoben and Rips, 1973; Anderson and Reder, 1974; Glass and Holyoak, 1974; Glass, Holyoak, and O'Dell, 1974; Sanford and Seymour, 1974). Another variable whose effect has been studied is relatedness, the degree to which an instance is related to its category, measured by asking subjects to rate how related or typical an instance is to its category (Rips, Shoben and Smith, 1973; Smith, Shoben and Rips, 1974; and Rosch, 1975). And lastly, category size (i.e. the number of instances that a category contains) has been scrutinized as a storage variable that could affect retrieval (Landauer and Freedman, 1968; Collins and Quillian, 1970b; Meyer, 1960; Wilkins, 1971; Freedman and Loftus, 1971, 1974; Landauer and Meyer, 1972; Homa, 1973; and Smith, Shoben and Rips, 1974).

A variety of tasks have been used to test the validity of the semantic memory models and the effects of the variables under question. Subjects have been required to identify whether common English words do or do not belong to well-known verbal categories (Landauer and Freedman, 1968; Collins and Quillian, 1970b; Wilkins, 1972; Smith and Haviland, Buckley and Sack, 1972; Loftus, 1973; Rips, Shoben and Smith, 1973; Sanford and Seymour, 1974; Anderson and Reder, 1974), to ascertain the truth or falsity of a sentence such as "a collie is a dog", or "all/some/few/many/no collies are dogs" (Collins and Quillian, 1969; Conrad, 1972; Rips, Shoben and Smith, 1973; Smith, Shoben and Rips, 1974;

Holyoak and Glass, 1974, 1975), to judge or to designate whether two words have the same or different meaning (Schaeffer and Wallace, 1970), to designate whether a target word belongs to either of two designated categories (Meyer, 1973) and to produce a word that satisfies various specified restrictions, such as a word that names a member of the category "fruits" or a word that names a member of the category "animals" and also begins with the letter "Z" (Loftus, Freedman and Loftus, 1970; Freedman and Loftus, 1971, 1974; Loftus and Freedman, 1972; Glass and Holyoak, 1974; Grober and Loftus, 1974; Loftus and Bolton, 1974; Loftus and Cole, 1974; and Holyoak and Glass, 1975). Some of these tasks require subjects to identify whether or not two words have same or different meanings and whether or not a given instance is a member of a particular class or category, while other tasks require the subjects to produce a word.

The selection of such tasks reveals the underlying assumption made by these experimenters that categorization of some sort is the basic structure of word memory. For network models, the categorization is seen as an all-or-none phenomenon, while for the set-theoretic models degrees of categorization are hypothesized. It is imperative, however, to offer evidence regarding the soundness of these basic assumptions. The phenomena of chunking, categorical and subjective organization observed in free recall experiments of word lists, though widely used, are not adequate evidence to support such assumptions. The need for evidence becomes especially clear when one considers the issue of retrieval versus storage. With classification experiments the question arises whether the observed reaction time is due to getting information out of the storage based on categories or due to

time needed to compute or infer based on bits and pieces of information stored in several different places. In other words, the observed reaction time could be due to output variables that organize the material before they are spewed out or to the structural variables of the specific memory. If the observed times are not due to structural but output variables, then, it is a great fallacy to base models of storage on such experiments.

Sentence verification and classification experiments contain further problems. Such tasks involve not only retrieval from semantic memory and understanding, but also interpretation of the idea expressed through the sentence and experimenter's requirements in the tasks. For example, one may understand that "a chicken is a bird" without accepting that the sentence is correct. To render it as correct, one might like to see it read "broadly speaking, a chicken is a bird". Similarly, one understands that "a sparrow is a singing bird" but may not agree with the sentence. One may believe that a sparrow chirps and does not sing. Thus, interpretation and verification of such sentences depend on the definitions given by the subject to the critical words "bird" and "sing". Also in sentence like "some mountains are Alps" there is an implication in "some" that would render this sentence false for many people (i.e. if only some are, then some are not). Therefore, the subject might believe that in some instances, the experimenter wants him/her to use the broader definition of words and of others their narrower definitions. It is clear then that such tasks combine understanding and retrieval from memory with interpretation of the expressed idea leading to confounded conclusions on the structure

of memory.

Dissatisfaction with the verification and classification tasks has been nicely expressed by Johnson-Laird (1974, p.142):

"The [semantic memory] experiments may even pass by the fundamental problem [of human semantic processing] since it is so rare in everyday life to have to ascertain the truth of a sentence such as "a dog is an animal". Of course, one can hardly understand such a sentence without verifying it. But there is a considerable distinction between these two transactions for ordinary contingent sentences like "a dog is expensive to keep". In understanding this sentence, an individual presumably retrieves some information from the lexical entry for "dog", but what? It seems that for the most important semantic retrieval problem, we have no clear idea of what is retrieved, let alone how it is retrieved."

The present research is directed to exactly this question, what is retrieved from human memory for the meanings of words.

This question of what is retrieved from semantic memory has been given attention by recently proposed models (Smith, Shoben and Rips, 1974; and Glass and Holyoak, 1974/1975). The two models whose views about meaning representations are reviewed in this paper, are the ones that include a formal and somewhat detailed treatment of word meanings and their representations in memory. Smith et al. (1974) have proposed a feature-comparison model that stems from the set-theoretic tradition. In brief, this model assumes that a semantic category can be represented in memory as a set of features. These features vary in the extent to which they define that category. In other words, there is a continuum along which some features will be more essential in defining the category (called defining features) and others will be relatively unimportant or non-essential (called characteristic features). The features of each item are presumed to be ordered by degree of defining-

ness with features that are more defining being at the top and features that are least defining being at the bottom. In addition, there is presumed to be an arbitrary boundary creating the distinction between defining and characteristic features. The boundary depends on the implicit weights attached to each feature. The number of defining features contained in an item's meaning are assumed to decrease as the item becomes increasingly abstract. This assumption seems unavoidable when one views meaning of words in terms of defining features, since abstract words should have defining features that encompass a number of instances. In retrieval from memory the entire set of features is accessed and for accurate judgments of class inclusions or exclusions defining features are given more attention.

A network model has been proposed by Glass and Holyoak (1974/1975) that has incorporated the marker structure as described by Katz (1972). Words are associated with a single marker in the attribute structure, referred to as the "defining" marker. For example, "avian" is the defining marker for "bird". Markers are best thought of as semantic properties of that word and the marker "canary" stands for an abstract concept equivalent to "possessing the essential properties of a canary" (Glass and Holyoak, p.14). However, markers are interrelated in such a way that any marker stands for, or dominates, a set of further markers associated with it. Therefore, class membership for an instance and its category is represented by the "defining" marker of the category that also dominates the defining marker of the instance, while class exclusion is represented by the lack of common marker between the word and the category in question. In fact, when

such a common marker does not exist ambivalence arises. Contradictions are structurally represented in the system through association between markers. The structural representations of the contradictions and how some associations among markers are labeled as contradictory is not clear. However, the essential point that this model makes is that intersections are of two types - contradictory and non-contradictory.

Clearly, the marker model proposed by Glass and Holyoak (1974/1975) comes in opposition to the representation of meaning as outlined by the feature-comparison model. Markers are only defining properties and there are no significant, semantic properties of a word that can be considered "characteristic", as Smith et al. (1974) proposed. Characteristic features are, according to Glass and Holyoak (1974/1975), "defining" markers of other words that are dominated by the "defining" markers of the word in question. It is pertinent, therefore, to review the evidence of the characteristic features assumption.

The major linguistic evidence presented by Smith et al. (1974) is Lakoff's analysis of hedges (1972). Hedges are a class of modifiers whose major function seems to be that of qualifying predicates - some of such hedges being "technically speaking", "loosely speaking", "a true" etc. (i.e. a robin is a true bird). Lakoff hypothesized the existence of characteristic features to explain why sentences with different hedges show different degrees of acceptability as meaningful sentences. In other words, if the hedge "a true" in the sentence "a robin is a true bird" is replaced by "loosely speaking", the new sentence is not acceptable as a meaningful one.

Further linguistic evidence is drawn from Sapir (1944) and Bierwisch (1971) in their analysis of relative adjectives. Basically

they propose that when a relative adjective modifies a particular subordinate term the sentence is understood in relation to the characteristic feature, implied by the modifier, contained in the meaning of the superordinate term. To illustrate this point, Smith et al. uses this example:

Consider Sentence A:

(A) That bird is big.

In order to evaluate the truth of this sentence, one needs to compare the size of the designated bird with some size norm. Following Bierwisch's argument, this norm often might be the average size of the direct superordinate class; that is, the average size of a bird. Hence, sentences B and C are paraphrases of A:

(B) That bird is big for a bird.

(C) That bird's size is bigger than the average size of a bird.

Thus, a sentence like A contains an implicit comparison to a particular dimension value that characterizes the class to which the subject noun belongs, and this comparison is made explicit in C. Phrased somewhat differently, the superordinate class contains characteristic features (e.g. a particular average size) and constructions like A are understood in relation to these characteristic values (Smith et al., 1974, p.218).

Experimental evidence for the characteristic features assumptions is presented by Rosch (1973) and Rips et al. (1973). Subjects were presented with a set of instance-category pairs (e.g. fruit - apple, fruit - fig, etc.) and were asked to rate how typical or how good an example of a category various instances were. It was found that agreement among subjects was high, especially in ranking the "best examples" of categories and that these results were highly replicable (Rosch, 1974). Moreover, the typicality ratings were reported as being

in excellent congruence with the results of Lakoff's (1972) hedge analysis, in that instances rated as very typical (e.g. "robin" and "sparrow" for the category "bird") are those that are judged as meaningful when modified in a sentence by the hedge "a true", while instances judged to be atypical (e.g. "chicken" and "duck") are acceptable with the hedge "technically speaking". In light of these results, Smith et al. (1974) concluded that typicality ratings reflect the extent to which the characteristic features of a superordinate are similar to the features of an instance. The defining features of a superordinate cannot exercise much influence on such ratings because all instances contain these features.

Further results that support the characteristic feature assumption are presented by Rosch (1974). She had a group of subjects generate sentences for superordinate terms. An example of a sentence generated for the superordinate "bird" is "the tree has about twenty birds perched in it". Rosch then substituted an instance for the superordinate term in the constructed sentence, where this instance varied in how typical it was of the superordinate (e.g. "robin" or "chicken" might be substituted for "bird" in the above example). Then another group rated the altered sentences for acceptability as meaningful sentences. The major finding was that rated acceptability decreased as typicality decreased. The explanation offered by Rosch was in terms of characteristic features of the superordinate. The sentence generated by the first group had a congruence between the characteristic features of the superordinate (e.g. "bird") and the predication in the sentence (e.g. perch in trees). It was inferred that this congruence

was violated when atypical instance was substituted, since an atypical instance does not share the specific characteristic features implied by the predicate of the sentence.

It should be noted that the evidence offered thus far for the characteristic feature assumption is indirect. The assumption of characteristic features has been invoked to explain various results. As one might surmise from the indirectness of the evidence, different interpretations of such results have been offered and, consequently, the distinction between characteristic and defining features remains in some doubt.

One different explanation has been offered by Glass and Holyoak (1974/1975) who claimed that Lakoff's (1972) analysis of hedges can be reinterpreted in light of dual definitions for common English words. One is a popular definition and another is a technical definition, first agreed upon for some specific purpose by a select group, and eventually imposed on the general public. The definition of a bird as a small flying animal with wings is an example of a popular definition, while the biological definition of a bird is an example of a technical definition. Thus, the hedge "a true" signifies an instance of the category that fulfills the requirements of both the technical and popular definitions (as "robin" is for "bird"). The hedge "technically speaking" is used when an instance fulfills only the technical definition (e.g. "chicken" for "bird"), and the hedge "loosely speaking" is used when an instance satisfies only the popular definition (e.g. "bat" for "bird").

In view of this alternative explanation the present experiments

were designed to investigate more directly the characteristic-features assumption. They were addressed to the question of whether both defining and characteristic features possess the qualities attributed to them. More specifically, the degree to which relatedness norms for instances reflect differences in the overlap of both types of features for the instance and the category name was investigated. Relatedness norms reflect the degree of relationship of the instance to its category. Such norms were obtained by Rosch (1975) who instructed subjects to rate, on a 7-point scale, the extent to which each instance (e.g. "robin" or "vulture") represented their idea or image of the meaning of the category term (e.g. "bird"). Lakoff (1972) in his analysis of hedges suggests that relatedness norms reflect the extent to which some instances share with the category both defining and characteristic features (a highly related instance), while others share only defining features (a moderately related instance) or characteristic features (a low related instance).

In Experiment 1, frequencies of features were collected for several semantic categories and their instances selected to represent different levels of relatedness. In Experiment 2, the subjects of the first experiment separated the features that they had given into defining and characteristic categories. In Experiment 3, a new group of subjects was presented with many of the features generated in Experiment 1 and was asked to separate them into defining and characteristic categories.

The central hypotheses of the study were the following:

- (1) Defining features of a word are more central to word

meaning than characteristic features;

(2) The number of defining features in an item's meaning increases or decreases with the degree of abstractness;

(3) Relatedness norms reflect the structure of semantic categories that can be analyzed to specific kind(s) of features that a category shares with its instances. As the specific kind(s) of features varies, relatedness measure of the instance to the category also varies.

The following specific predictions, as derived respectively from the three hypotheses, were tested:

(A₁) Subjects would give more defining than characteristic features for a word when asked to provide properties or features for that word because defining features carry more weight in defining a word.

(A₂) There would be more defining features given as the first feature of a word than characteristic features.

(B) The number of defining features provided for an instance would be greater than the number of defining features given for its superordinate.

(C) The correlation of defining and characteristic features of an instance with the defining and characteristic features of its category would vary with the degree of relatedness of the instance to the category. More specifically (based on Lakoff (1972), (C₁): highly related instances of a category would show a correlation between the defining and characteristic features of the instance and those of the defining and characteristic features of their category: (C₂): moderately related instances would show a correlation only between their

defining features and those of their category; and (C_3): low related instances would show a correlation between their characteristic features and those of their category name.

EXPERIMENT 1

Before attempting to examine the internal structure of mental representations of semantic categories, it was necessary to obtain frequencies of features for a number of categories and their instances. Such frequencies must be obtained empirically because features that appear in dictionary definitions do not necessarily reflect the operating knowledge of word meanings by any specified population, since they are intended for special groups, i.e. scientific dictionaries, children's dictionaries, etc. It would be incautious to assume that most users of a word know its exact dictionary definition.

METHOD

Subjects

One hundred and five volunteer students from several introductory psychology classes at the University of Rhode Island participated in this study. Only native speakers of English were included as found by asking the subjects to write down their country of birth and languages spoken frequently. This criterion did not eliminate any of the participating subjects.

Sex of the subjects was not treated as a variable following the research in this area (Landauer and Freedman, 1968; Collins and Quillian, 1969; Meyer, 1971; Smith et al., 1974 etc.) showing that asking subjects to define common English words is not influenced by the sex of the subjects. Similarly, age of the subjects was not treated as a

variable, since all subjects were of typical college age.

All subjects received extra credit for their participation in this task. Although the subjects were rewarded volunteers the representation of the sample was not restricted, since of the subjects asked to participate 100% of them took part in this experiment. Such reward was not expected to influence the subjects' verbal responses in any systematic way as there were no right or wrong answers.

Stimuli

The category names for which features were to be gathered were chosen from Rosch's (1975) categories on which relatedness norms appear for a number of their instances (see Rosch, 1975, for reliability measures). Selection proceeded in the following manner: Categories were excluded if (a) their name was not a single word; (b) instances of a category could possibly overlap with instances from another category (e.g. "toy" and "weapon"); and (c) instances of a category was likely to be more familiar to one sex of subjects than another. The selected categories were: vegetable, fruit, bird, vehicle and furniture.

For each of these five categories four instances were selected from Rosch's norms to represent different levels of relatedness. However, instances across categories were utilized to represent same levels of relatedness (see Table 1).

Sixteen random orders of the 25 stimulus words were randomly selected with the restriction that two instances of the same category would be separated by a minimum of two non-instances. In this case, category names were treated as instances.

Procedure

Subjects were tested in groups in their classes. They were given a 25-page booklet that had one stimulus word per page. They were also provided with a written copy of the instructions that read:

This study has to do with the question of what properties or features one has in mind when seeing a word. Let's take the word "robin" as an example. If you are asked to give the properties or features that you think of when you see the word "robin", you might say: "a robin is two-legged, has wings, is brown and red, perches in trees, is untamed, etc.". Similarly, if you are asked to give the features or properties that come in mind with "apple" you could say: "an apple is round, is yellow, is red, is green, has hard skin, shiny skin, soft inside, etc.".

When you turn this page, you will see a number of well-known words, one word per page. Under each word are a number of spaces marked off. Think of the features or properties that come in mind when seeing each word and write them down in the provided spaces. Write one property or feature in each space. There is no limit of how many features you can give for a particular word, but do give all features that you can think of. There is no time limit for this task, but, please, work efficiently and quickly.

Results

All responses made by each subject for categories and instances were tallied. The basic data, presented in Table 1 for each of the 25 stimuli, contain responses given with a total frequency of 10 or more. Category names appear first in the tables, followed by their instances arranged in a decreasing order of relatedness. The features have been ordered so that most frequent features appear first and least frequent last. The two measures recorded are absolute frequencies in the first column and percentages in the second.

TABLE 1

FREQUENCIES AND PERCENTAGES OF FEATURES

20

FROM PRODUCTION MEMORY

CATEGORY 1

VEGETABLE

	Frequencies	Percentages
1. is nutritious (healthy)	47	44.76
2. is green	39	37.14
3. is edible	34	32.38
4. grows in gardens	29	27.62
5. is many varieties	26	24.76
6. eaten fresh	26	24.76
7. has vitamins	25	23.81
8. is yellow	22	20.95
9. is a plant	20	19.05
10. is various colors	19	18.10
11. eaten at meals	17	16.19
12. is red	16	15.24
13. can be cooked	15	14.29
14. is hard	14	13.33
15. grows from soil	13	12.38
16. is a food	13	12.38
17. grows from soil (ground)	13	12.38
18. has many shapes	13	12.38
19. tastes good	12	11.43
20. is soft	12	11.43
21. can be cultivated	10	9.52

22. has leaves

10

9.52

SPINACH

	Frequencies	Percentages
1. is green	99	94.29
2. is a vegetable	78	74.29
3. has leaves	57	54.29
4. is nutritious (healthy)	33	31.43
5. can be cooked	30	28.57
6. has minerals (iron)	20	19.05
7. tastes bad	18	17.14
8. is mushy	16	15.24
9. has vitamins	14	13.33
10. tastes good	14	13.33
11. grows from soil	13	12.38
12. eaten at meals	13	12.38
13. children do not like it	13	12.38
14. has green leaves	12	11.43
15. grows in gardens	10	9.52
16. eaten raw	10	9.52

TOMATO

	Frequencies	Percentages
1. is red (when ripe)	102	97.14
2. is juicy	60	57.14
3. has seeds	57	54.29
4. eaten raw	50	47.62
5. is almost round	39	37.14
6. grows in gardens	36	34.29
7. is a vegetable	35	33.33
8. is green (when not ripe)	30	28.57
9. is skin-covered	29	27.62
10. makes sauce	26	24.76
11. is a plant	22	20.95
12. is a fruit	21	20.00
13. grows in vines	17	16.19
14. can be cooked	16	15.24
15. is shinny	14	13.33
16. tastes good	10	9.52
17. is edible	10	9.52
18. made into juice	10	9.52
19. is smooth	10	9.52

PARSLEY

	Frequencies	Percentages
1. is green	88	83.81
2. used for decorating food	45	42.86
3. is a spice	27	25.71
4. used for seasoning	25	23.81
5. is a vegetable	21	20.00
8. can be dried up (flakes)	17	16.19
9. is small	16	15.24
10. has little or no taste	14	13.33
11. has stem	13	12.38
12. is edible	13	12.38
13. eaten raw	10	12.38

DANDALION

	Frequencies	Percentages
1. is yellow	68	64.75
2. is a flower	65	61.90
3. is a weed	56	53.33
4. has stem	43	40.95
5. has yellow flowers	34	32.38
6. grows in lawns	33	31.43
7. has green stem	25	23.81
8. grows in grass	24	22.86
9. grows in the summer	23	21.90
10. blown away (for good luck)	20	19.05
11. has white fluff		
(attached to seeds)	20	19.05
12. grows in the spring	19	18.10
13. has fuzzy seeds	16	15.24
14. has yellow petals	16	15.24
15. made into wine	15	14.29
16. has green leaves	15	14.29
17. removed from lawns (not liked)	14	13.33
18. is short	14	13.33
19. is pretty	13	12.38
20. is a food	13	12.38
21. is green	12	11.43
22. is white	11	10.48
23. is edible	10	9.52

CATEGORY 2

FRUIT

	Frequencies	Percentages
1. is juicy	46	43.81
2. grows on trees	44	41.90
3. is nutritious (healthy)	43	40.95
4. is sweet	30	28.57
5. has many colors	24	22.86
6. tastes good	24	22.86
7. has seeds	24	22.86
8. is edible	22	20.95
9. many varieties	22	20.95
10. has vitamins	16	15.24
11. has skin	15	14.29
12. grows on bushes	14	13.33
13. is soft (inside)	13	12.38
14. is sour	12	11.43
15. is various shapes	11	10.58
16. makes salads	10	9.52
17. is red	10	9.52
18. makes desserts	10	9.52
19. is various sizes	10	9.52

PLUM

	Frequencies	Percentages
1. is purple	92	87.62
2. has a pit (seed)	67	63.81
3. is a fruit	66	62.86
4. is juicy	59	56.19
5. has skin	49	46.67
6. is soft inside	41	39.05
7. is small	36	34.29
8. is round (almost)	38	36.19
9. is sweet	33	31.43
10. grows on trees	30	28.57
11. is sour	21	20.00
12. is red	19	18.10
13. tastes good	19	18.10
14. grows in summer	17	16.19
15. can be cooked	11	10.48
16. is edible	10	9.52
17. has shinny skin	10	9.52

WATERMELON

	Frequencies	Percentages
1. has black and white seeds	92	87.62
2. is large (big)	64	60.95
3. is juicy	63	60.00
4. grows in summer	49	46.67
5. is red insidde	47	44.76
6. is a fruit	44	41.90
7. is green	41	39.05
8. is pinkish-red	39	37.14
9. has green skin	39	37.14
10. has rind	31	29.52
11. is sweet	27	25.71
12. is oval	26	24.76
13. contains water	25	23.81
14. tastes good	22	20.95
15. grows in vines	21	20.00
16. is heavy	18	17.14
17. has white rind	16	15.24
18. stops thirst	14	13.33
19. is soft inside	13	12.38
20. has green rind	13	12.38
21. is edible	12	11.43
22. is red	11	10.48
23. is sticky	11	10.48

GOOSEBERRY

	Frequencies	Percentages
1. grows on bushes	32	30.48
2. is a kind of berry	26	24.76
3. is a fruit	22	20.95
4. can be cooked	20	20.95
5. has shinny skin	17	16.19
6. is red	17	16.19
7. is round (almost)	16	15.24
8. is edible	10	9.52

AVOCADO

	Frequencies	Percentages
1. is green	82	78.10
2. has a pit	82	78.10
3. is a fruit	38	36.19
4. is a vegetable	24	22.86
5. is pear-shaped	22	20.95
6. has skin	20	19.05
7. is soft inside	19	18.10
8. is edible	18	17.14
9. has hard skin	18	17.14
10. grows on trees	15	14.29
11. grows plants from pit	14	13.33
12. is a plant	12	11.43
13. tastes bad	11	10.48
14. can be eaten raw	11	10.48

CATEGORY 3

BIRD

	Frequencies	Percentages
1. flies	91	86.67
2. has (two) wings	77	73.33
3. has beak (bill)	48	45.71
4. has (two) legs	48	45.71
5. has feathers	45	42.86
6. lays eggs	30	28.57
7. chirps	30	28.57
8. is small (little)	26	24.76
9. builds nests	25	23.81
10. eats worms	25	45.71
11. is multicolored	24	22.86
12. sings	23	21.90
13. perches in trees (branches)	21	20.00
14. lives in nests	17	16.19
15. is an animal	17	16.19
16. has (two) feet	16	15.24
17. many species (types)	16	15.24
18. migrates (flies south in winter)	15	14.29
19. is domestic (tamed)	15	14.29
20. is wild (untamed)	13	12.38
21. eats seeds	11	10.48
22. lives in trees	11	10.48
23. has (two) eyes	10	9.52

SPARROW

	Frequencies	Percentages
1. is a bird	81	77.14
2. is small (little)	68	64.76
3. has (two) wings	58	55.24
4. flies	48	45.71
5. has (two) legs	40	38.10
6. is brown	36	34.29
7. has beak (bill)	22	20.95
8. sings	18	17.14
9. chirps	17	16.19
10. eats worms	17	16.19
11. has feathers	16	15.24
12. lives in nests	14	13.33
13. moves fast	10	9.52
14. eats seeds	10	9.52
15. lives in trees	10	9.52

PARROT

	Frequencies	Percentages
1. is a bird	76	72.38
2. can talk	67	63.81
3. is colorful	41	39.05
4. has beak (bill)	39	37.14
5. lives in cage	38	36.19
6. has (two) wings	37	35.24
7. can mimick (imitate)	32	30.48
8. has (two) legs	29	27.62
9. is a house pet (domesticated)	26	24.76
10. is multi-colored	22	20.95
11. flies	20	19.05
12. is green	20	19.05
13. has feathers	17	16.19
14. has large beak	17	16.19
15. lives in tropical areas	16	15.24
16. is large (big)	15	14.29
17. can be trained	13	12.38
18. has (two) eyes	11	10.48

VULTURE

	Frequencies	Percentages
1. is a bird	46	43.81
2. preys on dead (or almost dead) flesh	52	49.52
3. is large (big)	46	43.81
4. is black	38	36.19
5. has (two) wings	36	34.29
6. has beak (bill)	30	28.57
7. flies	30	28.57
8. is ugly	25	23.81
9. circles around prey (victim)	24	22.86
10. lives in desert	21	20.00
11. has large beak	19	18.10
12. has (two) legs	17	16.19
13. has feathers	15	14.29
14. has claws	14	13.33
15. is predatory (bird of prey)	14	13.33
16. is bad (evil, mean)	14	13.33
17. has (two) eyes	12	11.43
18. symbol of death	11	10.48
19. is carnivorous	11	10.48

PENGUIN

	Frequencies	Percentages
1. is black and white	89	84.76
2. waddles (walks funny)	59	56.19
3. lives in cold weather (winter, snow)	53	50.48
4. is a bird	47	44.76
5. resembles tuxedo	40	38.10
6. has beak (bill)	29	27.62
7. swims	26	24.76
8. is an animal	19	18.10
9. cannot fly	19	18.10
10. lives in Antartica	17	16.19
11. has (two) legs	15	14.29
12. lives in North Pole	14	13.33
13. catch fish	14	13.33
14. has webbed feet	13	12.38
15. has (two) wings	13	12.38
16. is small (little)	13	12.38
17. found in zoo	11	10.48
18. found in water	10	9.52

CATEGORY 4

FURNITURE

	Frequencies	Percentages
1. made of wood	52	49.52
2. used in homes	32	30.48
3. is comfortable	31	29.52
4. used for sitting on (or at)	31	29.52
5. has (1-4) legs	17	16.19
6. is supportive (put things on)	17	16.19
7. made of (covered with) cloth	16	15.24
8. a variety of sizes	15	14.29
9. made of plastic	14	13.33
10. made of metal	14	13.33
11. used for decoration	14	13.33
12. a variety of styles	12	11.43
13. is functional (useful)	12	11.43
14. is various colors	11	10.48
15. many types	11	10.48
16. made of cushions	10	9.52
17. found in most buildings	10	9.52

TABLE

	Frequencies	Percentages
1. has (1-4) legs	86	81.90
2. used for eating	63	60.00
3. made of wood	57	54.29
4. has flat surface	48	45.71
5. is supportive (put things on)	38	36.19
6. is a piece of furniture	30	28.57
7. is round	26	24.76
8. surrounded by chairs	25	23.81
9. made of metal	25	23.81
10. is square	20	19.05
11. found in kitchen	18	17.14
12. is hard	16	15.24
13. has smooth (finish) top	15	14.29
14. a variety of sizes	14	13.33
15. made of plastic	14	13.33
16. is rectangular	13	13.68
17. used for sitting on (or at)	12	11.43
18. is a variety of shapes	11	10.48
19. made of glass	10	9.52
20. used for studying	10	9.52

BOOKCASE	Frequencies	Percentages
1. holds books	91	86.67
2. has shelves	63	60.00
3. made of wood	61	58.10
4. made of metal	24	22.86
5. found in libraries	23	21.90
6. holds trinkets (ornaments,candles)	17	16.19
7. is tall (high)	15	14.29
8. is a piece of furniture	14	13.33
9. found against (close to) a wall	14	13.33
10. is brown	14	13.33
11. holds objects	11	10.48
12. is large (wide)	11	10.48
13. found in study room	10	9.52
14. used for homes	10	9.52

STOOL

	Frequencies	Percentages
1. has (1-4) legs	79	75.24
2. made of wood	60	57.14
3. used for sitting on (or at)	57	54.29
4. used as a step (stand on)	32	30.48
5. is a type of seat		
(small chair)	29	27.63
6. used as a footrest	27	25.71
7. has a round top	23	21.90
8. is short (low)	22	20.95
9. found in bars	22	20.95
10. is small (narrow)	20	19.05
11. has no back	19	18.10
12. is a piece of furniture	18	17.14
13. made of metal	18	17.14
14. is tall (high)	17	16.19
15. is hard	17	16.19
16. can be uncomfortable	12	11.43

WASTEBASKET

	Frequencies	Percentages
1. holds waste (garbage)	82	78.10
2. made of metal	35	33.33
3. is round	32	30.48
4. holds (old) papers	28	16.67
5. made of plastic	25	23.81
6. is smelly (dirty)	20	19.05
7. is a container	20	19.05
8. is cylindrical	20	19.05
9. is various colors	17	16.19
10. is square	17	16.19
11. emptied when full	14	13.33
12. is small (narrow)	13	12.38
13. found near (under) desks	11	10.48
14. is gray	11	10.48
15. can be decorated	10	9.52
16. a variety of sizes	10	9.52

CATEGORY 5

VEHICLE

	Frequencies	Percentages
1. means of transportation	70	66.67
2. has wheels	51	48.57
3. needs a fare	22	20.95
4. carries people (passengers)	16	15.24
5. has engine (motor)	15	14.29
6. is various colors	15	14.29
7. is various sizes	15	14.29
8. covers distance	15	14.29
9. is driven	14	13.33
10. is various shapes	13	12.38
11. is dangerous (accidents)	12	11.43
12. is fast	12	11.43
13. made of metals	11	10.48
14. has steering wheel	11	10.48
15. is expensive	10	9.52

CAR

	Frequencies	Percentages
1. has wheels	71	67.62
2. means of transportation	52	49.52
3. takes gas	42	40.00
4. has engine (motor)	38	36.19
5. is various colors	33	31.43
6. has steering wheel	33	31.43
7. is expensive	31	29.52
8. has (2 to 4) doors	31	29.52
9. is various sizes	31	29.52
10. has glass windows	27	28.42
11. is a vehicle	27	25.71
12. has seats	25	23.81
13. is dangerous (accidents)	23	21.90
14. is various makes	23	21.90
15. is fast	22	20.95
16. is various styles	20	19.05
17. has metalic frame	18	17.14
18. is driven	16	15.24
19. goes on roads (highways, driveways)	14	13.33
20. has trunk	14	13.33
21. has lights	13	12.38
22. needs repairs	13	12.38
23. has rubber tires	13	12.38
24. is fun for cruising	12	11.43

25. has horn	12	11.43
26. has a radio	12	11.43
27. has brakes	10	9.52
28. is a symbol of prestige (status)	10	9.52
29. is convenient	10	9.52

TROLLEY

	Frequencies	Percentages
1. goes on tracks	64	19.05
2. means of transportation	56	53.33
3. found in San Francisco	52	49.52
4. carries people (passengers)	34	32.38
5. is old-fashioned	32	30.48
6. is a train like	27	25.71
7. has seats	23	21.90
8. run by electricity	22	20.95
9. attached to wire overhead	20	19.05
10. has wheels	20	19.05
11. found in cities	18	17.14
12. needs a conductor (driver)	17	16.19
13. has a bell	15	14.29
14. is noisy	14	13.33
15. has (glass) windows	13	12.38
16. is various makes	12	11.43
17. is open	11	10.48
18. is a vehicle	11	10.48
19. found in Boston	11	10.48
20. goes on roads (highways, driveways)	10	9.52
21. goes uphill	10	9.52

SCOOTER

	Frequencies	Percentages
1. has wheels	92	87.62
2. children's toy	50	47.62
3. has steering handle	41	39.05
4. may have engine (motor)	33	31.43
5. means of transportation	27	25.71
6. is red	25	23.81
7. is pushed with one foot	23	21.90
8. is a vehicle	18	17.14
9. made of metal	15	14.29
10. takes gas	13	12.38
11. is fast	12	11.43
12. is driven	10	9.52
13. has seats	10	9.52

SKATES

	Frequencies	Percentages
1. has sharp blades	77	73.33
2. has wheels	42	40.00
3. is white	34	32.38
4. has laces	34	32.38
5. used for hockey	29	27.62
6. used on ice	28	26.67
7. used for sport	41	20.00
8. is shoe like	21	20.00
9. is black	20	19.05
10. is fun	18	17.14
11. made of leather	14	13.33
12. means of transportation	13	12.38
13. can glide	12	11.43

EXPERIMENT 2

As previously mentioned, Smith, Shoben and Rips' (1974) feature comparison model assumes that features which define a word, vary along a continuum of importance, from very-important-in-defining (defining features) to unimportant-in-defining (characteristic features). These features are presumed to be ordered according to degree of definingness with defining features at the top and characteristics at the bottom. In retrieval from memory, the entire set of features is retrieved including both defining and characteristic features. Since defining features are more essential for the meaning of a word and are also ordered first, one would expect that when asking subjects to produce features that define a word in a limited time span, defining features would be both greater in number than characteristic features and given earlier.

It is possible, however, that the total set of features that define some words contain more characteristic than defining features. Consequently, defining features could be less frequent in number than characteristic features when subjects are asked to define a word even if defining features are more central to word meaning. Even in such a case, however, one would expect the defining features to be given earlier if they are more basic of words' subjective definitions. Therefore, defining features would be more frequently given as first responses when subjects are asked to generate features that pertain to a specific word.

An additional assumption made by feature models (H. Clark, 1970; Meyer, 1970; and Smith et al., 1976) is that the number of defining features contained in an item's meaning decreases as the item becomes increasingly abstract; for example, "robin" contains more defining features than "bird". Since frequencies of features were gathered in Experiment 1, this assumption vis-a-vis production memory could be tested, by asking these same subjects to separate the produced features into defining and characteristic categories.

METHOD

Subjects

Ninety-five students from Experiment 1 participated in this study. The ten subjects from the previous study that did not participate were absent. Subjects received course credit for their participation and of the students present in classes all of them took part in this experiment. For reasons described in detail in the Method section of Experiment 1, sex and age of the subjects were not treated as variables.

Stimuli

Stimuli were the same booklets used for Experiment 1, containing five categories and four instances per category. The order of presentation of the stimuli for each booklet was reversed from the last experiment.

Procedure

Subjects were tested in groups in their classrooms. Each subject was given the booklet that he/she had filled out in Experiment 1.

They were presented with a new set of instructions that they were asked to read. Specific instructions read:

This study has to do with separating the features or properties that you previously gave for a word into two categories: (1) properties that are essential for the meaning of the word, and (2) properties that are not absolutely necessary for the meaning of the word, but which further explain it. For example, remember the word "robin". The features we hypothesized that this word contains were: "a robin is two-legged, has wings, is brown and red, perches in trees and is untamed". Trying to separate the features of "robin" into necessary ones for the meaning of the word, one could decide that "is two-legged, has wings, is brown and red" are essential for the meaning of "robin". However, "perches in trees, is untamed" could be decided as not necessary to the meaning of the word, but further explaining it. Similarly, for "apple" we hypothesized that its features could be: "an apple is round, is yellow, is red, is green, has hard skin, shiny skin, soft inside". The necessary features for "apple" could be: "is round, has hard skin" but the not absolutely necessary features could be: "is red, is yellow, is green, shiny skin, soft inside".

Now, in front of you, you have the features that you gave for each word. Read the features or properties of each word carefully and try to separate them into essential for the meaning of the word and those not absolutely necessary for the meaning of the word. If you decide that a property is necessary put a (+) sign next to it, but if you decide that a property or feature is not always necessary put a (-) sign next to it. There is no time limit for this task, but, please, work quickly and efficiently.

RESULTS

Responses given by each subject were tallied and the data are presented in Table 2. This table follows the order of presentation of features from Table 1 of Experiment 1. The two recorded measures are absolute frequencies and percentages in parentheses.

On the number of defining and characteristic features that each subject gave for five category names and four instances per category, a

FREQUENCIES AND PERCENTAGES OF ESSENTIAL AND NON-ESSENTIAL
FEATURES FROM PRODUCTION MEMORY

CATEGORY 1

VEGETABLE

	Essential	Non-essential
1. is nutritious (healthy)	27 (28.42)	15 (15.79)
2. is green	20 (21.05)	17 (17.89)
3. is edible	14 (14.74)	15 (15.79)
4. grows in gardens	16 (16.84)	11 (11.58)
5. is many varieties	13 (13.68)	10 (10.53)
6. eaten fresh	21 (22.11)	3 (3.16)
7. has vitamins	14 (14.74)	10 (10.53)
8. is yellow	11 (11.58)	11 (11.58)
9. is a plant	4 (4.21)	13 (13.68)
10. is various colors	7 (7.37)	11 (11.58)
11. eaten at meals	16 (16.84)	0 (0.00)
12. is red	11 (11.58)	5 (5.26)
13. can be cooked	12 (12.63)	2 (2.11)
14. is hard	9 (9.47)	4 (4.21)
15. grows from soil	5 (5.26)	8 (8.42)
16. is a food	5 (5.26)	8 (8.42)
17. grows in soil (ground)	4 (4.21)	7 (7.37)
18. has many shapes	4 (4.21)	9 (9.47)
19. tastes good	11 (11.58)	0 (0.00)
20. is soft	8 (8.42)	3 (3.16)
21. can be cultivated	7 (7.37)	3 (3.16)

22. has leaves

8 (8.42)

3 (3.16)

SPINACH

	Essential	Non-essential
1. is green	7 (7.37)	83 (87.37)
2. is a vegetable	6 (6.32)	65 (68.42)
3. has leaves	6 (6.32)	46 (48.42)
4. is nutritious (healthy)	26 (27.37)	4 (4.21)
5. can be cooked	26 (27.37)	1 (1.05)
6. has minerals (iron)	10 (10.53)	8 (8.42)
7. tastes bad	15 (15.79)	1 (1.05)
8. is mushy	7 (7.37)	8 (8.42)
9. has vitamins	7 (7.37)	4 (4.21)
10. tastes good	11 (11.58)	1 (1.05)
11. grows from soil	10 (10.53)	3 (3.16)
12. eaten at meals	9 (9.47)	2 (2.11)
13. children do not like it	9 (9.47)	1 (1.05)
14. has green leaves	1 (1.05)	3 (3.16)
15. grows in gardens	4 (4.21)	2 (2.11)
16. eaten raw	7 (7.37)	1 (1.05)

TOMATO

	Essential	Non-essential
1. is red (when ripe)	25 (26.32)	66 (64.47)
2. is juicy	26 (27.37)	27 (28.42)
3. has seeds	19 (20.00)	32 (33.68)
4. eaten raw	41 (43.16)	2 (2.11)
5. is almost round	5 (5.26)	30 (31.58)
6. grows in gardens	17 (17.89)	14 (14.74)
7. is a vegetable	6 (6.32)	27 (28.42)
8. is green (when not ripe)	16 (16.84)	10 (10.53)
9. is skin-covered	8 (8.42)	19 (20.00)
10. makes sauce	19 (20.00)	3 (3.16)
11. is a plant	9 (9.47)	10 (10.53)
12. is a fruit	3 (3.16)	16 (16.84)
13. grows in vines	7 (7.37)	9 (9.47)
14. can be cooked	10 (10.53)	1 (1.05)
15. is shinny	6 (6.32)	8 (8.42)
16. tastes good	10 (10.53)	0 (0.00)
17. is edible	5 (5.26)	3 (3.16)
18. made into juice	8 (8.42)	2 (2.11)
19. is smooth	4 (4.21)	6 (6.32)

PARSLEY

	Essential	Non-essential
1. is green	10 (10.53)	68 (71.58)
2. used for decorating food	31 (32.63)	10 (10.53)
3. is a spice	6 (6.32)	17 (17.89)
4. used for seasoning	7 (7.37)	13 (13.68)
5. is a vegetable	2 (2.11)	7 (7.37)
8. can be dried up (flakes)	7 (7.37)	6 (6.32)
9. is small	7 (7.37)	7 (7.37)
10. has little or no taste	11 (11.58)	2 (2.11)
11. has stem	1 (1.05)	10 (10.53)
12. is edible	6 (6.32)	5 (5.26)
13. eaten raw	9 (9.47)	1 (1.05)

DANDALION

	Essential	Non-essential
1. is yellow	13 (13.68)	50 (52.63)
2. is a flower	9 (9.47)	51 (53.68)
3. is a weed	13 (13.68)	39 (41.05)
4. has stem	10 (10.53)	29 (30.53)
5. has yellow flowers	4 (4.21)	27 (28.42)
6. grows in lawns	21 (22.11)	11 (11.58)
7. has green stem	3 (3.16)	18 (18.95)
8. grows in grass	11 (11.58)	8 (8.42)
9. grows in summer	16 (16.84)	3 (3.16)
10. blown away (for good luck)	12 (12.63)	6 (6.32)
11. has white fluff		
(attached to seeds)	8 (8.42)	11 (11.58)
12. grows in spring	11 (11.58)	6 (6.32)
13. has fuzzy seeds	10 (10.53)	3 (3.16)
14. has yellow petal	1 (1.05)	9 (9.47)
15. made into wine	11 (11.58)	0 (0.00)
16. has green leaves	3 (3.16)	9 (9.47)
17. removed from lawns		
(not liked)	13 (13.68)	1 (1.05)
18. is short	6 (6.32)	7 (7.37)
19. is pretty	8 (8.42)	3 (3.16)
20. is a food	10 (10.53)	1 (1.05)
21. is green	2 (2.11)	9 (9.47)
22. is white	2 (2.11)	8 (8.42)
23. is edible	7 (7.37)	1 (1.05)

CATEGORY 2

FRUIT

	Essential	Non-essential
1. is juicy	21 (22.11)	20 (21.05)
2. grows on trees	19 (20.00)	22 (23.16)
3. is nutritious (healthy)	32 (33.68)	1 (1.05)
4. is sweet	16 (16.84)	12 (12.63)
5. has many colors	18 (18.95)	5 (5.26)
6. tastes good	19 (20.00)	4 (4.21)
7. has seeds	6 (6.32)	16 (16.84)
8. is edible	6 (6.32)	14 (14.74)
9. many varieties	9 (9.47)	11 (11.58)
10. has vitamins	9 (9.47)	6 (6.32)
11. has skin	1 (1.05)	12 (12.63)
12. grows on bushes	6 (6.32)	8 (8.42)
13. is soft (inside)	5 (5.26)	7 (7.37)
14. is sour	7 (7.37)	4 (4.21)
15. is various shapes	7 (7.37)	4 (4.21)
16. makes salads	9 (1.05)	1 (1.05)
17. is red	7 (7.37)	3 (3.16)
18. makes desserts	10 (10.53)	0 (0.00)
19. is various sizes	6 (6.32)	4 (4.21)

PLUM

	Essential	Non-essential
1. is purple	23 (24.21)	58 (61.05)
2. has a pit (a seed)	27 (28.42)	31 (32.63)
3. is a fruit	5 (5.26)	55 (57.89)
4. is juicy	30 (31.58)	20 (21.05)
5. has skin	13 (13.68)	29 (30.53)
6. is soft inside	18 (18.95)	16 (16.84)
7. is small	10 (10.53)	19 (20.00)
8. is round (almost)	2 (2.11)	30 (31.58)
9. is sweet	20 (21.05)	9 (9.47)
10. grows on trees	17 (17.89)	8 (8.42)
11. is sour	16 (16.84)	2 (2.11)
12. is red	6 (6.32)	8 (8.42)
13. tastes good	12 (12.63)	1 (1.05)
14. grows in summer	12 (12.63)	2 (2.11)
15. can be cooked	7 (7.37)	0 (0.00)
16. is edible	1 (1.05)	6 (6.32)
17. has shinny skin	5 (5.26)	4 (4.21)

WATERMELON

	Essential	Non-essential
1. has black and white seeds	28 (29.47)	56 (58.95)
2. is large (big)	23 (24.21)	34 (35.79)
3. is juicy	28 (29.47)	28 (29.47)
4. grows in summer	35 (36.84)	8 (8.42)
5. is red inside	7 (7.37)	34 (35.79)
6. is a fruit	4 (4.21)	33 (34.74)
7. is green	5 (5.26)	30 (31.58)
8. is pinkish-red	11 (11.58)	26 (27.37)
9. has green skin	8 (8.42)	26 (27.37)
10. has rind	8 (8.42)	19 (20.00)
11. is sweet	21 (22.11)	5 (5.26)
12. is oval	4 (4.21)	21 (22.11)
13. contains water	9 (9.47)	13 (13.68)
14. tastes good	17 (17.89)	2 (2.11)
15. grows in vines	10 (10.53)	8 (8.42)
16. is heavy	11 (11.58)	5 (5.26)
17. has white rind	5 (5.26)	10 (10.53)
18. stops thirst	11 (11.58)	1 (1.05)
19. is soft inside	6 (6.32)	4 (4.21)
20. has green rind	3 (3.16)	10 (10.53)
21. is edible	8 (8.42)	3 (3.16)
22. is red	2 (2.11)	7 (7.37)
23. is sticky	8 (8.42)	2 (2.11)

GOOSERBERRY

	Essential	Non-essential
1. grows on bushes	8 (8.42)	20 (21.05)
2. is a kind of berry	6 (6.32)	20 (21.05)
3. is a fruit	0 (0.00)	19 (20.00)
4. can be cooked	18 (18.95)	1 (1.05)
5. is small	1 (1.05)	14 (14.74)
6. is red	9 (9.47)	6 (6.32)
7. is round (almost)	1 (1.05)	12 (12.63)
8. is edible	4 (4.21)	4 (4.21)

AVOCADO

	Essential	Non-essential
1. is green	17 (17.89)	59 (62.11)
2. has a pit	16 (16.84)	21 (22.11)
3. is a fruit	4 (4.21)	30 (31.58)
4. is a vegetable	5 (5.26)	14 (14.74)
5. is pear-shaped	4 (4.21)	15 (15.79)
6. has skin	2 (2.11)	15 (15.79)
7. is soft inside	7 (7.37)	10 (10.53)
8. is edible	7 (7.37)	8 (8.42)
9. has hard skin	1 (1.05)	14 (14.74)
10. grows on trees	10 (10.53)	2 (2.11)
11. grows plants from pit	12 (12.63)	0 (0.00)
12. is a plant	4 (4.21)	7 (7.37)
13. tastes bad	10 (10.53)	1 (1.05)
14. can be eaten raw	9 (9.47)	0 (0.00)

CATEGORY 3

BIRD

	Essential	Non-essential
1. flies	33 (34.74)	47 (49.47)
2. has (two) wings	3 (3.16)	64 (67.37)
3. has beak (bill)	11 (11.58)	33 (34.74)
4. has (two) legs	4 (4.21)	39 (41.05)
5. has feathers	2 (2.11)	39 (41.05)
6. lays eggs	8 (8.42)	18 (18.95)
7. chirps	24 (25.26)	5 (5.26)
8. is small (little)	15 (15.79)	7 (7.37)
9. builds nests	18 (18.95)	4 (4.21)
10. eats worms	6 (6.32)	18 (18.95)
11. is multi-colored	13 (13.68)	8 (8.42)
12. sings	3 (3.16)	18 (18.95)
13. perches in trees (branches)	18 (18.95)	1 (1.05)
14. lives in nests	6 (6.32)	10 (10.53)
15. is an animal	9 (9.47)	7 (7.37)
16. has (two) feet	3 (3.16)	11 (11.58)
17. many species (types)	10 (10.53)	5 (5.26)
18. migrates (flies south in winter)	11 (11.58)	2 (2.11)
19. is domestic (tamed)	12 (12.63)	1 (1.05)
20. is wild (untamed)	11 (11.58)	0 (0.00)
21. eats seeds	10 (10.53)	1 (1.05)
22. lives in trees	9 (9.47)	2 (2.11)
23. has (two) eyes	4 (4.21)	6 (6.32)

SPARROW

	Essential	Non-essential
1. is a bird	2 (2.11)	72 (75.79)
2. is small (little)	19 (20.00)	40 (42.11)
3. has (two) wings	6 (6.32)	46 (48.42)
4. flies	15 (15.79)	27 (28.42)
5. has (two) legs	2 (2.11)	34 (35.79)
6. is brown	10 (10.53)	23 (24.21)
7. has beak (bill)	6 (6.32)	14 (14.74)
8. sings	10 (10.53)	6 (6.32)
9. chirps	12 (12.63)	4 (4.21)
10. eats worms	13 (13.48)	4 (4.21)
11. has feathers	1 (1.05)	14 (14.74)
12. lives in nests	10 (10.53)	1 (1.05)
13. moves fast	6 (6.32)	2 (2.11)
14. eats seeds	7 (7.37)	1 (35.79)
15. lives in trees	7 (7.37)	0 (0.00)

PARROT

	Essential	Non-essential
1. is a bird	2 (2.11)	68 (71.58)
2. can talk	32 (33.68)	27 (28.42)
3. is colorful	10 (10.53)	23 (24.21)
4. has beak (bill)	4 (4.21)	31 (32.63)
5. lives in cage	30 (31.58)	2 (2.11)
6. has (two) wings	2 (2.11)	33 (34.74)
7. can mimick (imitate)	14 (14.74)	15 (15.79)
8. has (two) legs	3 (3.16)	23 (24.21)
9. is a house pet (domesticated)	22 (23.16)	2 (2.11)
10. is multi-colored	12 (12.63)	8 (8.42)
11. flies	6 (6.32)	12 (12.63)
12. is green	9 (9.47)	10 (10.53)
13. has feathers	1 (1.05)	14 (14.74)
14. has large beak	1 (1.05)	13 (13.68)
15. lives in tropical areas	4 (4.21)	8 (8.42)
16. is large (big)	10 (10.53)	5 (5.26)
17. can be trained	8 (8.42)	2 (2.11)
18. has (two) eyes	1 (1.05)	8 (8.42)

VULTURE

	Essential	Non-essential
1. is a bird	4 (4.21)	72 (75.79)
2. preys on dead (or almost dead) flesh	22 (23.16)	23 (24.21)
3. is large (big)	14 (14.74)	26 (27.37)
4. is black	8 (8.42)	28 (29.47)
5. has (two) wings	2 (2.11)	32 (33.68)
6. has beak (bill)	8 (8.42)	20 (21.05)
7. flies	14 (14.74)	13 (13.68)
8. is ugly	17 (17.89)	8 (8.42)
9. circles around prey (victim)	11 (11.58)	1 (1.05)
10. lives in desert	10 (10.53)	8 (8.42)
11. has large beak	7 (7.37)	12 (12.63)
12. has (two) legs	0 (0.00)	16 (16.84)
13. has feathers	2 (2.11)	12 (12.63)
14. has claws	1 (1.05)	11 (11.58)
15. is predatory (bird of prey)	5 (5.26)	8 (8.42)
16. is bad (evil, mean)	10 (10.53)	3 (3.16)
17. has (two) eyes	1 (1.05)	10 (10.53)
18. symbol of death	11 (11.58)	0 (0.00)
19. is carnivorous	2 (2.11)	6 (6.32)

PENGUIN

	Essential	Non-essential
1. is black and white	10 (10.53)	72 (75.79)
2. waddles (walks funny)	33 (34.74)	19 (20.00)
3. lives in cold weather (winter, snow)	25 (26.32)	23 (24.21)
4. is a bird	1 (1.05)	44 (46.32)
5. resembles tuxedo	24 (25.26)	11 (11.58)
6. has beak (bill)	10 (10.53)	16 (16.84)
7. swims	17 (17.89)	6 (6.32)
8. is an animal	3 (3.16)	15 (15.79)
9. cannot fly	7 (7.37)	9 (9.47)
10. lives in Antartica	9 (9.47)	6 (6.32)
11. has (two) legs	2 (2.11)	13 (13.68)
12. lives in North Pole	9 (9.47)	4 (4.21)
13. catch fish	10 (10.53)	1 (1.05)
14. has webbed feet	3 (3.16)	10 (10.53)
15. has (two) wings	2 (2.11)	10 (10.53)
16. is small (little)	3 (3.16)	15 (15.74)
17. found in zoo	10 (10.53)	0 (0.00)
18. found in water	9 (9.47)	1 (1.05)

CATEGORY 4

FURNITURE

	Essential	Non-essential
1. made of wood	26 (27.37)	23 (24.21)
2. used in homes	22 (23.16)	6 (6.32)
3. is confortabel	20 (21.05)	7 (7.37)
4. used for sitting on (or at)	17 (17.89)	12 (12.63)
5. has 1-4 legs	8 (8.42)	9 (9.47)
6. is supportive (put things on)	7 (7.37)	7 (7.37)
7. made of (covered with) cloth	13 (13.68)	3 (3.16)
8. a variety of sizes	12 (12.63)	1 (1.05)
9. made of plastic	10 (10.53)	2 (2.11)
10. made of metal	11 (11.58)	2 (2.11)
11. used for decoration	8 (8.42)	5 (5.26)
12. a variety of sizes	8 (8.42)	4 (4.21)
13. is functional (useful)	7 (7.37)	4 (4.21)
14. is various colors	8 (8.42)	3 (3.16)
15. many types	5 (5.26)	4 (4.21)
16. made of cushions	8 (8.42)	2 (2.11)
17. found in most buildings	6 (6.32)	2 (2.11)

TABLE

	Essential	Non-essential
1. has (1-4) legs	11 (11.58)	68 (71.58)
2. used for eating	46 (48.42)	10 (10.53)
3. made of wood	31 (32.63)	24 (25.26)
4. has flat surface	9 (9.47)	35 (36.84)
5. is supportive (put things on)	22 (23.16)	13 (13.68)
6. is a piece of furniture	8 (8.42)	19 (20.00)
7. is round	13 (13.68)	10 (10.53)
8. surrounded by chairs	15 (15.79)	4 (4.21)
9. made of metal	17 (17.89)	7 (7.37)
10. is square	10 (10.53)	8 (8.42)
11. found in kitchen	12 (12.63)	2 (5.11)
12. is hard	5 (5.26)	9 (9.47)
13. has smooth (finish) top	10 (10.53)	4 (4.21)
14. a variety of sizes	10 (10.53)	4 (4.21)
15. made of plastic	9 (9.47)	4 (4.21)
16. used for sitting on (or at)	10 (10.53)	1 (1.05)
17. is a variety of shapes	6 (6.32)	4 (4.21)
18. made of glass	7 (7.37)	3 (3.16)
19. used for studying	8 (8.42)	1 (1.05)
20. is rectangular	7 (7.37)	4 (4.21)

BOOKCASE

	Essential	Non-essential
1. holds books	31 (32.63)	52 (54.74)
2. has shelves	12 (11.43)	47 (49.47)
3. made of wood	40 (42.11)	20 (21.05)
4. made of metal	17 (17.89)	5 (5.26)
5. found in libraries	17 (17.89)	3 (3.16)
6. holds trinkets (ornaments, candles)	10 (10.53)	6 (6.32)
7. is tall (high)	12 (11.43)	2 (2.11)
8. is a piece of furniture	4 (4.21)	6 (6.32)
9. found against (close to) a wall	9 (9.47)	4 (4.21)
10. is brown	10 (10.53)	3 (3.16)
11. holds objects	9 (9.47)	2 (2.11)
12. is large (wide)	10 (10.53)	0 (0.00)
13. found in study room	7 (7.37)	1 (1.05)
14. used in homes	9 (9.47)	0 (0.00)

STOOL

	Essential	Non-essential
1. has (1-4) legs	22 (23.16)	52 (54.74)
2. made of wood	39 (41.05)	17 (17.89)
3. used for sitting on (or at)	27 (28.42)	24 (25.26)
4. used as a step (stand on)	20 (21.05)	8 (8.42)
5. is a type of seat		
(small chair)	8 (8.42)	19 (20.00)
6. used as a footrest	17 (17.89)	6 (6.32)
7. has a round top	8 (8.42)	12 (12.63)
8. is short (low)	11 (11.58)	10 (10.53)
9. found in bars	15 (15.79)	3 (3.16)
10. is small (narrow)	11 (11.58)	7 (7.37)
11. has no back	6 (6.32)	12 (12.63)
12. is a piece of furniture	3 (3.16)	12 (12.63)
13. made of metal	10 (10.53)	9 (6.32)
14. is tall (high)	12 (12.63)	5 (5.26)
15. is hard	7 (7.37)	9 (9.47)
16. can be uncomfortable	12 (12.63)	0 (0.00)

WASTEBASKET

	Essential	Non-essential
1. holds waste (garbage)	20 (21.05)	56 (58.95)
2. made of metal	22 (23.16)	10 (10.53)
3. is round	19 (20.00)	11 (11.58)
4. holds (old) papers	15 (15.79)	10 (10.53)
5. made of plastic	15 (15.79)	6 (6.32)
6. is smelly (dirty)	15 (15.79)	3 (3.16)
7. is a container	5 (5.26)	13 (13.68)
8. is cylindrical	10 (10.53)	9 (9.47)
9. is various colors	12 (12.63)	2 (2.11)
10. is square	9 (9.47)	7 (7.37)
11. emptied when full	10 (10.53)	2 (2.11)
12. is small (narrow)	10 (10.53)	1 (1.05)
13. found near (under)		
desks	10 (10.53)	0 (0.00)
14. is gray	10 (10.53)	1 (1.05)
15. can be decorated	9 (9.47)	0 (0.00)
16. a variety of sizes	8 (8.42)	2 (2.11)

CATEGORY 5

VEHICLE

	Essential	Non-essential
1. means of transportation	8 (8.42)	56 (58.95)
2. has wheels	11 (11.58)	38 (40.00)
3. needs a fare	10 (10.53)	11 (11.58)
4. carries people (passengers)	8 (8.42)	5 (5.26)
5. has engine (motor)	8 (6.32)	7 (7.37)
6. is various colors	9 (9.47)	6 (6.32)
7. is various sizes	11 (11.58)	4 (4.21)
8. covers distance	5 5.26	10 (10.53)
9. is driven	4 (4.21)	9 (9.47)
10. is various shapes	7 (7.37)	6 (6.32)
11. is dangerous (accidents)	12 (12.63)	0 (0.00)
12. is fast	8 (8.42)	2 (2.11)
13. made of metals	7 (7.37)	4 (4.21)
14. has steering wheel	4 (4.21)	7 (7.37)
15. is expensive	8 (8.42)	0 (0.00)

CAR

	Essential	Non-essential
1. has wheels	8 (8.42)	57 (60.00)
2. means of transportation	10 (10.53)	37 (38.95)
3. takes gas	20 (21.05)	19 (20.00)
4. has engine (motor)	7 (7.37)	29 (30.53)
5. is various colors	24 (25.26)	7 (7.37)
6. has steering wheel	10 (10.53)	20 (21.05)
7. is expensive	22 (23.16)	6 (6.32)
8. has (2 to 4) doors	9 (9.47)	17 (17.89)
9. is various sizes	22 (23.16)	7 (7.37)
10. has glass windows	5 (5.26)	19 (20.00)
11. is a vehicle	5 (5.26)	19 (20.00)
12. has seats	8 (8.42)	6 (6.32)
13. is dangerous (accidents)	20 (21.05)	1 (1.05)
14. is various makes	14 (14.74)	6 (6.32)
15. is fast	15 (15.74)	4 (4.21)
16. is various styles	5 (5.26)	19 (20.00)
17. has metalic frame	5 (5.26)	12 (12.63)
18. is driven	7 (7.37)	8 (8.42)
19. goes on roads (highways, driveways)	8 (8.42)	3 (3.16)
20. has trunk	6 (6.32)	8 (8.42)
21. has lights	5 (5.26)	8 (8.42)
22. needs repairs	12 (12.63)	1 (1.05)
23. has rubber tires	1 (1.05)	10 (10.53)
24. is fun for cruising	10 (10.53)	1 (1.05)

25. has horn	7 (7.37)	5 (5.26)
26. has a radio	8 (8.42)	3 (3.16)
27. has brakes	5 (5.26)	5 (5.26)
28. is a symbol of prestige (status)		
	7 (7.37)	3 (3.16)
29. is convenient	7 (7.37)	3 (3.16)

TROLLEY

	Essential	Non-essential
1. goes on tracks	8 (8.42)	50 52.63)
2. means of transportation	21 (22.11)	30 (31.5
3. found in San Francisco	38 (40.00)	8 (8.42)
4. carries people (passengers)	15 (15.79)	14 (14.74)
5. is old-fashioned	26 (27.37)	4 (4.21)
6. is train-like	5 (5.26)	20 (23.16)
7. has seats	10 (10.53)	10 (10.53)
8. run by electricity	7 (7.37)	11 (11.58)
9. attached to a wire overhead	5 (5.26)	13 (13.68)
10. has wheels	4 (4.21)	12 (12.63)
11. found in cities	8 (8.42)	6 (6.32)
12. needs a conductor (driver)	10 (10.53)	5 (5.26)
13. has a bell	8 (8.42)	5 (5.26)
14. is noisy	8 (8.42)	3 (3.16)
15. has (glass) windows	4 (4.21)	9 (9.47)
16. is various makes	10 (10.53)	1 (1.05)
17. is open	6 (6.32)	4 (4.21)
18. is a vehicle	1 (1.05)	9 (9.47)
19. found in Boston	9 (9.47)	2 (2.11)
20. goes on roads (highways, driveways)	3 (3.16)	6 (6.32)
21. goes uphill	10 (10.53)	0 (0.00)

SCOOTER

	Essential	Non-essential
1. has wheels	11 (11.58)	73 (76.84)
2. children's toy	32 (33.68)	12 (12.63)
3. has steering handle	7 (7.37)	32 (33.68)
4. has engine (motor)	19 (20.00)	12 (12.63)
5. means of transportation	10 (10.53)	13 (13.68)
6. is red	18 (18.95)	4 (4.21)
7. is pushed with one foot	15 (15.79)	6 (6.32)
8. is a vehicle	4 (4.21)	12 (12.63)
9. made of metal	9 (9.47)	6 (6.32)
10. takes gas	7 (7.37)	5 (5.26)
11. is fast	11 (11.58)	1 (1.05)
12. is driven	8 (8.42)	2 (2.11)
13. has seats	2 (2.11)	8 (8.42)

SKATES

	Essential	Non-essential
1. has sharp blades	11 (11.58)	58 (61.05)
2. has wheels	8 (8.42)	32 (33.68)
3. is white	26 (27.37)	8 (8.42)
4. has laces	9 (9.47)	22 (23.16)
5. used for hockey	16 (16.84)	7 (7.37)
6. used on ice	14 (14.74)	13 (13.68)
7. used for sport	16 (16.84)	4 (4.21)
8. is shoe like	7 (7.37)	11 (11.58)
9. is black	15 (15.79)	4 (4.21)
10. is fun	14 (14.74)	3 (3.16)
11. made of leather	2 (2.11)	11 (11.58)
12. means of transportation	9 (9.47)	3 (93.16)
13. can glide	5 (5.26)	6 (6.32)

features x categories x instances ($2 \times 5 \times 5$) repeated measures factorial design was performed. All three variables were repeated. Features given for category names were treated as a level of instances. Instances were ordered with category name (C_n) as the first level and instances in a decreasing order of relatedness, with instance 1 (I_1) being the highly related instance and instance 4 (I_4), the low related instance.

An F max test showed that the variances were homogeneous [$F_{\max}(50,94) = 11.03$]. Means and standard deviations of the analysis are presented in Tables 3, 4, 5, and 6. Graphic presentation of the means of the analysis are presented in Figures 1 and 2.

The analysis yielded a significant effect of features, $F(1,94) = 9.27$, $p < .001$. (See Table 7 for summary table of the analysis.) It was found that characteristic features ($\bar{X}F_2 = 3.77$) were more prevalent than defining features ($\bar{X}F_2 = 3.22$).

A significant effect of number of features given for categories was also found, $F(4,376) = 30.83$, $p < .001$. A Newman-Keuls test (see Table 8) revealed that number of features given for category fruit ($\bar{X}C_2 = 3.13$) was significantly less than from features for category vehicle ($\bar{X}C_5 = 3.68$) and bird ($\bar{X}C_3 = 4.07$). Features given for category furniture ($\bar{X}C_4 = 3.22$) were significantly less than features for vehicle and bird. Lastly, features for category vegetable ($\bar{X}C_1 = 3.40$) were significantly less than those for bird.

A significant effect of instances was found, $F(4,376) = 35.71$, $p < .001$. A Newman-Keuls test (see Table 9) showed that number of features given for category name ($\bar{X}C_n = 3.37$) was significantly less than

TABLE 3

Means and Standard Deviations of Defining and
Characteristic Features for Categories

<u>Categories</u>		<u>Defining Feature</u>	<u>Characteristic Feature</u>	<u>Sum</u>
Vegetable	Means	3.29	5.57	3.40
	SD	1.80	1.89	
Fruit	Means	3.01	3.25	3.13
	SD	1.73	1.80	
Bird	Means	4.28	3.87	4.07
	SD	2.07	1.97	
Furniture	Means	2.20	4.23	3.22
	SD	1.48	2.06	
Vehicle	Means	3.42	3.93	3.68
	SD	1.85	1.98	

TABLE 4

Means and Standard Deviations for Defining
and Characteristic Features for Instances

<u>Instances</u>		<u>Defining Feature</u>	<u>Characteristic Feature</u>	<u>Sum</u>
Category Name	Means	2.73	4.01	3.37
	SD	1.65	2.00	
Instance 1	Means	3.70	4.11	3.90
	SD	1.92	2.02	
Instance 2	Means	3.60	4.17	3.88
	SD	1.89	2.04	
Instance 3	Means	2.78	3.05	2.92
	SD	1.66	1.74	
Instance 4	Means	3.33	3.51	3.42
	SD	1.82	1.87	

TABLE 5

Means and Standard Deviations of Features for
Instances and Categories

		<u>VEGETABLE</u>	<u>FRUIT</u>	<u>BIRD</u>	<u>FURNITURE</u>	<u>VEHICLE</u>
Category Name	Means	3.25	3.54	4.47	2.81	2.78
	SD	1.80	1.19	2.11	1.68	1.67
I_1	Means	2.87	3.49	3.80	3.88	5.47
	SD	1.69	1.87	1.95	1.97	2.34
I_2	Means	4.38	4.76	3.90	2.95	3.43
	SD	2.09	2.18	1.97	1.72	1.85
I_3	Means	2.66	1.35	4.17	3.25	3.15
	SD	1.63	1.16	2.04	1.80	1.77
I_4	Means	3.83	2.49	4.02	3.19	3.57
	SD	1.96	1.58	2.00	1.79	1.89

TABLE 6

Means and Standard Deviations for Defining and Characteristic
Features for Categories and Instances

Defining Features (F_1)										
<u>VEGETABLE</u>					<u>FRUIT</u>					
	<u>C_n</u>	<u>I_1</u>	<u>I_2</u>	<u>I_3</u>	<u>I_4</u>	<u>C_n</u>	<u>I_1</u>	<u>I_2</u>	<u>I_3</u>	<u>I_4</u>
Means	2.65	2.84	3.81	2.63	4.21	2.67	3.45	4.75	1.47	2.69
SD	2.22	1.19	1.91	1.56	2.09	2.39	1.75	1.86	1.46	1.54
<u>BIRD</u>					<u>FURNITURE</u>					
	<u>C_n</u>	<u>I_1</u>	<u>I_2</u>	<u>I_3</u>	<u>I_4</u>	<u>C_n</u>	<u>I_1</u>	<u>I_2</u>	<u>I_3</u>	<u>I_4</u>
Means	4.17	4.21	4.13	4.50	4.38	1.54	2.82	2.14	2.42	2.09
SD	2.28	2.04	2.51	2.93	2.40	1.70	2.02	1.84	1.73	1.68
<u>VEHICLE</u>										
	<u>C_n</u>	<u>I_1</u>	<u>I_2</u>	<u>I_3</u>	<u>I_4</u>					
Means	2.62	5.18	3.19	2.86	3.27					
SD	2.34	3.86	1.94	1.67	2.06					

TABLE 6 (Continued)

Characteristic Features (F_2)

	<u>VEGETABLE</u>					<u>FRUIT</u>				
	<u>C_n</u>	<u>I₁</u>	<u>I₂</u>	<u>I₃</u>	<u>I₄</u>	<u>C_n</u>	<u>I₁</u>	<u>I₂</u>	<u>I₃</u>	<u>I₄</u>
Means	3.85	2.90	4.95	2.68	3.44	4.41	3.53	4.78	1.23	2.28
SD	2.75	1.71	3.06	2.06	2.62	3.31	2.51	2.82	1.75	2.14

	<u>BIRD</u>					<u>FURNITURE</u>				
	<u>C_n</u>	<u>I₁</u>	<u>I₂</u>	<u>I₃</u>	<u>I₄</u>	<u>C_n</u>	<u>I₁</u>	<u>I₂</u>	<u>I₃</u>	<u>I₄</u>
Means	4.78	3.40	3.67	3.84	3.65	4.08	4.95	3.77	4.07	4.29
SD	2.98	2.49	2.46	2.73	2.33	2.96	3.01	2.77	2.45	2.86

	<u>VEHICLE</u>				
	<u>C_n</u>	<u>I₁</u>	<u>I₂</u>	<u>I₃</u>	<u>I₄</u>
Means	2.94	5.76	3.66	3.44	3.87
SD	2.81	3.94	2.29	2.52	2.77

Figure 1. Mean number of defining features given for levels of relatedness (i.e., category name and each of the four instances) for the 5 categories.

Figure 2. Mean number of characteristic features given for levels of relatedness (i.e., category name and each of the four instances) for the 5 categories.

TABLE 7

Summary Table of Analysis of Variance for Number
of Defining and Characteristic Features
for Categories and Instances

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	4873.15	94	51.84		
Features	347.63	1	347.63	9.27	<.001
SF	3525.21	94	97.50		
Categories	562.00	4	140.50	30.83	<.001
SC	1713.65	376	4.56		
Instances	640.11	4	160.03	35.71	<.001
SI	1684.74	376	4.48		
FC	774.67	4	193.67	25.95	<.001
SFC	2805.90	376	7.46		
FI	183.08	4	45.77	10.48	<.001
SFI	1641.64	376	4.37		
CI	1990.60	16	124.91	37.91	<.001
SCI	4935.98	1504	3.28		
FCI	185.87	16	11.62	2.82	<.001
SFCI	6188.97	1504	4.11		
Total	32053.20	4749			

TABLE 8

Newman-Keuls Test of Features for Categories

		<u>Fruit</u>	<u>Furn.</u>	<u>Veget.</u>	<u>Veh.</u>	<u>Bird</u>		
	Means	3.13	3.22	3.40	3.68	4.07	r	Sc 9.99 (r,376)
Fruit	3.13	--	0.09	0.27	0.55*	0.94*	5	0.32
Furn.	3.22		--	0.18	0.46*	0.85*	4	0.30
Veget.	3.40			--	0.28	0.67*	3	0.28
Veh.	3.68				--	0.39	2	0.25
Bird	4.07							

*indicates significant mean pairs

TABLE 9

Newman-Keuls Test for Features at Instances

		I ₃	C _n	I ₄	I ₂	I ₁	r	S $\bar{I}$ 9.99(r,376)
	Means	2.92	3.37	3.42	3.88	3.90		
I ₃	2.92	--	0.45*	0.50*	0.96*	0.98*	5	0.27
C _n	3.37		--	0.05	0.51*	0.53*	4	0.25
I ₄	3.42			--	0.46*	0.48*	3	0.23
I ₂	3.88				--	0.02	2	0.19
I ₁	3.90					--		

*indicates significant mean pairs

features for Instance 2 ($\bar{X}I_2=3.88$) and Instance 1 ($\bar{X}I_1=3.90$). Number of features given for Instance 3 ($\bar{X}I_3=2.92$) was less than features given for category name and all instances. Features for Instance 4, the low related instance ($\bar{X}I_4=3.42$), were found to be significantly less than features given for Instance 2 and 1, the high related instances.

Number of defining and characteristic features given for different categories, Features X Categories interaction, yielded a significant effect, $F(4,376) = 25.95, p < .001$. Subsequent simple main effects test for defining and characteristic features given for different categories (see Table 10) found that only for category furniture there were more characteristic features given than defining, $F(4,376) = 32.84, p < .001$. The respective means for the category furniture were: $\bar{X}F_1C_4=2.20$ and $\bar{X}F_2C_4=4.23$. Defining features given at different categories were found to be significant, $F(4,376) = 35.75, p < .001$. Similarly, characteristic features given for different categories were found to be significant, $F(4,376) = 9.04, p < .001$.

A significant effect was found for number of defining and of characteristic features given for category name and instances, features X instances interaction [$F(4,376) = 10.48, p < .001$]. Subsequent simple main effects test of overall features given for category name and instances (see Table 11) revealed that for category name [$F(4,376) = 22.26, p < .001$], Instance 1 [$F(4,376) = 2.28, p < .001$] and Instance 2 [$F(4,376) = 4.41, p < .001$] there were more characteristic features given than defining (see Table 4 for appropriate means). Simple main effects test for defining and characteristic features given for

TABLE 10

Summary Table for Partitioning of Features X
Categories Interaction

F at levels of C

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
FC	774.67	4	193.67	25.95	<.001
F at C ₁	26.95	1	6.73	0.90	
F at C ₂	13.44	1	3.36	0.45	
F at C ₃	40.03	1	10.00	1.34	
F at C ₄	980.24	1	254.06	32.84	<.001
F at C ₅	61.65	1	15.41	2.06	
SFC	2805.90	376	7.46		

C at levels of F

FC	774.67	4	193.67	25.95	<.001
C at F ₁	1066.69	4	266.67	35.75	<.001
C at F ₂	269.68	4	67.42	9.04	<.001
SFC	2805.90	376	7.46		

TABLE 11

Summary Table for Partitioning of Features X
Instances Interaction

F at levels of I

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
FI	183.08	4	45.77	10.48	<.001
F at C_n	389.12	1	97.28	22.26	<.001
F at I_1	39.92	1	9.98	2.28	<.001
F at I_2	77.16	1	19.29	4.41	<.01
F at I_3	17.31	1	4.32	0.98	
F at I_4	5.58	1	1.39	0.31	
SFI	1641.64	376	4.37		

I at levels of F

FI	183.08	4	45.77	10.48	<.001
I at F_1	389.63	4	97.40	22.28	<.001
I at F_2	436.62	4	109.15	24.97	<.001
SFI	1641.64	376	4.37		

category name and instances (see Table 11) showed that characteristic features given for instances and category name were significantly different from each other, $F(4,376) = 24.97, p < .001$. Defining features for instances and category names were also found to be significantly different, $F(4,376) = 22.28, p < .001$. In fact, defining features given for category names ($\bar{X}_{F_1 C_n} = 2.73$) were less than defining features for Instance 1 ($\bar{X}_{F_1 I_1} = 3.70$), Instance 2 ($\bar{X}_{F_1 I_2} = 3.60$) and Instance 4 ($\bar{X}_{F_1 I_4} = 3.33$), but not from Instance 3 ($\bar{X}_{F_1 I_3} = 2.78$) (see Table 12 for Newman-Keuls test).

Finally, the analysis yielded a significant features $\times$ categories $\times$ instances interaction, $F(16,1504) = 2.82, p < .001$. Subsequent simple main effects test (see Table 13) showed that number of defining features given at categories $\times$ instances were significantly different, $F(16,1504) = 12.86, p < .001$, as well as number of characteristic features given at categories $\times$ instances, $F(16,1504) = 20.17, p < .001$ (see Table 5 for appropriate means). A subsequent simple main effects test (see Table 13) showed that number of defining features given for a level of relatedness for different categories were significantly different. Similarly, characteristic features given for a level of relatedness for different categories were found to be significant. Furthermore, defining features given for different categories and their instances were found to be significantly different except for the bird category (see Table 13 continued). Newman-Keuls tests were performed on the significant differences to see whether the number of defining features given for the category name of a specific category was significantly less than the number of defining features given for the

TABLE 12

Newman-Keuls Test for Defining
Features at Instances

	C_n	I_3	I_4	I_2	I_1		
Means	2.73	2.78	3.33	3.60	3.70	r	Sr at F_1 .99(r,376)
C_n	2.73	--	0.05	0.60*	0.87*	0.97*	5 0.44
I_3	2.78		--	0.55*	0.82*	0.92*	4 0.42
I_4	3.33			--	0.27	0.37*	3 0.39
I_2	3.60				--	0.10	2 0.35
I_1	3.70						

*indicates significant mean pairs

TABLE 13

Summary Table for Partitioning of Features X
Categories X Instances Interaction

CI at levels of F

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
FCI	185.87	16	11.62	2.82	<.001
CI at F_1	847.20	16	52.95	12.86	<.001
CI at F_2	1329.22	16	83.08	20.17	<.001
SFCI	6188.97	1504	4.12		

C at levels of FI

FCI	185.87	16	11.62	2.82	<.001
C at F_1C_n	333.80	4	83.45	20.26	<.001
C at F_1I_1	381.67	4	95.42	23.17	<.001
C at F_1I_2	374.97	4	93.74	22.76	<.001
C at F_1I_3	459.87	4	114.97	27.91	<.001
C at F_1I_4	363.88	4	90.97	22.09	<.001
C at F_2C_n	183.69	4	45.92	11.15	<.001
C at F_2I_1	542.72	4	135.68	32.94	<.001
C at F_2I_2	155.75	4	38.94	9.45	<.001
C at F_2I_3	500.59	4	125.15	30.38	<.001
C at F_2I_4	216.18	4	54.04	13.12	<.001
SFCI	6188.87	1504	4.12		

TABLE 13 (Continued)

I at levels of FC

<u>Source</u>	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
FCI	185.87	16	11.62	2.82	<.001
I at F_1C_1	203.80	4	50.95	12.36	<.001
I at F_1C_2	552.01	4	138.00	34.49	<.001
I at F_1C_3	9.30	4	2.32	0.56	
I at F_1C_4	83.98	4	30.99	5.09	<.001
I at F_1C_5	392.02	4	98.00	23.78	<.001
I at F_2C_1	307.85	4	76.96	18.68	<.001
I at F_2C_2	834.68	4	208.67	50.64	<.001
I at F_2C_3	108.13	4	27.03	6.56	<.001
I at F_2C_4	74.26	4	18.56	4.50	<.001
I at F_2C_5	441.32	4	110.33	26.78	<.001
SFCI	6188.97	1504	4.12		

instances of that category (see tables 15-18). The above (inequality) relation held only for the following cases: (a) category "vegetable" for I_2 and I_4 , (b) category "fruit" for I_2 , (c) category "furniture" for I_1 , and (d) category "vehicle" for I_1 .

To further investigate whether defining features are central to word meanings a chi-square test was performed on the first response given for category names and instances to see whether defining features, characteristic features or other idiosyncratic responses were more frequently given (see Table 19). The result of the chi-square showed that defining features were more frequently given first than would be expected by chance ($\chi^2=1,091.21$, $df=2$, $p<.001$). The first feature given for instances was also compared against the first feature given for categories (see Table 20) and it was found that defining features were more frequently given first for instances than for categories ($\chi^2=115.64$, $df=2$, $p<.001$). Lastly, for all levels of relatedness defining features were more frequently given first to instances than were given to the category names (see Table 21).

TABLE 14
PERCENTAGES OF FEATURES FROM RECOGNITION MEMORY

CATEGORY 1			
VEGETABLE (N=167)			
	Essential	Non-essential	Not a property
1. is various colors	62.9	35.3	0.6
2. is a herb	16.2	56.9	25.7
3. has yellow flowers	4.2	83.2	11.4
4. is red	6.6	86.8	5.4
5. has green stem	31.7	65.3	1.8
6. has fuzzy seeds	6.6	83.8	8.4
7. has edible leaves	19.2	73.7	6.0
8. is a fruit	9.0	26.9	62.3 *
9. grows from soil	74.9	21.6	2.4
10. can be cultivated	66.5	29.3	3.0
11. is a spice	6.6	64.1	25.7
12. has green leaves	28.7	66.5	1.8
13. can be cooked	52.1	45.5	0.6
14. grows in gardens	54.5	43.7	0.6
15. is a food	84.4	14.4	0.0
16. makes sauce	13.8	75.4	9.0
17. tastes good	18.6	77.2	3.0

Footnote: * indicates statistical significance ($p < .05$) between the distributions of essential, non-essential and not a property categories when category names were presented

prior and after instances.

18. used for decorating

food	6.0	85.0	7.8
------	-----	------	-----

19. can be dried up	19.2	76.0	3.0
---------------------	------	------	-----

20. tastes bad	1.2	82.6	15.0
----------------	-----	------	------

21. eaten in salads	22.8	74.3	1.8
---------------------	------	------	-----

22. is a weed	3.0	45.5	49.7
---------------	-----	------	------

23. is green	12.0	83.2	3.6
--------------	------	------	-----

24. grows in lawns	4.2	52.1	42.5
--------------------	-----	------	------

25. has yellow petals	4.2	68.9	25.7
-----------------------	-----	------	------

26. grows in grass	4.2	59.9	34.1*
--------------------	-----	------	-------

27. made into pie	6.6	79.0	12.6
-------------------	-----	------	------

28. is nutritious

(healthy)	70.7	26.9	0.6
-----------	------	------	-----

29. is mushy	5.4	88.0	3.6
--------------	-----	------	-----

30. is many varieties	68.3	29.3	0.6
-----------------------	------	------	-----

31. is small	4.2	89.8	4.8
--------------	-----	------	-----

32. made into wine	5.4	58.7	34.7
--------------------	-----	------	------

33. removed from lawns

(not liked)	1.8	46.7	49.7
-------------	-----	------	------

34. is hard	5.4	84.4	9.0
-------------	-----	------	-----

35. is yellow	8.4	83.2	7.2
---------------	-----	------	-----

36. is a flower	7.8	51.5	38.9*
-----------------	-----	------	-------

37. has stem	33.5	61.7	3.6
--------------	------	------	-----

38. grows in soil

(ground)	64.7	33.5	6.6
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39. used for cooking	41.9	54.5	1.8
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40. eaten at meals	55.7	42.5	0.0
41. tastes bitter	3.6	89.8	4.8
42. eaten fresh	28.1	70.1	0.6
43. has vitamins	72.5	25.1	0.6*
44. is juicy	12.6	82.6	3.6
45. is skin-covered	29.3	65.3	3.6*
46. is pretty	1.8	84.4	12.0
47. has many shapes	50.9	43.1	3.0
48. is almost round	3.6	84.4	10.8
49. children do not like it	4.2	74.9	19.2
50. is a plant	65.9	29.3	1.8
51. has lacy leaves	6.6	84.9	7.8
52. grows in spring	20.4	71.3	4.8
53. is a wild flower	4.2	49.7	44.3
54. has white fluff (attached to seeds)	2.5	61.7	34.1
55. used for seasoning	10.8	71.9	14.4
56. is edible	78.4	19.2	1.8
57. blown away (for good luck)	1.2	33.5	64.1
58. is shiny	1.2	86.8	10.8
59. is short	1.8	88.6	8.4
60. contains acid	51.6	77.8	8.4
61. has little or no taste	4.8	73.7	20.4

62. grows in vines	12.6	71.9	14.4
63. has minerals			
(iron)	50.9	45.5	2.4
64. grows in the summer			
	29.3	67.1	1.8
65. eaten raw	25.7	71.9	1.2
66. grows in fields	31.1	60.5	6.0

SPINACH (N=90)

	Essential	Non-essential	Not a property
1. is various colors	10.0	30.0	56.7
2. is a herb	20.0	22.2	54.48 *
3. has yellow flowers	8.9	26.7	61.1
4. is red	4.4	8.9	84.4*
5. has green stem	63.3	23.3	10.0
6. has fuzzy seeds	8.9	26.7	61.1
7. has edible leaves	70.0	23.3	3.3
8. is a fruit	1.1	13.3	82.2
9. grows from soil	75.6	18.9	3.3
10. can be cultivated	50.0	38.9	8.9
11. is a spice	5.6	16.7	73.3
12. has green leaves	83.3	14.4	0.0
13. can be cooked	50.0	45.6	2.2
14. grows in gardens	52.2	44.4	1.1
15. is a food	90.0	6.7	1.1
16. makes sauce	6.7	38.9	52.2
17. tastes good	23.3	65.6	8.9 *
18. used for decorating			
food	11.1	62.2	23.3
19. can be dried up	12.2	53.3	32.2
20. tastes bad	3.3	65.6	28.9
21. eaten in salads	22.2	65.6	10.0
22. is a weed	4.4	20.0	72.2
23. is green	84.4	8.9	4.4
24. grows in lawns	5.6	35.6	56.7

25. has yellow petals	7.8	14.4	75.6*
26. grows in lawns	6.7	40.0	51.7
27. made into pie	14.4	63.3	16.7
28. is nutritious			
(healthy)	78.9	18.9	0.0
29. is mushy	15.6	46.7	35.6
30. is many varieties	25.6	43.3	27.8
31. is small	6.7	72.2	18.9
32. made into wine	1.1	18.9	77.8
33. removed from lawns			
(not liked)	3.3	23.3	70.0
34. is hard	2.2	31.1	64.4
35. is yellow	3.3	17.8	75.6*
36. is a flower	5.6	17.8	74.4
37. has stem	60.0	27.8	10.0
38. grows in soil			
(ground)	65.6	26.7	5.6
39. used for cooking	41.1	52.2	4.4
40. eaten at meals	53.3	43.3	1.1
41. tastes bitter	4.4	71.1	22.2
42. eaten fresh	23.3	63.3	11.1
43. has vitamins	78.9	15.6	2.2*
44. is juicy	12.2	43.3	42.2
45. is skin-covered	8.9	18.9	70.0
46. is pretty	13.3	65.6	18.9
47. has many shapes	26.7	34.4	36.7
48. is almost round	4.4	33.3	60.0

49. children do not			
like it	15.6	67.8	14.4
50. is a plant	77.8	13.3	5.6*
51. has lacy leaves	37.8	31.1	28.9
52. grows in spring	27.8	61.1	7.8
53. is a wild flower	8.9	23.3	64.4 (*
54. has white fluff			
(attached to seeds)	5.6	23.3	67.8
55. used for seasoning	8.9	54.4	33.3
56. is edible	82.2	15.6	0.0
57. blown away			
(for good luck)	2.2	15.6	78.9
58. is shiny	7.8	50.0	40.0
59. is short	10.0	65.6	21.1
60. contains acid	34.4	37.8	24.4
61. has little or			
no taste	7.8	48.9	40.0
62. grows in vines	4.4	20.0	72.2
63. has minerals	76.7	18.9	2.2
64. grows in the			
summer	30.0	54.4	11.1
65. eaten raw	14.4	70.0	13.3
66. grows in fields	30.0	52.2	15.6
67. is a vegetable	92.2	4.4	1.1

TOMATO (N=77)

	Essential	Non-essential	Not a property
1. is various colors	15.6	45.5	37.7
2. is a herb	3.9	24.7	70.1
3. has yellow flowers	13.0	22.1	62.2
4. is red	80.5	18.2	1.3
5. has green stem	59.7	35.1	5.2
6. has fuzzy seeds	2.6	19.5	75.3
7. has edible leaves	2.6	31.5	59.7
8. is a fruit	42.9	19.5	36.4
9. grows from soil	72.7	19.5	6.5
10. can be cultivated	54.5	40.3	3.9
11. is a spice	7.8	22.1	70.1
12. has green leaves	57.1	36.4	3.9
13. can be cooked	50.6	48.1	1.3
14. grows in gardens	54.5	39.0	2.6
15. is a food	0.0	0.0	0.0
16. makes sauce	45.5	49.4	2.6
17. tastes good	20.8	70.1	6.5
18. used for decorating			
food	10.4	68.8	20.8
19. can be dried up	2.6	26.0	67.5
20. is many varieties	0.0	50.6	49.4
21. eaten in salads	45.5	49.4	1.3
22. is a weed	0.0	9.1	89.6
23. is green	13.0	62.3	24.7
24. grows in lawns	5.2	36.4	58.4

25. has yellow petals	10.4	26.0	62.3
26. grows in grass	1.3	29.9	66.2
27. made into pie	2.6	32.5	63.6
28. is nutritious			
(healthy)	71.4	24.7	2.6 *
29. is mushy	24.7	66.2	9.1
30. is many varieties	45.5	40.3	10.4
31. is small	20.8	71.4	7.8*
32. made into wine	1.3	19.5	77.9
33. removed from lawns			
(not liked)	0.0	15.6	83.1
34. is hard	2.6	28.6	68.8
35. is yellow	6.5	32.5	55.8
36. is a flower	5.2	24.7	68.8
37. has stem	61.0	28.6	10.4
38. grows in soil			
(ground)	68.8	13.0	18.2
39. used for cooking	44.2	54.5	1.3
40. eaten at meals	46.8	46.8	5.2
41. tastes bitter	2.6	44.2	53.2
42. eaten at meals	51.9	48.1	0.0
43. has vitamins	79.2	20.8	0.0 *
44. is juicy	66.2	28.6	5.2
45. is skin-covered	72.7	22.1	5.2
46. is pretty	9.1	67.5	22.1
47. has many shapes	26.0	40.3	33.8
48. is almost round	64.9	32.5	0.0

49. children do not			
like it	0.0	68.8	28.6
50. is a plant	80.5	14.3	5.2
51. has lacy leaves	9.1	36.4	51.9
52. grows in spring	29.9	50.6	19.5
53. is a wild flower	2.6	16.9	80.5*
54. has white fluff			
(attached to seeds)	0.0	11.1	87.0
55. used for seasoning	22.1	55.8	22.1
56. is edible	84.4	13.0	1.3
57. blown away			
(for good luck)	1.3	7.8	89.6
58. is shiny	28.6	59.7	10.4
59. is short	3.9	37.7	55.8
60. contains acid	66.2	19.5	9.1
61. has little or			
no taste	3.9	40.3	54.5
62. grows in vines	39.0	24.7	36.4
63. has minerals	58.4	27.3	11.7 *
64. grows in summer	48.1	45.5	6.5
65. eaten raw	45.5	50.6	2.6
66. grows in fields	31.2	45.5	20.8
67. is a vegetable	61.0	15.6	22.1
68. grows in the spring			
	31.2	45.5	20.8

PARSLEY (N=90)

	Essential	Non-essential	Not a property
1. is various colors	3.3	37.8	56.7
2. is a herb	78.9	15.6	4.4
3. has yellow flowers	4.4	28.9	64.4
4. is red	2.2	13.3	83.3
5. has green stem	70.0	23.3	4.4
6. has fuzzy seeds	4.4	28.9	65.6
7. has edible leaves	74.4	22.2	3.3
8. is a fruit	4.4	13.3	82.2
9. grows from soil	67.8	27.8	3.3
10. can be cultivated	40.0	52.2	7.8
11. is a spice	54.4	27.8	17.8
12. has green leaves	72.2	20.0	7.8
13. can be cooked	42.2	55.6	2.2
14. grows in gardens	52.2	47.8	0.0
15. is a food	65.6	27.8	5.6
16. makes sauce	7.8	56.7	34.4
17. tastes good	12.2	78.9	8.9
18. used for decorating			
food	44.4	52.2	3.3
19. can be dried up	48.9	42.2	7.8
20. tastes bad	3.3	71.1	25.6
21. eaten in salads	36.7	62.2	1.1
22. is a weed	3.3	25.6	71.1*
23. is green	81.1	16.7	1.1
24. grows in lawns	4.6	35.6	56.7

25. has yellow petals	2.2	20.0	77.8
26. grows in grass	10.0	42.2	47.8
27. made into pie	1.1	23.3	74.4
28. is nutritious			
(healthy)	45.6	48.9	5.6
29. is mushy	2.2	25.6	72.2
30. is many varieties	34.4	45.6	18.9
31. is small	43.3	50.0	6.7
32. made into wine	1.1	21.1	77.8
33. removed from lawns			
(not liked)	3.3	34.4	61.1
34. is hard	1.1	16.7	82.2
35. is yellow	1.1	27.8	70.0
36. is a flower	7.8	36.7	55.6
37. has stem	71.1	26.7	1.1
38. grows in soil			
(ground)	64.4	30.0	4.4
39. used for cooking	47.8	51.1	1.1
40. eaten at meals	27.8	70.0	2.2
41. tastes bitter	7.8	53.3	38.9
42. eaten fresh	36.7	57.8	5.6
43. has vitamins	52.2	44.4	3.3
44. is juicy	5.6	35.6	58.9
45. is skin-covered	5.6	15.6	77.8
48. is almost round	2.2	24.4	73.3
49. children do not			
like it	3.3	77.8	18.9 *

50. is a plant	77.8	16.7	5.6*
51. has lacy leaves	73.3	24.4	2.2
52. grows in spring	21.1	66.7	12.2
53. is a wild flower	4.4	34.4	58.9*
54. has white fluff			
(attached to seeds)	1.1	18.9	77.8
55. used for seasoning	63.3	34.4	2.2
56. is edible	82.2	16.7	1.1
57. blown away			
(for good luck)	1.1	28.9	70.0
58. is shiny	4.4	23.3	72.2
59. is short	42.2	53.3	4.4
60. contains acid	11.1	53.3	35.6
61. has little or			
no taste	22.2	55.6	22.2
62. grows in vines	4.4	20.0	74.4
63. has minerals	54.4	37.8	7.8
64. grows in the summer			
	25.5	63.3	1.1
65. eaten raw	38.9	58.9	2.2
66. grows in fields	35.6	58.9	5.6
67. is a vegetable	0.0	0.0	0.0
68. grows in the spring	0.0	0.0	0.0
69. grows in the summer			
	27.8	64.4	6.7

DANDALION (N=77)

	Essential	Non-essential	Not a property
1. is various colors	7.8	31.2	59.7
2. is a herb	16.9	29.9	53.2
3. has yellow flowers	85.7	9.1	5.2
4. is red	0.0	11.7	88.3
5. has green stem	72.7	19.5	5.2
6. has fuzzy seeds	64.9	15.6	16.9
8. is a fruit	1.3	18.2	80.5
9. grows from soil	70.1	14.3	13.0 *
10. can be cultivated	27.3	48.1	24.7
11. is a spice	3.9	19.5	72.7
12. has green leaves	53.2	23.4	22.1
13. can be cooked	28.6	49.4	22.1
14. grows in gardens	28.6	54.5	15.6
15. is a food	24.7	44.2	31.2
16. makes sauce	3.9	20.8	72.7
17. tastes good	11.7	59.7	28.6
18. used for decorating			
food	3.9	36.4	59.7
19. can be dried up	11.7	40.3	46.8
20. tastes bad	3.9	57.1	37.7
21. eaten in salads	24.7	44.2	29.9
22. is a weed	67.5	20.8	10.4
23. is green	16.9	31.2	49.4
24. grows in lawns	64.9	31.2	3.9
25. has yellow petals	63.6	16.9	16.9

26. grows in grass	80.5	16.9	2.6
27. made into pie	2.6	29.9	67.5
28. is nutritious			
(healthy)	24.7	39.0	36.4
29. is mushy	3.9	26.0	68.8
30. is many varieties	11.7	45.5	41.6
31. is small	31.2	61.0	6.5
32. made into wine	10.4	49.4	40.3
33. removed from lawns			
(not liked)	51.9	42.9	3.9
34. is hard	2.6	18.2	79.2*
35. is yellow	74.0	16.9	7.8
36. is a flower	58.4	18.2	19.5
37. has stem	74.4	11.7	1.3
38. grows in soil			
(ground)	75.3	15.6	6.5
39. used for cooking	18.2	41.6	40.3
40. eaten at meals	14.3	49.4	36.4
41. tastes bitter	22.2	44.2	32.5
42. eaten fresh	18.2	44.2	36.4
43. has vitamins	28.6	37.7	33.8
44. is juicy	3.9	35.1	59.7
45. is skin-covered	5.2	20.8	72.7
46. is pretty	20.8	67.5	11.7
47. has many shapes	7.8	37.7	51.9
48. is almost round	22.1	39.0	39.0*
49. children do not			

like it	1.3	55.8	42.9
50. is a plant	68.8	18.2	11.7
51. has lacy leaves	18.2	27.3	53.2
52. grows in spring	71.4	26.0	1.3
53. is a wild flower	50.6	24.7	22.1
54. has white fluff			
(attached to seeds)			
	57.1	24.7	18.2
55. used for seasoning	7.8	39.0	51.9
56. is edible	50.6	26.0	20.8
57. blown away			
(for good luck)	26.0	53.2	19.5
58. is shiny	5.2	36.4	57.1
59. is short	19.5	58.4	20.8
60. contains acid	14.3	36.4	44.2
61. has little or			
no taste	2.6	48.1	46.8
62. grows in vines	0.0	7.8	92.2
63. has minerals	22.2	42.9	35.1
64. grows in the			
summer	46.8	45.5	6.5
65. eaten raw	19.5	45.5	35.1
66. grows in fields	53.2	40.3	5.2
67. is a vegetable	9.1	22.1	64.9

CATEGORY 2

FRUIT (N=166)

	Essential	Non-essential	Not a property
1. has many colors	53.0	45.2	0.6
2. has skin	42.8	31.9	1.2
3. grows on trees	42.8	56.0	1.2
4. is edible	75.3	22.3	0.0*
5. has sour skin	6.6	88.0	3.6
6. makes salads	13.3	82.5	3.0
7. is nutritious			
(healthy)	65.1	31.9	1.8
8. tastes good	25.3	69.9	3.0
9. stops thirst	15.1	75.9	7.8
10. is pear-shaped	4.6	84.9	3.6
11. is sticky	10.8	82.5	5.4
12. is a plant	53.0	33.1	12.7
13. many varieties	65.1	32.5	0.6*
14. is a kind of berry	6.0	84.3	7.8
15. is green	6.0	85.5	6.6
16. can be cooked	24.7	72.9	1.2
17. used for pies	17.5	79.5	1.8
18. is mushy	7.8	84.9	5.4
19. is red inside	4.8	86.7	7.2
20. has black and white			
seeds	7.8	77.1	13.9
21. has shiny skin	6.6	86.1	5.4
22. is a vegetable	8.4	24.7	65.1

23. contains water	42.2	51.8	4.8*
24. is purple	2.4	85.5	10.2
25. has green rind	4.8	86.1	7.8
26. has a pit	15.1	78.9	4.8
27. is heavy	3.0	77.7	17.5
28. is oval	4.2	85.5	7.8
29. is yellow	5.4	86.1	7.2
30. has green skin	5.4	84.9	8.4
31. grows in vines	12.7	79.5	6.0
32. is sweet	15.7	80.7	1.2
33. makes jam	15.1	79.5	3.6
34. is juicy	25.9	68.7	3.6
35. tastes bad	1.8	74.7	21.1
36. grows on bushes	15.1	75.9	7.2
37. is sour	3.6	90.4	4.8
38. has white rind	4.2	80.7	13.9
39. is small	6.0	88.6	4.2
40. is red	6.6	84.3	7.2
41. has gray skin	4.2	69.9	23.5
42. is round (almost)	12.0	82.5	3.0
43. has seeds	40.4	57.8	0.6
44. grows in summer	32.5	62.0	2.4
45. is food	78.9	18.1	0.6
46. makes desserts	25.3	69.3	3.6
47. is expensive	6.6	81.3	9.0
48. has vitamins	64.5	32.5	1.2*
49. is soft inside	14.5	81.3	2.4

50. is various sizes	55.4	42.2	1.2
51. has rind	13.3	80.7	4.8
52. has hard skin	6.0	86.7	4.8
53. is pinkish-red	5.4	86.7	6.0
54. is large (big)	3.6	86.7	7.2
55. grows plants			
from pit	25.3	69.9	3.6
56. is various shapes	58.4	37.3	0.6

PLUM (N=92)

	Essential	non-essential	Not a property
1. has many colors	23.9	43.5	32.6
2. has skin	83.7	16.3	0.0
3. grows on trees	89.1	9.8	1.1
4. is edible	87.0	13.0	0.0
5. has sour skin	41.3	47.8	10.9
6. makes salads	8.7	60.9	30.4
7. is nutritious			
(healthy)	72.8	27.2	0.0
8. tastes good	26.1	71.7	2.2
9. stops thirst	12.0	75.0	13.0
10. is pear-shaped	3.3	23.9	72.8 *
11. is sticky	15.2	69.6	15.2
12. is a plant	38.0	21.7	40.2
13. many varieties	44.6	46.7	8.7
14. is a kind of berry			
	10.9	34.8	53.3 *
15. is green	2.2	38.0	59.8
16. can be cooked	32.6	60.9	4.3
17. used for pies	15.2	77.2	7.6
18. is mushy	37.0	56.5	6.5
19. is red inside	28.3	51.1	20.7
20. has black and			
white seeds	2.2	22.8	75.0
21. has shiny skin	32.6	59.8	6.5
22. is a vegetable	2.2	14.1	82.6

23. contains water	54.3	38.0	7.6
24. is purple	55.4	44.6	0.0
25. has green rind	4.3	21.7	73.9
26. has a pit	81.5	17.4	1.1
27. is heavy	1.1	37.0	62.0
28. is oval	53.3	39.1	7.6
29. is yellow	3.3	37.0	59.8
30. has green skin	4.3	29.3	66.3
31. grows in vines	1.1	28.3	69.6
32. is sweet	32.6	60.9	6.6
33. makes jam	21.7	67.4	10.9
34. is juicy	52.2	46.7	0.0
35. tastes bad	2.2	52.2	45.7
36. grows on bushes	4.3	20.7	73.9 *
37. is sour	10.9	64.1	25.0
38. has white rind	1.1	23.9	75.0
39. is small	34.8	65.2	0.0
40. is red	33.7	41.3	25.0 *
41. has gray skin	4.3	23.9	68.5
42. is round (almost)	50.0	41.3	8.7
43. has seeds	41.3	25.0	33.7
44. grows in summer	39.1	55.4	4.3
45. is food	88.0	10.9	1.1
46. makes desserts	19.6	80.4	0.0
47. is expensive	6.5	68.5	23.9
48. has vitamins	68.2	33.7	1.1*
49. is soft inside	58.7	39.1	0.0

50. is various sizes	50.5	42.4	1.1
51. has rind	7.6	23.9	68.5
52. has hard skin	8.7	23.9	67.4
53. is pinkish-red	28.3	48.9	22.8
54. is large (big)	5.4	65.2	29.3
55. grows plants			
from pit	47.8	39.1	12.0
56. is various shapes	27.2	45.7	27.2
57. is a fruit	94.7	5.4	0.0

WATERMELON (N=75)

	Essential	Non-essential	Not a property
1. has many colors	13.3	28.0	58.7
2. has skin	68.0	22.7	9.3
3. grows on trees	0.0	10.7	89.3
4. is edible	84.0	13.3	2.7
5. has sour skin	18.7	42.7	37.3
6. makes salads	18.7	54.7	26.7
7. is nutritious			
(healthy)	53.3	41.3	5.3
8. tastes good	40.0	54.7	2.7
9. stops thirst	28.0	57.3	13.3
10. is pear-shaped	1.3	24.0	74.7
11. is sticky	22.7	53.3	22.7
12. is a plant	58.7	20.0	21.3 *
13. many varieties	25.3	30.7	44.0
14. is a kind of berry	4.0	17.3	76.0
15. is green	49.3	40.0	10.7
16. can be cooked	6.7	44.0	48.0
17. used for pies	5.3	48.0	46.7
18. is mushy	14.7	57.3	25.3
19. is red inside	76.0	18.7	4.0
20. has black and white			
seeds	68.0	25.3	6.7
21. has shiny skin	28.0	49.3	21.3
22. is a vegetable	9.3	14.7	76.0
23. contains water	81.3	17.3	1.3

24. is purple	2.7	14.7	82.7
25. has green rind	69.3	18.7	12.0
26. has a pit	10.7	17.3	69.3
27. is heavy	36.0	60.0	1.3
28. is oval	73.3	22.7	0.0
29. is yellow	0.0	20.0	78.7
30. has green skin	69.3	22.7	8.0
31. grows on vines	56.0	18.7	22.7
32. is sweet	49.3	49.3	1.3
33. makes jam	4.0	49.3	44.0
34. is juicy	65.3	26.7	3.0
35. tastes bad	1.3	49.3	48.0
36. grows on bushes	5.3	20.0	73.3
37. is sour	0.0	30.7	68.0
38. has white rind	58.7	20.0	18.7
39. is small	1.3	62.7	34.7
40. is red	48.0	44.0	6.7
41. has gray skin	0.0	14.7	85.3
42. is round (almost)	29.3	49.3	18.7
43. has seeds	90.7	9.3	0.0
44. grows in summer	69.3	24.0	2.7
45. is food	90.7	8.0	0.0
46. makes desserts	21.3	65.3	13.3
47. is expensive	2.7	78.7	17.3
48. has vitamins	70.7	28.0	1.3 *
49. is soft inside	40.0	56.0	4.0
50. is various sizes	52.0	44.0	4.0

51. has rind	81.3	12.0	4.0
52. has hard skin	58.7	36.0	5.3
53. is pinkish-red	85.3	10.7	4.0
54. is large (big)	37.3	58.7	4.0
55. grows plants			
from pit	28.0	21.3	46.7
56. is various shapes	42.7	44.0	12.0
57. is a fruit	81.3	10.7	5.3

GOOSEBERRY (N=90)

	Essential	Non-essential	Not a property
1. has many colors	6.7	42.2	38.9*
2. has skin	47.8	35.6	5.6
3. grows on trees	13.3	27.8	46.7
4. is edible	22.2	24.4	2.2
5. has sour skin	6.7	63.3	16.7
6. makes salads	3.3	42.2	42.2
7. is nutritious			
(healthy)	44.4	43.3	1.1
8. tastes good	10.0	70.0	8.9
9. stops thirst	4.4	56.7	26.7
10. is pear-shaped	4.4	28.9	54.4
11. is sticky	15.6	60.0	13.3
12. is a plant	43.3	24.4	20.0
13. many varieties	17.8	45.6	23.3
14. is a kind of berry	81.1	7.8	0.0
15. is green	4.4	37.8	45.6*
16. can be cooked	34.4	52.2	2.2
17. used for pies	15.6	63.3	5.6
18. is mushy	14.4	58.9	14.4
19. is red inside	30.0	44.4	13.3
20. has black and white			
seeds	7.8	37.8	41.1
21. has shiny skin	38.9	42.2	8.9
22. is a vegetable	3.3	21.1	63.3
23. contains water	41.1	42.2	6.7

24. is purple	16.7	45.6	21.1*
25. has green rind	7.8	18.9	64.4
26. has a pit	15.6	24.4	47.8
27. is heavy	1.1	38.9	51.1
28. is oval	12.2	52.2	23.3
29. is yellow	11.1	40.0	38.9
30. has green skin	8.9	37.8	40.0
31. grows in vines	43.3	22.2	24.4 *
32. is sweet	17.8	61.1	8.9
33. makes jam	35.6	53.3	1.1
34. is juicy	26.7	55.6	3.3
35. tastes bad	5.6	70.0	15.6
36. grows on bushes	48.9	31.1	7.8
37. is sour	14.4	65.6	7.8
38. has white rind	2.2	26.7	58.9
39. is small	60.0	27.8	1.1
40. is red	18.9	47.8	21.1
41. has gray skin	7.8	28.9	54.4
42. is round (almost)	66.7	21.1	1.1
43. has seeds	42.2	36.7	7.8
44. grows in summer	37.8	51.1	11.1
45. is food	67.8	20.0	0.0
46. makes desserts	30.0	57.8	1.1
47. is expensive	0.0	54.4	32.2
48. has vitamins	41.1	40.0	5.6*
49. is soft inside	32.2	53.3	2.2
50. is various sizes	26.7	44.4	17.8

51. has rind	10.0	21.1	57.8
52. has hard skin	6.7	34.4	47.8*
53. is pinkish-red	11.1	48.9	26.7
54. is large (big)	3.2	35.6	51.1
55. grows plants			
from pit	17.8	32.2	38.9
56. is various shapes	14.4	42.2	31.1
57. is a fruit	75.6	11.1	2.2

AVOCADO (N=75)

	Essential	Non-essential	Not a property
1. has many colors	6.7	33.3	56.0
2. has skin	70.7	24.0	1.3
3. grows on trees	45.2	22.7	26.7*
4. is edible	88.0	8.0	1.3
5. has sour skin	2.7	65.3	26.7
6. makes salads	17.3	56.0	22.7
7. is nutritious			
(healthy)	53.3	41.3	1.3*
8. tastes good	14.7	47.3	5.3
9. stops thirst	5.3	38.7	49.3
10. is pear-shaped	29.3	29.3	14.7
11. is sticky	6.7	58.7	30.7
12. is a plant	76.0	18.7	2.7
13. many varieties	24.0	41.3	26.7
14. is a kind of berry	4.0	24.0	62.7
15. is green	65.3	28.0	2.7
16. can be cooked	30.7	49.3	16.0
17. used for pies	2.7	44.0	49.3
18. is mushy	22.7	58.7	13.3
19. is red inside	4.0	24.0	66.7
20. has black and white			
seeds	4.0	28.0	64.0
21. has shiny skin	40.0	42.7	13.3
22. is a vegetable	48.0	17.3	32.0
23. contains water	36.0	44.0	14.7*

24. is purple	1.3	24.0	69.3
25. has green rind	30.7	30.7	34.7
26. has a pit	72.0	18.7	6.7
27. is heavy	8.0	58.7	28.0
28. is oval	20.0	45.3	30.7
29. is yellow	2.7	30.7	61.3
30. has green skin	62.7	28.0	6.7
31. grows in vines	5.3	25.3	65.3
32. is sweet	17.3	53.3	24.0
33. makes jam	4.0	30.7	58.7
34. is juicy	17.3	48.0	26.7
35. tastes bad	1.3	62.7	32.0
36. grows on bushes	20.0	32.0	44.0
37. is sour	4.0	58.7	33.3
38. has white rind	14.7	30.7	49.3
39. is small	17.3	64.0	14.7
40. is red	2.7	22.7	70.7
41. has gray skin	1.3	25.3	68.0
42. is round (almost)	29.3	42.7	22.7
43. has seeds	36.0	24.0	37.3
44. grows in summer	26.7	57.3	10.7
45. is food	82.7	8.0	6.7
46. makes desserts	4.0	69.3	24.0
47. is expensive	8.0	65.3	22.7
48. has vitamins	64.0	30.7	2.7
49. is soft inside	46.7	46.7	2.7
50. is various sizes	22.7	49.3	22.7

51. has rind	24.0	28.0	44.0
52. has hard skin	22.7	44.0	29.3
53. is pinkish-red	0.0	28.0	65.3
54. is large (big)	5.0	50.7	41.3
55. grows plants from pit			
	70.7	18.7	6.7
56. is various shapes	20.0	48.0	26.7
57. is a fruit	48.0	14.7	30.7

CATEGORY 3

BIRD (N=167)

	Essential	Non-essential	Not a property
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1. is a house pet			
(domesticated)	15.6	78.4	5.4
2. is ugly	0.0	77.8	21.6
3. moves fast	24.0	71.9	3.6
4. can talk	4.8	76.0	18.6
5. catch fish	9.0	84.4	6.0
6. has short wings	13.8	83.8	1.2
7. eats seeds	37.1	61.1	0.6
8. is colorful	18.0	80.8	0.6
9. lives in cage	15.0	78.4	6.0
10. symbol of death	1.8	49.1	48.5
11. is black	3.6	89.8	6.0
12. found in zoo	8.4	87.4	2.4
13. lays eggs	71.3	26.9	0.6
14. is wild (untamed)	16.2	81.4	1.8
15. chirps	54.5	44.3	0.6
16. flies	71.9	27.5	0.0
17. has short legs	21.0	77.8	0.6
18. lives in cold weather			
(winter,snow)	7.2	81.4	10.8
19. perches in trees			
(branches)	34.1	64.1	0.6
20. is large (big)	3.6	89.8	6.0
21. is bad			

(evil, mean)	1.8	58.1	38.3
22. migrates (flies			
south in winter)	28.1	69.5	1.2
23. sings	31.1	65.3	3.0
24. lives in trees	39.5	59.3	0.6
25. is multicolored	14.4	82.6	1.6
26. has feathers	81.4	18.0	0.6
27. lives in desert	3.0	83.2	13.2
28. is domestic (tamed)	7.8	83.2	7.8
29. is small (little)	7.8	89.2	1.8
30. circles around			
prey (victim)	7.8	82.0	7.8
31. eats worms	32.9	63.5	1.2
32. has beak (bill)	86.2	13.2	0.0
33. lives in tropical			
areas	8.4	88.6	1.8
34. has webbed feet	18.6	71.9	9.0
35. is powerful	3.6	77.8	17.4
36. waddles			
(walks funny)	6.6	77.8	14.4
37. can be trained	21.0	72.5	4.2
38. has claws	32.9	59.9	6.0
39. found in Alaska	4.2	82.0	12.0
40. is amusing			
(entertaining)	4.6	77.2	10.2
41. many species (types)			
	64.1	32.9	1.2

42. preys on small

animals	9.0	81.4	7.8
43. has large beak	8.4	86.2	4.2
44. cannot fly	6.0	52.7	39.5*
45. has (two) wings	79.0	18.6	1.2
46. lives in nests	44.9	53.3	0.6
47. is brown	3.0	88.0	7.2
48. preys on dead (or almost dead) flesh	6.6	82.6	10.2
49. has (two) eyes	79.0	19.8	0.6
50. is black and white	4.2	87.4	7.8
51. is free	19.8	74.3	5.4
52. lives in North Pole	3.6	74.3	5.4
53. resembles tuxedo	2.4	67.1	29.3 *
54. has (two) feet	69.5	26.3	1.2
55. swims	10.2	67.7	16.2 *
56. is an animal	73.1	13.8	12.0*
57. can mimick (imitate)			

SPARROW (N=72)

Essential Non-essential Not a property

1. is a house pet			
(domesticated)	2.8	34.7	59.7*
2. is ugly	2.8	59.7	36.1
3. moves fast	41.7	54.2	1.4
4. can talk	5.6	26.4	66.7 *
5. catch fish	12.5	26.4	56.9
6. has short wings	73.6	22.2	1.4
7. eats seeds	45.6	43.1	6.9
8. is colorful	12.5	44.4	41.7
9. lives in cage	5.6	62.5	30.6
10. symbol of death	1.4	2.8	19.4
11. is black	9.7	47.2	40.3
12. found in zoo	4.2	59.7	34.7
13. lays eggs	75.0	19.4	1.4
14. is wild (untamed)	44.4	44.4	9.7
15. chirps	80.6	16.7	0.0
16. flies	94.4	4.2	0.0
17. has short legs	47.2	48.6	2.8
18. lives in cold weather			
(winter, snow)	25.0	47.2	25.0

22. migrates (flies south in winter)	45.8	37.5	13.9
23. sings	38.9	36.1	22.2
24. lives in trees	59.7	30.6	2.8
25. is multicolored	19.5	51.4	17.8*
26. has feathers	91.7	6.9	0.0
27. lives in desert	2.8	30.6	61.1
28. is domestic (tamed)	5.6	56.9	34.7
29. is small (little)	76.4	22.2	0.0
30. circles around prey (victim)	5.6	30.6	58.3*
31. eats worms	61.1	33.3	4.2
32. has beak (bill)	76.4	13.9	5.6
33. lives in tropical areas	2.8	43.1	51.4
34. has webbed feet	19.4	19.4	56.9
35. is powerful	4.2	45.8	47.2*
36. waddles (walkes funny)	4.2	36.1	58.3
37. can be trained	9.7	59.7	27.8
38. has claws	47.2	20.8	29.2
39. found in Alaska	2.8	29.2	62.5
40. is amusing (entertaining)	4.2	70.8	23.6
41. many species (types)	47.2	38.9	11.1
42. preys on small			

animals	6.7	38.9	51.4
43. has large beak	20.8	30.6	47.2
44. cannot fly	4.2	8.3	84.7
45. has (two) wings	81.9	11.1	5.6
46. lives in nests	69.4	27.8	1.4
47. is brown	41.7	41.7	13.9
48. preys on dead (or almost dead) flesh	4.2	26.4	66.7
49. has (two) eyes	86.1	8.3	1.4
50. is black and white	8.3	41.7	44.4
51. is free	36.1	48.6	11.1
52. lives in North Pole	5.6	19.4	70.8
53. resembles tuxedo	4.2	15.3	77.8
54. has (two) feet	79.2	12.5	6.9
55. swims	5.6	29.2	62.5*
56. is an animal	75.0	9.7	12.5
57. can mimick (imitate)	8.3	37.5	50.0
58. has (two) legs	76.4	22.2	69.4
59. lives in Antartica	4.2	22.2	69.4
60. is a bird	91.7	6.9	1.4

PARROT (N=83)

	Essential	Non-essential	Not a property
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1. is a house pet			
(domesticated)	41.0	57.8	1.2
2. is ugly	2.2	60.2	36.1
3. moves fast	14.5	65.1	20.5
4. can talk	59.0	39.8	1.2
5. catch fish	4.8	43.4	51.8*
6. has short wings	24.1	56.6	18.1 *
7. eats seeds	43.4	54.2	2.4
8. is colorful	55.4	43.4	1.2
9. lives in cage	26.5	72.3	1.2
10. symbol of death	3.6	16.7	79.5
11. is black	4.8	54.2	39.8
12. found in zoo	28.9	68.7	2.4*
13. lays eggs	51.8	37.3	10.8
14. is wild (untamed)	10.8	74.7	14.5
15. chirps	43.3	39.8	15.7
16. flies	76.9	18.1	6.0
17. has short legs	44.6	55.4	0.0
18. lives in cold weather			
(winter, snow)	7.2	21.7	71.1
19. perches in trees			
(branches)	36.1	60.2	3.6
20. is large (big)	9.6	56.6	33.7
21. is bad			
(evil, mean)	2.4	47.0	50.6

22. migrates (flies			
south in winter	8.4	45.8 *	45.8 *
23. sings	33.7	59.0	6.0
24. lives in trees	45.8	51.8	2.4
25. is multicolored	57.8	39.8	2.4
26. has feathers	88.0	12.0	0.0
27. lives in desert	2.4	34.9	62.7
28. is domestic	38.6	57.8	3.6
29. is small (little)	32.5	63.9	3.6
30. circles around			
prey (victim)	0.0	41.0	57.8
31. eats worms	19.3	65.1	15.7
32. has beak (bill)	96.4	2.4	0.0
33. lives in tropical			
areas	55.4	43.4	1.2
34. has webbed feet	9.6	31.3	56.6
35. is powerful	3.6	47.0	49.4
36. waddles			
(walks funny)	15.7	41.0	37.3 *
37.	51.8	44.6	3.6
38. has claws	59.0	32.5.	8.4
39. found in Alaska	1.2	22.9	74.7
40. is amusing			
(entertaining)	33.7	60.2	6.0
41. many species			
(types)	41.0	47.0	12.0
42. preys on small			

animals	12.0	47.0	41.0 *
43. has large beak	0.0	0.0	0.0
44. cannot fly	15.7	25.3	59.0
45. has (two) wings	90.4	7.2	1.2
46. lives in nests	19.3	66.3	13.3
47. is brown	4.8	60.2	34.9
48. preys on dead (or almost dead) flesh	4.8	42.2	51.8
49. has (two) eyes	81.9	14.5	2.4
50. is black and white	3.6	51.8	44.6
51. is free	21.7	62.7	13.3
52. lives in North Pole	0.0	15.7	84.3 *
53. resembles tuxedo	2.4	20.5	77.1
54. has (two) feet	83.1	13.3	2.4
55. swims	4.8	25.3	68.7
56. is an animal	78.3	6.0	15.7
57. can mimick (imitate)	65.1	33.7	1.2
58. has (two) legs	79.5	19.3	1.2
59. lives in Antartica	0.0	20.5	78.3*
60. is a bird	92.8	6.0	1.2
61. has many species	0.0	0.0	0.0
62. lives in cage	24.1	71.1	3.6

VULTURE (N=72)

	Essential	Non-essential	Not a property
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1. is a house pet			
(domesticated)	2.8	13.9	81.9
2. is ugly	30.6	56.9	12.5
3. moves fast	51.4	41.7	4.2
4. can talk	1.4	16.7	80.6
5. catch fish	12.5	38.9	45.8
6. has short wings	2.8	34.7	61.1
7. eats seeds	6.9	43.1	50.0
8. is colorful	0.0	41.7	58.3
9. lives in cage	1.4	45.8	52.8
10. symbol of death	54.2	37.5	6.9
11. is black	27.8	62.5	8.3
12. found in zoo	6.9	68.1	23.6
13. lays eggs	62.5	29.2	2.9
14. is wild (untamed)	75.0	25.0	0.0
15. chirps	2.8	33.3	61.1
16. flies	86.1	9.7	1.4
17. has short legs	20.8	52.8	26.4
(winter, snow)	4.2	37.5	55.6
19. perches in trees			
(branches)	48.6	43.1	5.6
20. is large (big)	70.8	27.8	1.4
21. is bad			
(evil, mean)	36.2	50.0	13.9
22. migrates (flies			

south in winter)	2.8	34.7	59.7
23. sings	1.4	37.5	61.1
24. lives in trees	31.9	58.3	9.7
25. is multicolored	4.2	50.0	44.4
26. has feathers	90.3	5.6	4.2
27. lives in desert	41.7	36.1	20.8
28. is domestic (tamed)			
	2.8	18.1	75.0*
29. is small (little)	1.4	40.3	56.9
30. circles around			
prey (victim)	84.7	13.9	0.0
31. eats worms	20.8	43.1	34.7
32. has beak (bill)	72.2	20.8	5.6
33. lives in tropical			
areas	9.7	47.2	38.9
34. has webbed feet	9.7	20.8	68.1
35. is powerful	80.6	18.1	1.4
36. waddles			
(walks funny)	6.9	34.7	55.6
37. can be trained	9.7	43.1	47.2
38. has claws	93.1	6.9	0.0*
39. found in Alaska	4.2	45.8	47.2
40. is amusing			
(entertaining)	1.4	30.6	66.7
41. many species			
(types)	43.1	41.7	15.3
42. preys on small			

animals	0.0	0.0	0.0
43. has large beak	63.9	30.6	4.2
44. cannot fly	1.4	9.3	90.3
45. has (two) wings	91.7	6.9	1.4
46. lives in nests	62.5	30.6	6.9
47. is brown	12.5	63.9	20.8
48. preys on dead (or almost dead) flesh	95.8	4.2	0.0
49. has (two) eyes	83.3	15.3	1.4
50. has beak (bill)	22.2	50.0	26.4
51. is free	52.8	40.3	5.6
52. lives in North Pole	0.0	25.0	70.8
53. resembles tuxedo	4.2	11.1	84.7
54. has (two) feet	84.7	12.5	1.4
55. swims	4.2	27.8	66.7
56. is an animal	62.5	19.4	18.1
57. can mimick (imitate)	0.0	19.4	80.6
58. has (two) legs	79.2	16.7	4.2
59. lives in Antartica	4.2	22.2	70.8
60. is a bird	97.2	1.4	1.4
61. has many species	36.1	50.0	12.5

PENGUIN (N=83)

	Essential	Non-essential	Not a property
1. is a house pet (domesticated)	25.7	73.5	1.2
2. is ugly	2.4	65.1	32.5*
3. moves fast	4.8	57.8	37.3
4. can talk	1.2	21.7	77.1*
5. catch fish	65.1	27.7	7.2
6. has short wings	54.2	34.9	9.6
7. eats seeds	4.8	49.4	44.6
8. is colorful	14.5	41.0	44.6
9. lives in cage	1.2	56.6	42.2
10. symbol of death	2.4	21.7	73.5
11. is black	32.5	49.4	16.9
12. found in zoo	12.0	78.3	7.2
13. lays eggs	41.0	45.8	13.3
14. is wild (untamed)	33.7	56.6	8.4
15. chirps	16.9	30.1	51.8
16. flies	9.6	15.7	74.7*
17. has short legs	74.7	25.3	0.0
18. lives in cold weather (winter, snow)	90.4	5.4	0.0
19. perches in trees (branches)	2.4	12.0	81.9
20. is large (big)	10.8	68.7	20.5
21. is bad (evil, mean)	1.2	28.9	69.9

22. migrates (flies			
south in winter)	2.4	20.5	77.1
23. sings	0.0	33.7	66.3
24. lives in trees	1.2	10.8	88.0
25. is multicolored	19.3	43.4	37.3
26. has feathers	36.1	24.1	38.6
27. lives in desert	1.2	10.8	86.7
28. is domestic (tamed)	4.8	59.0	36.1
29. is small (little)	34.9	51.8	13.3
30. circles around			
prey (victim)	3.6	45.8	49.4
31. eats worms	4.8	38.6	55.4
32. has beak (bill)	79.5	14.5	6.0
33. lives in tropical			
areas	3.4	4.8	86.7
34. has webbed feet	77.1	15.7	6.0
35. is powerful	7.2	62.7	30.1
36. waddles			
(walks funny)	77.1	19.3	2.4
37. can be trained	19.3	68.7	12.0
38. has claws	32.5	30.1	37.3
39. found in Alaska	56.6	32.5	10.8
40. is amusing			
(is entertaining)	22.9	69.6	7.2
41. many species			
(types)	27.7	47.0	25.3
42. preys on small			

animals	0.0	0.0	0.0
43. has large beak	45.8	42.2	12.0
44. cannot fly	67.5	22.9	2.6
45. has (two) wings	71.1	20.5	4.8
46. lives in nests	9.6	31.3	59.0
47. is brown	2.4	28.9	68.7
48. preys on dead (or almost dead) flesh	12.0	41.0	45.8
49. has (two) eyes	79.5	19.3	1.2*
50. is black and white	88.0	10.8	0.0
51. is free	27.7	60.2	12.0
52. lives in North Pole	56.6	36.1	7.2
53. resembles tuxedo	54.2	44.6	1.2
54. has (two) feet	88.0	9.6	2.4
55. swims	78.3	18.1	3.6
56. is an animal	86.7	4.8	8.4
57. can mimick (imitate)	3.6	21.7	73.5
58. has (two) legs	83.1	13.3	2.4
59. lives in Antartica	60.2	33.7	6.0*
60. is a bird	85.5	8.4	6.0
61. has many species	24.1	47.0	27.7

CATEGORY 4

FURNITURE (N=167)

	Essential	Non-essential	Not a property
1. made of plastic	7.8	86.8	4.8
2. found in kitchen	28.1	69.5	1.8
3. used for sitting on			
(or at)	50.3	47.9	0.6 *
4. is comfortable	21.6	76.6	1.2
5. has flat surface	18.6	77.8	2.4
6. is a container	4.8	76.6	34.1
7. holds objects	20.4	70.1	9.0
8. has tall legs	3.6	90.4	5.4
9. is short (low)	5.4	90.4	3.6
10. a variety of sizes	58.1	40.1	1.2
11. is expensive	10.2	82.6	6.0
12. is a type of seat			
(small chair)	19.2	76.0	3.6
13. is gray	0.6	85.6	12.0
14. many types	66.5	31.7	1.2
15. is hard	11.4	83.2	3.0
16. has no back	4.8	83.8	10.8*
17. holds (old) papers	4.8	71.9	22.2
18. used for writing	9.6	70.1	18.6
19. found in bars	18.0	78.4	3.0
20. made of glass	10.2	83.2	5.4
21. can be decorated	17.4	79.0	3.0
22. is cylindrical	7.2	77.2	14.4

23. holds objects	18.6	73.1	6.0
24. can be uncomfortable			
	16.2	81.4	1.2
25. surrounded by chairs			
	7.8	85.0	6.6
26. is round	9.6	85.6	3.6
27. found in most buildings			
	56.3	38.3	2.4
28. holds waste			
(garbage)	7.2	45.5	45.5*
29. is various colors	42.5	55.7	0.6
30. used for decoration			
	30.5	67.1	1.2
31. found near (under)			
desks	9.0	79.0	11.4
32. made of wood	24.6	73.1	0.6
33. has smooth			
(finish) top	15.0	79.6	4.2
34. put things in	9.0	74.9	15.6
35. emptied when full	1.8	44.3	52.1
36. made of cushions	14.4	78.4	6.0
37. is smelly (dirty)	1.2	45.5	57.5
38. found against			
(close to) a wall	4.2	88.0	7.2
39. is square	10.2	83.8	5.4
40. is supportive			
(put things on)	32.9	62.9	3.6

41. used as a step			
(stand on)	7.8	76.0	15.0
42. found in libraries			
	26.9	69.5	1.8
43. is dark colored	5.4	89.8	4.2
44. is tall (high)	6.0	87.4	4.8
45. a variety of styles			
	58.1	40.1	0.6
46. made of metal	7.8	87.4	4.2
47. is oval	7.2	85.6	6.0
48. has shelves	9.0	85.6	4.8
49. used for studying	11.4	82.6	5.4
50. found in study room			
	23.4	72.5	1.8
51. has a round top	11.4	83.5	3.0
52. is functional			
(useful)	67.7	29.9	3.0
53. made of (covered			
with) cloth	10.2	82.6	4.8
54. used in homes	55.1	40.7	1.2
55. has (1-4) legs	60.5	37.1	1.8
56. found in rooms	60.5	37.1	1.8
57. is small (narrow)	3.0	91.0	5.4
58. used as a footrest	9.0	86.8	5.4
59. is rectangular	6.0	89.2	4.2
60. holds trinkets (ornaments,			
candles)	7.2	81.4	10.8

61. is a variety of shapes

58.7

40.7

0.6

62. used for working

15.6

73.1

9.6

TABLE (N=91)

	Essential	Non-essential	Not a property
1. made of plastic	8.8	86.8	4.4
2. found in kitchen	36.3	62.6	1.1
3. used for sitting			
on (or at)	47.3	40.3	8.8
4. is comfortable	5.5	58.2	36.3
5. has flat surface	72.5	26.4	1.1
6. is a container	5.5	30.8	62.6
7. holds objects	26.4	60.4	12.1
8. has tall legs	8.8	85.7	4.4
9. is short	9.9	81.3	7.7
10. a variety of sizes			
	53.8	45.1	1.1
11. is expensive	4.4	86.8	8.8
12. is a type of seat			
(small chair)	2.2	27.5	69.2
13. is gray	1.1	87.9	11.0
14. many types	54.9	44.1	1.1*
15. is hard	62.6	36.3	1.1
16. has no back	39.6	39.6	19.8
17. holds (old) papers	3.3	65.9	30.8
18. used for writing	24.3	67.0	7.7
19. found in bars	24.2	71.4	3.3
20. made of glass	13.2	86.8	0.0
21. can be decorated	19.8	74.7	5.5
22. is cylindrical	11.0	69.2	18.7

23. holds objects	38.5	47.3	12.1
24. can be uncomfortable			
	8.8	70.3	19.8
25. surrounded by chairs			
	29.7	68.1	2.2
26. is round	15.4	82.4	2.2
27. found in most buildings			
	47.3	50.5	2.2
28. holds waste			
(garbage)	3.3	18.7	78.3
29. is various colors	35.2	63.7	1.1*
30. used for decoration			
	14.3	78.0	6.6
31. found near			
(under) desk	2.2	42.9	54.9
32. made of wood	30.8	68.1	0.0
33. has smooth			
(finish) top	48.4	49.5	2.2
34. put things in	9.9	45.1	45.1
35. emptied when full	6.6	25.3	68.1
36. made of cushions	0.0	36.3	63.7*
37. is smelly (dirty)	4.4	52.7	41.8
38. found against			
(close to) a wall	4.4	85.7	9.9
39. is square	15.4	83.5	1.1
40. is supportive			
(put things on)	62.6	35.2	1.1

41. used as a step			
(stand on)	3.3	40.3	54.9
42. found in libraries			
	27.5	71.4	1.1
43. is dark-colored	4.4	92.3	3.3
44. is tall (high)	3.3	84.6	7.7
45. a variety of styles			
	54.9	44.0	1.1
46. made of metal	7.7	87.9	3.3
47. is oval	11.0	87.9	1.1
48. has shelves	2.2	45.1	52.7
49. used for studying	23.1	73.6	3.3
50. found in study room			
	20.9	76.9	2.2
51. has a round top	13.2	83.5	3.3
52. is functional	67.0	33.0	0.0
53. made of (covered			
with) cloth	8.8	75.8	15.4
54. used in homes	42.9	56.0	1.1
55. has (1-4) legs	71.4	27.5	1.1
56. found in rooms	40.7	59.3	0.0
57. is small (narrow)	6.6	89.0	4.4
58. used as a footrest	2.2	56.0	41.8
59. is rectangular	11.0	85.7	3.3
60. holds trinkets			
(ornaments, candles)			
	11.0	75.8	13.2

61. is a variety of shapes

48.4

49.5

2.2

62. used for working 26.4

71.4

2.2

63. is a furniture 89.0

9.9

1.1

BOOKCASE (N=76)

	Essential	Non-essential	Not a property
1. made of plastic	3.9	82.9	13.2
2. found in kitchen	1.3	2.6	50.0
3. used for sitting			
on (or at)	1.3	31.6	65.8
4. is comfortable	0.0	34.2	65.8
5. has flat surface	55.2	42.1	2.6
6. is a container	50.0	25.0	23.7
7. holds objects	72.4	27.6	0.0
8. has tall legs	3.8	67.1	28.9*
9. is short	0.0	85.5	14.5
10. a variety of sizes			
	50.0	48.7	1.3
11. is expensive	3.9	85.5	10.5
12. is a type of seat			
(small chair)	0.0	26.3	73.7
13. is gray	2.6	78.9	17.1
14. many types	50.0	47.4	2.6
15. is hard	43.4	48.7	6.6
16. has no back	3.9	76.3	19.7
17. holds (old) papers			
	15.8	68.4	14.5
18. used for writing	3.9	25.0	71.1
19. found in bars	1.3	40.8	57.9
20. made of glass	2.3	77.6	17.1
21. can be decorated	7.9	80.3	11.8

22. is cylindrical	5.3	47.4	47.4
23. holds objects	71.1	27.6	0.0
24. can be uncomfortable			
	3.9	31.6	63.2
25. surrounded by chairs			
	3.9	55.3	40.8
26. is round	0.0	59.2	40.8
27. found in most buildings			
	19.7	69.7	10.5
28. holds waste			
(garbage)	1.3	26.3	71.1
29. is various colors	28.9	68.4	2.6
30. used for decoration			
	15.8	78.9	5.3
31. found near			
(under) desk	7.9	55.3	36.8
32. made of wood	14.5	80.3	5.3
33. has smooth			
(finish) top	25.0	73.7	1.3
34. put things in	63.2	27.6	6.6
35. emptied when full	3.9	22.4	73.7 *
36. made of cushions	1.3	18.4	80.3
37. is smelly (dirty)	2.6	40.8	55.3
38. found against			
(close to) a wall	26.3	65.8	7.9 *
39. is square	10.5	81.6	7.9
40. is supportive			

(put things on)	86.8	13.2	0.0
41. used as a step			
(stand on)	1.3	44.7	52.6
42. found in libraries			
	68.4	30.3	1.3
43. is dark-colored	1.3	89.5	7.9
44. is tall (high)	5.3	89.5	5.3
45. a variety of styles			
	50.0	46.1	3.9
46. made of metal	7.9	88.2	3.9
47. is oval	0.0	52.6	43.4
48. has shelves	39.5	9.2	1.3
49. used for studying	15.8	52.6	41.6
50. found in study room			
	34.2	61.8	3.9
51. has a round top	0.0	60.5	38.2
52. is functional			
(useful)	68.4	27.2	3.9
53. made of			
(covered with) cloth			
	2.6	59.2	38.2
54. used in homes	27.6	68.4	3.9
55. has (1-4) legs	23.7	57.9	18.4
56. found in rooms	39.5	53.9	5.3
57. is small (narrow)	5.3	80.3	14.5
58. used as a footrest	1.3	36.8	61.8
59. is rectangular	14.5	81.6	3.9

60. holds trinkets

(ornaments, candles)

10.5

69.7

19.7

61. is a variety of shapes

42.1

56.6

1.3

62. used for working 14.5

53.9

30.3

63. is a furniture 84.2

15.8

30.3

STOOL (N=91)

	Essential	Non-essential	Not a property
1. made of plastic	6.6	80.2	12.1
2. found in kitchen	6.6	87.9	5.5
3. used for sitting			
on (or at)	65.9	28.6	5.5
4. is comfortable	9.9	81.3	8.8
5. has flat surface	64.0	33.0	1.1
6. is a container	1.1	17.6	80.2
7. holds objects	5.5	54.9	38.5
8. has tall legs	7.7	82.4	9.9
9. is short	16.5	82.4	1.1
10. a variety of sizes			
	37.4	59.3	1.1
11. is expensive	1.1	78.0	20.9
12. is a type of seat			
(small chair)	67.0	25.3	6.6*
13. is gray	2.2	80.2	16.5
14. many types	46.2	51.6	2.2
15. is hard	44.0	54.9	1.1
16. has no back	74.7	20.9	3.3
17. holds (old) papers	1.1	42.9	51.6
18. used for writing	0.0	39.6	60.4
19. found in bars	26.4	69.2	4.4
20. made of glass	2.2	64.8	30.8
21. can be decorated	12.1	80.2	7.7
22. is cylindrical	4.4	71.4	24.2

23. holds objects	12.1	45.1	41.8
24. can be uncomfortable			
	8.8	79.1	11.0
25. surrounded by chairs			
	6.6	59.3	33.0
26. is round	11.0	84.6	4.4
27. found in most buildings			
	15.4	79.1	5.5
28. holds waste			
(garbage)	0.0	19.8	80.2
29. is various colors	0.0	75.8	3.3*
30. used for decoration			
	6.6	78.0	15.4*
31. found near			
(under) desk	15.4	73.6	9.9
32. made of wood	30.8	67.0	2.2
33. has smooth			
(finish) top	26.4	72.5	1.1
34. put things in	2.2	26.4	71.4
35. emptied when full	2.2	13.2	84.6
36. made of cushions	6.6	74.7	18.7
37. is smelly (dirty)	0.0	34.1	65.9
38. found against			
(close to) a wall	2.2	86.8	11.0
39. is square	1.1	90.1	7.7
40. is supportive			
(put things on)	44.0	50.5	5.5

41. used as a step			
(stand on)	41.8	56.0	2.2
42. found in libraries			
	16.5	76.9	6.6
43. is dark-colored	0.0	96.7	3.3
44. is tall (high)	4.4	84.6	11.0
45. a variety of styles			
	37.4	60.4	2.2
46. made of metal	6.6	84.6	8.8
47. is oval	5.5	90.1	4.4
48. has shelves	1.1	16.5	82.4
49. used for studying	3.3	75.8	20.9
50. found in study room			
	6.6	89.0	4.4
51. has a round top	9.9	85.7	4.4
52. is functional			
(useful)	65.9	34.1	0.0
53. made of (covered			
with) cloth	4.4	87.9	7.7
54. used in homes	26.4	72.5	1.1
55. has (1-4) legs	70.3	26.4	2.2
56. found in rooms	30.8	69.2	0.0
57. is small (narrow)	7.7	80.2	11.0
58. used as a footrest			
	44.0	54.9	1.1
59. is rectangular	3.3	85.7	11.0
60. holds trinkets			

(ornaments, candles)

	1.1	24.2	74.7
61. is a variety of shapes			
	35.2	59.3	4.4
62. used for working	16.5	74.7	8.8
63. is a furniture	85.7	13.2	1.1

WASTEBASKET (N=76)

	Essential	Non-essential	Not a property
1. made of plastic	10.5	89.5	0.0
2. found in kitchen	21.1	43.3	55.3
3. used for sitting			
on (or at)	1.3	43.3	55.3
4. is comfortable	0.0	26.3	73.7
5. has flat surface	28.9	44.7	25.0
6. is a container	76.3	21.1	1.3
7. holds objects	60.5	30.3	9.2
8. has tall legs	0.0	28.9	71.1
9. is short	17.1	77.6	5.3
10. a variety of sizes	1.3	55.3	42.1
11. is expensive	2.6	61.8	35.5
12. is a type of seat			
(small chair)	19.7	77.6	2.6
13. is gray	0.0	86.8	13.2
14. many types	53.9	44.7	1.3
15. is hard	22.4	68.4	9.2
16. has no back	7.9	23.7	68.4
17. holds (old) papers			
	39.5	56.6	2.6
18. used for writing	1.3	17.1	80.3
19. found in bars	14.5	75.0	9.2
20. made of glass	3.9	40.8	53.9
21. can be decorated	5.3	89.5	5.3
22. is cylindrical	14.5	77.6	7.9

23. holds objects	57.9	36.8	5.3
24. can be uncomfortable			
	0.0	35.5	63.2
25. surrounded by chairs			
	1.3	46.1	52.6
26. is round	6.6	80.3	13.2
27. found in most buildings			
	57.9	40.8	1.3
28. holds waste			
(garbage)	94.7	5.3	0.0
29. is various colors	39.5	57.9	2.6
30. used for decoration			
	1.3	64.5	34.2
31. found near			
(under) desk	34.2	61.8	2.6
32. made of wood	5.3	77.6	17.1
33. has smooth			
(finish) top	0.0	53.9	46.1
34. put things in	77.6	19.7	2.6
35. emptied when full	80.3	18.4	1.3
36. made of cushions	0.0	18.4	78.9
37. is smelly (dirty)	14.5	81.6	3.9
38. found against			
(close to) a wall	13.2	81.6	5.3
39. is square	1.3	82.9	13.2
40. is supportive			
(put things on)	5.3	40.8	53.9

41. used as a step			
(stand on)	2.6	60.5	36.8
42. found in libraries			
	19.7	77.6	2.6
43. is dark-colored	1.3	80.3	17.1
44. is tall (high)	1.3	65.8	32.9
45. a variety of styles			
	50.0	47.4	2.6
46. made of metal	10.5	82.9	6.6
47. is oval	7.9	86.8	5.3
48. has shelves	0.0	13.2	86.8
49. used for studying	0.0	22.4	77.6
50. found in study room			
	32.9	64.5	2.6
51. has a round top	2.6	65.8	31.6
52. is functional			
(useful)	80.3	19.7	0.0 *
53. made of (covered			
with) cloth	1.3	56.6	42.1 *
54. used in homes	42.1	52.6	2.6
55. has (1-4) legs	1.3	26.3	72.4
56. found in rooms	38.2	56.6	0.6
57. is small (narrow)	0.0	78.9	18.4
58. used as a footrest	1.3	73.7	22.4
59. is rectangular	3.9	85.5	10.5
60. holds trinkets (ornaments,			
candles)	2.6	42.1	55.3

61. is a variety of shapes

57.9

39.5

2.6

62. used for working 11.8

55.3

32.9

63. is a furniture 30.3

42.1

26.3

CATEGORY 5

VEHICLE (N=168)

	Essential	Non-essential	Not a property
1. made of metals	48.2	50.0	0.6
2. has wheels	73.2	25.0	0.6
3. means of transportation	91.1	8.3	0.6
4. is a machine	70.2	28.0	0.6
5. is noisy	6.0	91.7	1.8
6. is various colors	35.1	61.9	2.4
7. is driven	72.6	25.6	1.2
8. has radio	8.9	86.3	4.2
9. is expensive	12.5	82.7	3.6
10. has steering wheel	57.7	37.5	1.8
11. found in Europe	11.9	79.2	8.3*
12. is various sizes	47.6	50.0	1.8
13. needs a conductor	36.9	50.6	11.3
14. is not-common	3.6	37.5	85.3
15. takes gas	37.5	58.3	1.8
16. needs a fare	5.4	82.1	11.9
17. is fun	13.1	72.6	13.1
18. has seats	58.9	39.3	0.6
19. is crowded	2.4	83.9	13.1
20. is various shapes	48.8	48.2	1.8
21. has trunk	20.8	73.8	4.8
22. has sharp blades	4.2	48.2	47.0
23. has engine (motor)	53.6	41.7	4.2

24. is pushed with			
one foot	7.1	61.9	30.4
25. has a bell	3.0	69.6	26.8
26. is dangerous			
(accidents)	14.3	76.8	8.3 *
27. children's toy	1.2	57.1	41.1
28. is black	0.6	38.7	10.1
29. has laces	0.6	26.8	71.4
30. has brakes	62.5	32.7	2.6
31. is a pair	0.0	30.4	69.0
32. is open	0.6	75.6	22.0
33. is old-fashioned	0.6	79.8	17.9*
34. has lights	44.6	51.8	3.0
35. has steering			
handle	57.7	36.9	4.8
36. found in cities	20.2	75.6	3.6
37. is fast	13.7	82.1	2.4
38. has metalic frame	41.7	54.8	2.4
39. is a necessity	22.6	59.5	16.7
40. used for sport	8.9	84.5	5.4
41. has rubber tires	46.4	51.2	1.8
42. used on ice	1.8	67.9	29.8
43. is various makes	41.7	56.5	1.2
44. needs repairs	36.9	57.1	5.4
45. is shoe like	4.6	31.5	62.5
46. carries people			
(passengers)	57.7	41.1	0.6

47. has horn	29.8	67.3	2.4
48. can glide	7.1	71.4	20.2
49. has (2 to 4) doors	35.1	61.3	2.4
50. is a symbol of prestige (status)	12.5	73.8	13.1
51. is white	1.2	89.3	8.9
52. has hubcaps	19.0	76.2	3.6
53. is popular in winter	4.8	75.6	19.6
54. is luxurious	4.5	85.7	8.3
55. used for hockey	0.0	36.9	61.9*
56. is various styles	45.2	50.6	3.6
57. made of leather	1.2	52.4	45.8
58. has glass windows	33.3	62.5	3.0
59. is fun for cruising	13.1	79.2	7.1
60. goes on tracks	6.0	76.8	16.7
61. found in San Francisco	7.1	83.3	8.9
62. covers distance	64.9	31.5	1.8
63. goes on roads (highways, driveways)	53.6	42.9	1.8

CAR (N=79)

	Essential	Non-essential	Not a property
1. made of metals	60.8	36.7	1.3
2. has wheels	86.1	13.9	0.0
3. means of			
transportation	92.4	6.3	1.3
4. is a machine	87.3	11.4	1.3
5. is noisy	11.4	79.7	7.6
6. is various colors	45.6	50.6	1.3
7. is driven	86.1	13.9	0.0
8. has radio	19.0	79.7	1.3
9. is expensive	40.5	55.7	3.8 *
10. has steering wheel	0.0	0.0	0.0
11. found in Europe	19.0	73.4	7.6
12. is various sizes	55.7	38.0	1.3
13. needs a conductor	45.6	21.5	32.9
14. is not-common	3.8	34.2	62.0*
15. takes gas	67.1	27.8	1.3
16. needs a fare	2.5	60.8	35.4
17. is fun	13.9	78.5	7.6
18. has seats	74.7	22.8	0.0
19. is crowded	2.5	62.0	35.4
20. is various shapes	50.6	46.8	2.5
21. has trunk	44.3	53.2	1.3
22. has sharp blades	3.8	30.4	63.3
23. has engine (motor)	91.1	8.9	0.0
24. is pushed with			

1. made of metals	60.8	36.7	1.3
2. has wheels	86.1	13.9	0.0
3. means of			
transportation	92.4	6.3	1.3
4. is a machine	87.3	11.4	1.3
5. is noisy	11.4	79.7	7.6
6. is various colors	45.6	50.6	1.3
7. is driven	86.1	13.9	0.0
8. has radio	19.0	79.7	1.3
9. is expensive	40.5	55.7	3.8 *
10. has steering wheel	0.0	0.0	0.0
11. found in Europe	19.0	73.4	7.6
12. is various sizes	55.7	38.0	1.3
13. needs a conductor	45.6	21.5	32.9
14. is not-common	3.8	34.2	62.0*
15. takes gas	67.1	27.8	1.3
16. needs a fare	2.5	60.8	35.4
17. is fun	13.9	78.5	7.6
18. has seats	74.7	22.8	0.0
19. is crowded	2.5	62.0	35.4
20. is various shapes	50.6	46.8	2.5
21. has trunk	44.3	53.2	1.3
22. has sharp blades	3.8	30.4	63.3
23. has engine (motor)	91.1	8.9	0.0
24. is pushed with			

one foot	3.8	16.5	79.7
25. has a bell	5.1	41.8	51.9
26. is dangerous			
(accidents)	24.1	67.1	7.6
27. children's toy	1.3	40.5	58.2
28. is black	2.5	84.8	11.4
29. has laces	0.0	11.4	88.6
30. has brakes	79.7	17.7	2.5
31. is a pair	0.0	8.9	91.1 *
32. is open	3.8	74.7	21.5
33. is old-fashioned	3.8	68.4	26.6 *
34. has lights	62.0	35.4	2.5
35. has steering			
handle	77.2	13.9	7.6
36. found in cities	26.6	68.4	3.8
37. is fast	13.9	78.5	7.6*
38. has metalic frame	58.2	38.0	3.8
39. is a necessity	29.1	55.7	15.2
40. used for sport	10.1	77.2	11.4
41. has rubber tires	75.9	24.1	0.0
42. used on ice	1.3	30.4	68.4 *
43. is various makes	51.9	46.8	1.3
44. needs repairs	41.8	54.4	2.5
45. is shoe like	3.8	12.7	83.5
46. carries people			
(passengers)	89.9	8.9	1.3
47. has horn	49.4	49.4	1.3

48. can glide	3.8	50.6	45.6
49. has (2 to 4) doors			
	67.1	31.6	1.3
50. is a symbol of prestige			
(status)	12.7	74.7	12.7
51. is white	0.0	86.1	13.9
52. has hubcaps	30.4	68.4	1.3
53. is popular in winter			
	17.7	63.3	29.0
54. is luxurious	8.9	83.5	7.6
55. used for hockey	0.0	15.2	83.5
56. is various styles	54.4	44.3	1.3
57. made of leather	0.0	55.7	43.0
58. has glass windows	50.6	49.4	0.0
59. is fun for cruising			
	2.5	39.2	58.2
60. goes on tracks	7.6	81.0	11.4
61. found in San			
Francisco	72.2	25.3	2.5
62. covers distance	82.3	16.5	1.3
63. goes on roads (highways,			
driveways)	87.3	10.1	1.3
64. is a vehicle	70.9	21.5	7.6
65. has steering			
handle	70.9	21.5	7.6

TROLLEY (N=75)

	Essential	Non-essential	Not a property
1. made of metals	60.0	40.0	0.0
2. has wheels	85.3	8.0	5.3
3. means of transportation	89.3	9.3	1.3
4. is a machine	65.3	29.3	5.3
5. is noisy	36.0	64.0	0.0
6. is various colors	34.7	64.0	1.3
7. is driven	72.0	18.7	9.3
8. has radio	5.3	58.7	36.0
9. is expensive	20.0	68.0	12.0
10. has steering wheel	62.7	16.0	20.0
11. found in Europe	13.3	74.4	9.3
12. is various sizes	32.0	61.3	6.7
13. needs a conductor	80.0	20.0	0.0
14. is not-common	25.3	60.0	14.7
15. takes gas	32.0	24.0	42.7
16. needs a fare	57.3	41.3	1.3*
17. is fun	9.3	77.3	13.3
18. has seats	68.0	32.0	0.0
19. is crowded	25.3	70.7	4.0
20. is various shapes	30.7	48.0	20.0
21. has trunk	5.3	37.3	57.3 *
22. has sharp blades	4.0	26.7	68.0
23. has engine (motor)			
	72.0	14.7	13.3

24. is pushed with			
one foot	2.7	17.3	80.0*
25. has a bell	58.7	41.3	0.0
26. is dangerous			
(accidents)	8.0	68.0	24.0 *
27. children's toy	1.3	28.0	70.7
28. is black	1.3	82.7	16.0
29. has laces	1.3	14.7	84.0
30. has brakes	90.7	8.0	0.0
31. is a pair	1.3	17.3	80.0
32. is open	21.3	62.7	16.0
33. is old-fashioned	37.3	56.0	6.7
34. has lights	53.3	44.0	1.3
35. has steering			
handle	76.0	14.7	8.0
36. found in cities	52.0	45.3	2.7
37. is fast	20.0	68.0	12.0
38. has metalic frame	58.7	37.3	4.0
39. is a necessity	13.3	61.3	25.3
40. used for sport	0.0	30.7	69.3
41. has rubber tires	8.0	25.3	65.3
42. used on ice	0.0	14.7	85.3
43. is various makes	34.7	62.7	2.7
44. needs repairs	38.7	52.0	9.3 *
45. is shoe like	4.0	8.0	86.7
46. carries people			
(passengers)	82.7	16.0	0.0

47. has horn	30.7	48.0	21.3
48. can glide	16.0	45.3	38.7
49. has (2 to 4) doors	20.0	49.3	30.7
50. is a symbol of prestige (status)	0.0	18.7	81.3
51. is white	1.3	86.7	12.0
52. has hubcaps	2.7	42.7	54.7
53. is popular in winter	4.0	48.0	48.0*
54. is luxurious	0.0	58.7	41.3
55. used for hockey	0.0	13.3	84.0
56. is various styles	34.7	60.0	5.3
57. made of leather	2.7	26.7	70.7 *
58. has glass windows	26.7	61.3	12.0
59. is fun for cruising	13.3	60.0	26.7
60. goes on tracks	86.7	12.0	0.0
61. found in San Francisco	42.7	54.7	2.7
62. covers distance	69.3	28.0	2.7
63. goes on roads (highways, driveways)	13.3	29.3	56.0
64. is a vehicle	93.3	5.3	1.3

SCOOTER (N=91)

	Essential	Non-essential	Not a property
1. made of metals	47.3	45.1	5.5
2. has wheels	93.4	4.4	1.1
3. means of transportation	74.7	18.7	3.3
4. is a machine	51.6	27.5	20.9
5. is noisy	6.6	66.1	23.1
6. is various colors	35.2	62.6	2.2
7. is driven	75.8.	15.4	8.8
8. has radio	2.2	27.5	70.4
9. is expensive	0.0	65.9	34.1
10. has steering wheel	1.1	39.6	20.9
11. found in Europe	7.7	82.4	8.8
12. is various sizes	47.3	49.5	2.2
13. needs a conductor	33.0	26.4	38.5
14. is not-common	2.2	73.6	24.2
15. takes gas	14.3	24.2	61.5
16. needs a fare	0.0	16.5	81.3
17. is fun	30.8	65.9	3.3
18. has seats	17.6	37.4	45.1
19. is crowded	0.0	31.9	65.9
20. is various shapes	38.5	44.0	17.6
21. has trunk	0.0	15.4	84.6
22. has sharp blades	0.0	25.3	73.6
23. has engine (motor)	14.3	33.0	52.7
24. is pushed with			

one foot	69.2	23.1	6.6
25. has a bell	3.3	70.3	24.2
26. is dangerous			
(accidents)	14.3	69.2	13.2
27. children's toy	44.0	48.4	7.7
28. is black	0.0	82.4	17.6
29. has laces	0.0	17.6	81.3*
30. has brakes	37.4	25.3	36.3
31. is a pair	0.0	12.1	87.9
32. is open	71.4	22.0	5.5
33. is old-fashioned	13.2	75.8	11.0
34. has lights	13.2	48.4	37.4
35. has steering			
handle	84.6	7.7	7.7
36. found in cities	5.5	79.1	13.2
37. is fast	13.2	72.5	12.1
38. has metalic frame	40.7	51.6	7.7
39. is a necessity	0.0	54.9	41.8
40. used for sport	18.7	62.6	18.7
41. has rubber tires	46.2	45.1	7.7
42. used on ice	26.4	71.4	1.1
43. is various makes	34.1	54.9	9.9
44. needs repairs	26.4	67.0	5.5
45. is shoe like	5.5	25.3	69.2
46. carries people			
(passengers)	50.5	37.4	12.1*
47. has horn	9.9	67.0	23.1

48. can glide	63.7	24.2	12.1
49. has (2 to 4) doors	0.0	16.5	83.5
50. is a symbol of prestige (status)	4.4	51.6	42.9
51. is white	0.0	79.1	19.8
52. has hubcaps	4.4	47.3	48.4
53. is popular in winter	0.0	31.9	67.0
54. is luxurious	1.1	48.4	49.5
55. used for hockey	0.0	15.4	84.6
56. is various styles	28.6	60.4	7.7
57. made of leather	1.1	23.1	75.8 *
58. has glass windows	1.1	17.6	18.3
59. is fun for cruising	39.6	52.7	7.7
60. goes on tracks	1.1	20.9	76.9
61. found in San Francisco	4.4	78.0	15.4
62. covers distance	65.9	30.8	1.1
63. goes on roads (highways, driveways)	47.3	45.1	6.6
64. is a vehicle	73.6	20.9	4.4

SKATES (N=76)

	Essential	Non-essential	Not a property
1. made of metals	17.1	59.2	22.4
2. has wheels	23.7	26.3	48.7
3. means of transportation	42.1	42.1	14.5
4. is a machine	1.3	7.9	89.5
5. is noisy	2.6	30.3	67.1
6. is various colors	21.1	76.3	2.6
7. is driven	5.3	11.8	80.3
8. has radio	0.0	2.6	97.4
9. is expensive	1.3	76.3	21.1
10. has steering wheel	1.3	1.3	97.4
11. found in Europe	7.9	82.9	7.9
12. is various sizes	59.2	36.8	2.6
13. needs a conductor	3.9	10.5	80.3
14. is not-common	1.3	50.0	47.4*
15. takes gas	1.3	0.0	98.7
16. needs a fare	1.3	5.3	93.4
17. is fun	30.3	65.8	3.9*
18. has seats	0.0	1.3	97.4
19. is crowded	2.6	1.3	96.1
20. is various shapes	26.3	48.7	25.0
21. has trunk	1.3	0.0	98.7
22. has sharp blades	64.5	34.2	1.3
23. has engine (motor)	0.0	2.6	97.4
24. is pushed with			

one foot	6.6	43.4	50.0
25. has a bell	1.3	28.9	68.4
26. is dangerous			
(accidents)	9.2	75.0	15.8
27. children's toy	11.8	71.1	14.5
28. is black	3.9	89.5	6.6
29. has laces	69.7	30.3	0.0
30. has brakes	1.3	10.5	88.2*
31. is a pair	84.2	14.5	0.0
32. is open	1.3	27.6	69.7
33. is old-fashioned	3.9	50.0	44.7
34. has lights	0.0	2.6	97.4
35. has steering			
handle	1.3	1.3	97.4
36. found in cities	2.6	80.3	17.1
37. is fast	42.1	56.6	1.3
38. has metalic frame	21.1	46.1	32.9
39. is a necessity	1.3	34.2	64.5
40. used for sport	81.1	28.9	0.0
41. has rubber tires	1.3	17.1	81.6
42. used on ice	64.5	35.5	0.0
43. is various makes	47.4	50.0	2.6
44. needs repairs	26.3	56.6	15.8
45. is shoe like	78.9	21.1	0.0
46. carries people			

48. can glide	56.6	36.8	5.3
49. has (2 to 4) doors	0.0	0.0	98.7
50. is a symbol of prestige (status)	3.9	26.3	69.7
51. is white	5.3	86.8	7.9
52. has hubcaps	0.0	2.6	97.4
53. is popular in winter			
	56.6	43.4	0.0
54. is luxurious	2.6	46.1	51.3
55. used for hockey	73.7	25.0	1.3
56. is various styles	42.1	50.0	5.3*
57. made of leather	31.6	61.8	6.6
58. has glass windows	0.0	3.9	96.1
59. is fun for cruising			
	21.1	52.6	26.3
60. goes on tracks	1.3	14.5	84.2
61. found in San Francisco	3.9	76.3	19.7
62. covers distance	63.2	34.2	2.6
63. goes on roads (highways, driveways)	10.5	47.4	42.1
64. is a vehicle	21.1	9.2	68.4

TABLE 15

Newman-Keuls Test for Instances at F_1C_1

		I_3	C_n	I_1	I_2	I_4	r	S_r at FC .99($r, 94$)
		2.63	2.65	2.84	3.81	4.21		
I_3	2.63	--	.02	.21	1.18*	2.58*	5	0.98
C_n	2.65		--	.19	1.16*	1.56*	4	0.93
I_1	2.84			--	.97	1.37*	3	0.87
I_2	3.81				--	.40	2	0.77
I_4	4.21					--		

*indicates significant mean pairs

TABLE 16

Newman-Keuls Test for Instances at F_1C_2

	I_3	C_n	I_4	I_1	I_2	r	S_r at FC .99(r,94)
	1.47	2.67	2.69	3.45	4.75		
I_3	1.47	--	1.20*	1.22*	1.98*	5	.98
C_n	2.67	--	.02	.78	2.08*	4	.93
I_4	2.69		--	.76	2.06*	3	.87
I_1	3.45			--	1.30*	2	.77
I_2	4.75				--		

*indicates significant mean pairs

TABLE 17

Newman-Keuls Test for Instances at F_1C_4

		C_n	I_4	I_2	I_3	I_1		
		1.54	2.09	2.14	2.42	2.82	r	S_r at FC .99(r,94)
C_n	1.54	--	.55	.60	.88	1.28*	5	.98
I_4	2.09		--	.05	.33	.73	4	.93
I_2	2.14			--	.28	.68	3	.87
I_3	2.42				--	.40	2	.77
I_1	2.82					--		

*indicates significant mean pairs

TABLE 18

Newman-Keuls Test for Instances at F_1C_5

	C_n	I_3	I_2	I_4	I_1		
	2.62	2.86	3.19	3.27	5.18	r	S_r at FC .99($r, 94$)
C_n	2.62	--	.24	.57	.65	2.56*	5 .98
I_3	2.86		--	.33	.41	2.32*	4 .93
I_2	3.19			--	.8	1.99*	3 .87
I_4	3.27				--	1.91*	2 .77
I_1	5.18					--	

*indicates significant mean pairs

TABLE 19

Defining, Characteristic and Other Features Given as
First Response for Categories and Instances

	Defining	Characteristic	Others
Observed	1503.00	665.00	207.00
Expected	791.66	791.66	791.66

$$\chi^2=1,091.21$$

$$df=2$$

$$p<.001$$

TABLE 20

Comparison of Defining, Characteristic and Other
Features Given as the First Feature for
Average of Instances and Category Names

	Defining	Characteristic	Others
Instances	320.75	130.25	24.00
Categories	220.00	144.00	111.00

$$\chi^2=115.64$$

$$df=2$$

$$p<.001$$

TABLE 21

Comparison of Defining, Characteristic and Other
Features Given as First Response for Levels of
Relatedness and Categories

	Defining	Characteristic	Others	
<u>Level 1</u>				
Instance 1	359	100	16	$\chi^2=182.57$
Category	220	144	111	$p<.001$
<u>Level 2</u>				
Instance 2	306	159	10	$\chi^2=127.08$
Category	220	144	111	$p<.001$
<u>Level 3</u>				
Instance 3	312	120	43	$\chi^2=84.13$
Category	220	144	111	$p<.001$
<u>Level 4</u>				
Instance 4	306	142	27	$\chi^2=97.21$
Category	220	144	111	$p<.001$

DISCUSSION: EXPERIMENTS 1 AND 2

The results of this study did not support the hypothesis that the defining features of a word are more "basic" to word meaning than characteristic ones, as Smith, Shoben and Rips (1974) assume according to the criterion of total number of features generated. Defining features were significantly less rather than more frequently given than were characteristic features.

Such results can be readily interpreted through Collins and Quillian's network model, which assumes that each word has stored with it a configuration of pointers representing the word's meaning. The configuration contains superordinates and properties that uniquely characterize a word. It is assumed that under each node are stored the unique properties of the word, while properties shared with other concepts are stored under the superordinate set. Since defining features are shared with the category, it would be more difficult to retrieve them, because they are stored at a higher node than the characteristic features of a word that are stored exclusively with the word itself.

Analyzing the first feature generated by each 8 subject produced a different pattern. Defining features were more frequently given as first responses than characteristic or other idiosyncratic responses. This finding supports Smith's et al. (1974) assumption that defining features are more "basic" to word meanings. It was also found that there were more defining features given first for instances than for

category names. Subjects showed greater difficulty in defining category names than instances and frequently they took refuge in enumerating the instances contained in a category (see Tables 20 and 21 for "other" responses). The emerging picture is that category names do not seem to function as conceptual superordinates and their representation in memory appears to be different than that of instances, at least to some extent. Additional evidence against the notion that category names function as subjective superordinates of their instances in semantic memory is discussed in Experiment 3 (page 193).

The hypothesis that the number of defining features in an item's meaning decreases with degree of abstractness was not supported in this study. For the five categories utilized in this experiment only five of the twenty instance words exhibited a significantly larger number of defining features than the corresponding category name. For the category "vegetable" two instances produced more defining features, for "bird", no instances produced more defining features and the other two categories each showed one instance producing more defining features. However, since this research utilized only two degrees of abstractness, category name and instance, the hypothesis cannot be conclusively rejected.

The total number of defining and characteristic features produced per word did not vary with degree of relatedness. There appears to be something intrinsic about the words themselves that can account for the number of features produced. A cursory view of the Kučera and Francis (1967) word frequencies (see Table a) shows that they are not able to predict the total number of features produced for a word. They

seem to be good predictors of high frequency words, when one would expect a substantial number of features, but not of low frequency words. Similarly, production frequencies, as measured by Battig and Montague (1969), cannot be hypothesized as the controlling factor of the produced features. For the most part, production frequency covaries with relatedness (see Table a) and it was found that relatedness cannot predict the number of features produced from memory. More specifically, the correlation between production frequency and number of defining features given as $r=.31$ ($\omega^2=.09$), while the correlation between production frequency and number of characteristic features given was $r=.57$ ($\omega^2=.32$).

A factor that might account for the number of features produced could be the absolute number of features required to express a word's meaning. Some words might need fewer features than others to exhaust their physical attributes. This factor rests upon the physical characteristics of what is denoted by word. If the words in a category are closely related in physical appearance (i.e., instances of the "bird" category), the features that can express their meaning should not differ greatly with degree of relatedness. On the other hand, if the words in a category are different in their physical description (i.e., table, stool, wastebasket) one would expect differing number of features. The same must be true for words between categories. Therefore, in order to test whether degree of relatedness, production frequency or any other interesting psychological variable can account for the number of defining and characteristic features produced, the number of features used to describe a word must be kept constant. Indeed, the

methodology used in this experiment can be regarded as a procedure for identifying what features a word does describe.

EXPERIMENT 3

Most traditions of thought, when describing subjective, semantic categories analytically, imply that categories are logical, clearly bounded entities, whose membership is defined by an item's possession of a simple set of criterial features. Category membership is, thus, an all-or-none phenomenon, as all instances possessing the criterial attributes have a full and equal degree of membership.

In contrast to such a view, it has been recently argued (Lakoff, 1972; Rosch, 1973) that many natural categories, (i.e., concepts designatable by words in natural languages) appear to possess an analog structure. Rosch (1973, 1975) has further characterized some natural analog categories as internally structured in terms of a prototype (clearest cases, best examples) of the category, surrounded by other instances of decreasing similarity to the prototype and of decreasing degree of membership.

Lakoff (1972) hypothesized that the structure of analog categories can be explained by incorporating not only a single criterial set of features (defining), but also a variable, incidental set (characteristic). Category membership, then, depends on the specific set of features that the category and its instances share. More specifically, it was hypothesized that best members share with the category both sets of features, while better non-prototypic members share only defining features and poorer non-prototypic members share only characteristic features, and it was this hypothesis which was

addressed in Experiment 3.

In addition, Experiment 3 was designed to offer direct confirmation of the characteristic-features assumption. This assumption could be tested, since features were generated by subjects in the prior experiment for instances that varied in degree of relatedness to the category. However, these features were gathered through recall from memory. It has well been documented that a subject can recognize items much more easily than he can recall them (Postman and Rau, 1957; Shepard, 1967). This phenomenon could explain the fact that there were not very many features per word recalled by subjects and that the agreement among subjects about what features characterized the stimulus words was relatively low (see Table 1). In light of these results, the present experimenter decided that the characteristic features assumption could be more sensitively tested if frequencies of defining and characteristic features per word were obtained through recognition memory.

The effect of presenting the category name prior to vs. after its instances was also tested in this experiment. It was hypothesized that if category names are logical entities that share with their instances a criterial set of features and if category names function as superordinates, category names could trigger this criterial set, resulting in a greater number of features of the instances judged "essential" or "non-essential" than "not a property" after seeing the category name. However, if categories are of an analog structure, the presentation of category name prior to its instances should not effect the judgment of subjects in categorizing features.

METHOD

Subjects

One hundred and sixty seven volunteer students from several Introductory Psychology classes at the University of Rhode Island participated in this study. The restrictions for participating were that (a) they had not participated in the previous experiments and (b) they should be native speakers of English. All subjects received extra credit towards course grade for their participation in this task. It was not expected that such reward can influence the subjects' responses in a systematic way as there are no right or wrong answers. For reasons described in the Method section of Experiment 1, age and sex of the subjects were not treated as variables.

Stimuli

Five sets of features, one set per category, were generated by pooling together the features produced by 10% or more subjects in Experiment 1 for a category name and all its related instances.

Due to the large number of features contained in each set, each subject received only two instances per category along with the category name. The instances included per category were separated by one degree of relatedness, so that a subject could either have instances of a category representing only Level 1 and 3 or 2 and 4 of relatedness. Among categories subjects could have Level 1 and 3 for some categories and 2 and 4 for others and presentation of specific instances were selected from 10 random orders.

All five category names were presented to each subject. For

half of the subjects the category names were presented prior to all the instances (Group A) and for the other half were presented after all the instances (Group B). The order of category names presentation was selected from 10 random orders, each of which was represented equally in each group.

Procedure

Subjects were tested in their classes in groups. They were presented with a booklet that contained five category names and 10 instances, each with their set of features after the stimulus word. A typewritten set of instructions was given to each subject.

Subjects were asked to read each feature (carefully) and indicate with a check sign whether it belonged into one of three categories: (1) properties that are essential for the meaning of a word; (2) properties that are not absolutely necessary for the meaning and the word, but which further explain it; and (3) those that are not properties of the particular word. This third category was included to avoid forced choices especially for features of instances, since the features presented to S for each instance within a category (as well as the category name) were drawn from a common pool generated by all of those instances in the prior experiment.

Results

Chi-squares on the distribution of frequencies per feature on essential, non-essential and not-a-property categories, for category names preceding vs. succeeding instances were performed. One thousand five hundred and eighty chi-squares were computed of which 70 were significantly beyond the .05 level of confidence. Since one would ex-

pect 79 of these chi-squares to be significant at the .05 level merely by chance, the accounted variability was deemed too small to allow a conclusion of any difference between the frequency distributions of the two groups. Thus, the frequencies of both groups were averaged and total percentages are presented in Table 14. As in Table 1 and 2 a category name is presented first followed by its instances arranged in a decreasing order of relatedness. For comparison purposes, features for instances were re-ordered to resemble the order of features of their category names. Significant chi-squares on the distributions of frequencies on essential, non-essential and not-a-property per feature, when category names were presented prior and after instances are indicated in Table 14 by an asterisk (*) next to the total percentages.

Chi-squares were also performed from 3X3 contingency tables on the number of features that were judged as essential, non-essential and not-a-property for a category name vs. each of its instances. Subjects were also averaged in these analyses. All 20 chi-squares were found to be statistically significant and contingency co-efficients decreased with decreasing degrees of relatedness in all except four cases (see Table 22). Level 3 of relatedness for category "fruit" and furniture had a higher contingency co-efficient than Level 2, but not Level 1. Also, relatedness Level 4 for category "fruit" was higher than Level 3 and 2, but not from Level 1.

Since the percentages of features judged "not-a-property" category were stable for all comparisons (being very low for the category name and more frequent but still low for instances) chi-squares were performed only on essential and non-essential categories for number of

TABLE 22

Chi-squares and Contingency Coefficients on the
Number of Essential, Non-Essential and Not a
Property Features Shared by a Category
Name and Its Instances*¹

Variable	χ^2	df	p	Contingency* ² Coefficient
Vegetable by Spinach	1609.07	4	<.001	0.47
Vegetable by Tomato	1286.19	4	<.001	0.46
Vegetable by Parsley	1005.84	4	<.001	0.38
Vegetable by Dandelion	127.18	4	<.001	0.16
Fruit by Plum	1040.15	4	<.001	0.42
Fruit by Watermelon	368.74	4	<.001	0.29
Fruit by Gooseberry	487.37	4	<.001	0.32
Fruit by Avocado	496.89	4	<.001	0.33
Bird by Sparrow	1160.97	4	<.001	0.47
Bird by Parrot	1285.76	4	<.001	0.46
Bird by Vulture	538.75	4	<.001	0.34
Bird by Penguin	305.98	4	<.001	0.25
Furniture by Table	1638.14	4	<.001	0.48
Furniture by Bookcase	612.04	4	<.001	0.34
Furniture by Stool	1090.48	4	<.001	0.41
Furniture by Wastebasket	439.18	4	<.001	0.29
Vehicle by Car	2948.11	4	<.001	0.61
Vehicle by Trolley	1088.64	4	<.001	0.44
Vehicle by Scooter	1095.79	4	<.001	0.40
Vehicle by Skates	346.61	4	<.001	0.26

*¹The set-up for each of these tables in its abstract form is:

		Category		
		Essential	Not-Essential	Not-a-Property
An Instance	Essential	Number of Features		
	Not-Essential	Number of Features	etc.	
	Not-a-Property	Number of Features		

*² $C_{\max} = .82$

features shared by the category name and each instance, while averaging across categories for comparable levels of relatedness. Here it was even more clearly seen that degree of overlap as measured by ϕ coefficients decreased with decreasing levels of relatedness (see Table 23).

Overall it was the very high percentages shared between features judged non-essential (characteristic) for both category name and instances that greatly accounted for the ϕ variance in coefficients. These percentages remain at a stable high level. The percentage of features judged essential for both category names and instances was consistently higher than the percentage of features judged essential for the category and non-essential for the instance (a critical comparison). Indeed, for instances at Level 1 of relatedness this percentage is the second highest in the table (22.26% overall). This percentage declines steadily, however, as the level of relatedness decreases.

DISCUSSION

In agreement with several studies performed by Rosch (Rosch, 1975; Rosch and Mervis, in press) it was found that natural categories possess some aspects of an analog structure. It was shown that category names presented prior to instances did not effect the judgment of subjects in categorizing features. This finding is congruent with the view that category names do not function as superordinates in memory, but can be represented by the best exemplars of the category. As Rosch (Rosch and Mervis, in press) well puts it:

"As speakers of our language and members of our culture, we know that a chair is a more reasonable exemplar of the category furniture than a radio, and that some chairs fit

TABLE 23

Essential and Non-Essential Classes of Features
for Category and Levels of Relatedness

		<u>Category</u>		<u>χ^2</u>	<u>p</u>	<u>ϕ Coeff.</u>	<u>$\phi_{\max}$</u>
		<u>Essen.</u>	<u>Non-Essen.</u>				
Level 1	Essen.	802.20 22.26%	655.80 18.20%	757.60	<.001	0.46	.58
	Non- Essen.	265.00 7.35%	1879.20 52.16%				
Level 2	Essen.	641.60 20.33%	703.40 22.28%	369.32	<.001	0.34	.44
	Non- Essen.	292.20 9.26%	1519.20 48.13%				
Level 3	Essen.	619.20 17.89%	648.20 18.72%	385.91	<.001	0.33	.39
	Non- Essen.	382.20 11.04%	1811.20 52.33%				
Level 4	Essen.	446.60 16.40%	611.20 22.45%	195.17	<.001	0.27	.36
	Non. Essen.	295.60 10.86%	1369.00 50.29%				

our idea or image of a chair better than others."
(Rosch and Mervis, in press.)

The characteristic-features assumption received strong support from the fact that subjects categorized features into essential and non-essential with high agreement. Furthermore, properties attributed to specific kinds of features were also confirmed. Specifically, the hypothesis that relatedness norms reflect the structure of semantic categories which can be analyzed into specific kind(s) of features (defining and characteristic) was supported, as was the hypothesis that as relatedness measure of instance to category varies, so does the degree of overlap between feature classes. Contrary to the prediction that the correlation of defining and characteristic features of an instance with the defining and characteristic features of its category would vary with degree of relatedness of the instance to the category, it was found that the correlation held only for the defining features. Characteristic features remained constant at various degrees of relatedness, while the percentage of defining (essential) features shared between the category name and its instances decreased as relatedness decreased. It should also be noted that categories and instances share their features as essential and non-essential more than chance; that is, the overlap of essential-essential features was greater than essential-non-essential; and the overlap of non-essential-non-essential features was greater than non-essential-essential.

The more specific predictions derived from Lakoff's theory (1972) were only partially supported. It was confirmed that highly related instances would share their defining and characteristic features

with those of their category name. Moderately related instances shared the category name's characteristic features, but overlapped their defining features less than the percentage shared with the highly related instance, which is contrary to Lakoff's view that moderately related instances should show a correlation only between their defining features and those of the category. However, Lakoff's prediction that low related instances would show a correlation only between their characteristic features and those of their category name was supported.

In summary, the natural language categories utilized in this experiment can be described as possessing something of an analog structure. This analog structure and the degree of membership, as defined by relatedness norms, was depicted by shifts on the number of defining features shared between instances, representing different levels of relatedness, and the category name. As relatedness decreased, defining features decreased. Therefore, the characteristic-features assumption has received supporting evidence, while it only partially supported Lakoff's theory.

GENERAL DISCUSSION

The present research investigated the structure of semantic memory representations. More specifically, it addressed the question of what constitutes the cognitive representation of word meanings for category names and instances and whether such meanings can be represented by two sets of features, one being criterial and the other incidental.

There were three basic findings from the present series of experiments. First, it appears that the psychological structure of natural language categories can be analyzed meaningfully into defining and characteristic sets of features. When subjects were asked to recall features that a word possesses they readily and reliably generated both types of features. This phenomenon offers support to the hypothesis that both sets constitute part of the meaning representation of a word. In fact, the number of characteristic features generated was greater than that of the defining features, which could be explained either by supposing that characteristic features are more basic to the meaning of a word, or that there are simply more characteristic features than defining features in the physical descriptions denoted by some words. Analyzing the first feature given, it was confirmed that defining features are more basic to word meaning than characteristic ones. Furthermore, subjects find it a meaningful task to separate features into defining and characteristic which provides face validity for such a distinction.

The second basic finding was concerned with the differential meaning representation of abstract and concrete words. It has been hypothesized that category names (perhaps all generic words) possess, for the most part, fewer defining features than concrete words like instances. This hypothesis was not supported and it was found that category names possess as many defining features as the instances of that category except for the highly related instances. Instances 1 and/or 2 possess a greater number of defining features than the category name. The mental representation of the category name seems to be

exemplified by an ability to abstract general features from the instances of the category. The present results reveal that the category name cannot be represented by all members of the category but only through its best members. These results concur with other evidence in the field which supports the view that the mental representation of category names can best be exemplified by its best members (Rosch, 1975). However, the position supported by the present results needs further empirical evidence especially in view of the fact that only one degree of abstractness was utilized.

The third empirical finding confirmed that natural language categories possess an analog structure which defines degrees of membership through common features shared with the category name and its instances. A category name is represented by its best members and exemplars that share together a number of defining and characteristic features. As degrees of relatedness decrease, the overlap of defining features also decreases. Characteristic features, however, remain at a high level of overlap without demonstrating decreasing levels of relatedness. Since characteristic features, by definition, are not essential for the meaning of a word one would not expect them to depict fine discriminations among word meanings. Thus, while both defining and characteristic features constitute the structure of a category, only defining features depict degrees of relatedness among exemplars of that category.

It is very important that the pattern of features given by subjects and, therefore, raised to the awareness of the subjects, confirms the analog structure of categories as well as defining versus charac-

teristic features distinction. A tendency of several experimenters has been to assume that meaning of words must reside in philosophical or linguistic primitives consisting of feature lists of that nature. To use Smith, Shoben and Rips' definition of features as an illustration, they assumed that a lexical item is represented by a set of relevant semantic dimensions (e.g., size, predacity, etc.). For each item, there is a distribution of possible values on each relevant dimension. At any given time, the meaning of a lexical item can be represented as a list of values, one value being sampled from each dimension. It is, then, these momentary values that Smith, et al. (1974) call features. Due to the hypothetical nature of these features, they were derived from raw data by multidimensional scaling techniques (Rips, Shoben and Smith, 1973). In contrast, the present research indicates that subjects can respond to the different features that define words and to the psychological reality of the relationship between whether or not a particular feature is needed for the definition of a word and whether or not it is needed to define that word's subordinate instances of varying degrees of typicality.

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APPENDIX I

REVIEW OF THE MAJOR SEMANTIC MEMORY MODELS

The Collins and Quillian Model

The major proponents and investigators of semantic, psychological network models are Collins and Quillian (1969). The model of semantic memory structure that they introduced was adopted from Quillian's (1967, 1969) computer simulation model, in which each word has stored with it a configuration of pointers to other words in memory. This configuration represents the word's meaning. Two general types of words are in a configuration: superordinates (S) of a word (e.g. bird is a superordinate of canary) and properties (P) which uniquely characterize the word (e.g. yellow is a property of canary). According to this model, memory is organized hierarchically and the amount of space needed for storage is minimized, because under each node are stored only the intrinsic properties of the concept, while properties shared with other concepts are stored under the superordinate set. Connections between the nodes specify particular relations that hold between the concepts. As Landauer and Meyer (1972) showed, two concepts like "collie" and "dog" would be represented at distinct nodes in the network and a link between these nodes would specify that "collies" are a subset of "dogs".

The model further proposes that semantic memory retrieval involves entering this structure and searching for connections between concepts. Retrieval time depends on the distance separating concepts

and on the number of connections between them. For example, suppose that a person is asked to judge whether "a collie is a dog". The theory assumes that he would search the memory for an appropriate connection between "collie" and "dog". The search would take less than one to judge whether "a collie is an animal", because the semantic distance between "collie" and "dog" is less than between "collie" and "animal".

The supporting evidence for the greater semantic distance between "collie" and "animal" than "collie" and "dog" came from reaction time experiments. To verify that "a canary is a canary" took less time than to verify "a canary is a bird" which in turn took less time to verify than a "canary is an animal". The assumption was made that reaction time is an index of retrieval from long-term memory and measures semantic distance, which is the number of nodes, or concepts, separating the two concepts linked together in a given statement. The hierarchical retrieval of facts has received additional support by Collins and Quillian (1970a, 1972) and Smith and Haviland, Buckley and Sack (1972). One unexpected finding was that, although the closeness of items in the semantic network facilitated positive judgments about them, it impeded negative judgments. For example, it was more difficult to evaluate "a canary is an ostrich" than to evaluate "a canary is a fish". As Johnson-Laird (1974) reports, this difference has been repeatedly replicated (Schaeffer and Wallace, 1969, 1970; Wilkins, 1971) and perhaps constitutes the central regularity of semantic judgment. The greater the similarity in meaning between words the easier it is to make a positive judgment and the harder it is to make a

negative judgment about a semantic relation between them. The network model provides a natural account for the facilitation of positive judgments, but to account for the negative judgments it is necessary to suppose that are impeded by extraneous links between neighboring words (Collins and Quillian, 1972).

The property of hierarchical model of memory was supported by differential reaction times to various feature or property statements. Collins and Quillian (1969) found that the mean reaction time for statements like "a canary has wings" to be greater than the mean reaction time for statements like "a canary is yellow". The property of wings is common to all birds and it is not unique to canary, so it takes more time to retrieve the properties of a higher node than of the same node.

However, this assumption of cognitive economy has been attacked by Conrad (1972). In her experiment, Conrad did not simply generate a system of properties as Collins and Quillian had done, but collected normative data for properties (Conrad, 1971). Replicating Collins and Quillian's experiment she confirmed that property (P) sentences with a low and moderate frequency took longer to retrieve from memory than those of high frequency, with the exception of the high frequency sentences pertaining to a property of a superset (e.g. a canary can fly). The high frequency P sentences did not show a regular increase in reaction time with an increase in P, suggesting that these properties are stored with the words which they uniquely define and also with every word with which they are frequently associated.

The Landauer and Freedman Model

Another model of semantic memory is presented by Landauer and Freedman (1968) and is based on the principle of a stored list. Each category word in memory is assumed to have stored with it a "list" of all instances, or subordinates, known to the subject. If the statement "a collie is a dog" is presented for evaluation, the subject must search the "list" stored with "dog" as a concept name to discover the presence of "collie" as an instance. Similarly, if the statement "a collie is an animal" is presented for evaluation, the subject must search the "list" stored with "animal" as a concept name. This model differs from that of Collins and Quillian's in that it does not hypothesize a hierarchical network of interrelated concepts or nodes rather each word brings together its own list of superordinates and instances known to the subject.

Landauer and Freedman (1968) found that when common English words were asked to be classified as belonging or not belonging to well-known verbal categories, reaction time increased slightly as a function of category size, but only sometimes. Based on such results it was inferred that the search of list content involves parallel processing; that is, different entries in memory store are consulted simultaneously. Category size was manipulated by employing sets of nested categories, such as "word", "noun" or "living thing", "animal", "dog". The category size effect refers to the phenomenon of increases in category size, defined by the manipulation of category members, producing reaction time increases.

This category size effect was explained by Collins and Quillian

(1970c) in terms of an inference process. For instance, people take less time to confirm a sentence like "a daisy is a flower" than to confirm a sentence like "a daisy is a plant". This difference is predicted by a theory that people confirm sentences like "a daisy is a plant" by inference from their knowledge that daisies are flowers and flowers are plants. Thus, the controversy between the two models is reduced to a category size effect. If such an effect exists, then, Landauer and Freedman's model is correct, while Collins and Quillian's model can be disputed.

Category Size

As was previously mentioned, category size effect was supported by Landauer and Freedman's results (1968) using a series of nested categories. Collins and Quillian (1969), Meyer (1970), and Landauer and Meyer (1972) using somewhat different procedures report that categorization took somewhat longer for large categories. In contrast, Neisser (1964) compared categorization time for "animal" and "first names" and found no difference in latency. Although most of these studies did find a small difference favoring the small category, the magnitude of the difference was very small relative to the size of the categories involved. Also Collins and Quillian (1970c) demonstrated the categorization time for instances of a certain category (positive instances) did not increase consistently across the "dog", "bird", and "animal" distinction as was expected. The results for negative instances were more complicated. They found that only sometimes took longer to reject a negative instance as belonging to a larger category. They explained their findings in terms of the confusability of concepts

close together in semantic relatedness.

This relatedness effect has been documented by Collins and Quillian (1970), Meyer (1970), Wilkins (1971) and Rips, Shoben and Smith (1973). However, Wilkins (1971) has presented additional data which suggest a standard category size effect even when relatedness is held constant, though flaws in his experimental design, as for example the way he equated similarity across categories, call his conclusions into question. Landauer and Meyer (1972) have attempted to hold relatedness constant and have also shown a category size effect. Thus, relatedness appears not to account for all of the category size effect.

Freedman and Loftus (1971) departed from the previous work on categorization time and instead measured the speed with which subject could actually produce a word himself/herself. Subjects were presented with a noun category paired with either a letter (i.e. country-A) or an adjective (i.e. country-small) and were asked to provide a word belonging in the overlap by the pair. They repeatedly found that the speed of producing a word was independent of the size of the category to which the word belonged (Freedman and Loftus, 1971; Loftus, Freedman and Loftus, 1970). Furthermore, Freedman and Loftus (1974) demonstrated that reaction time increased as a function of size with small categories (less than 7 words), but at some point levelled off with no additional increase even with categories as large as 32 members. However, category size was manipulated through various lists of instances of newly constructed categories. The subjects were required to learn these lists well and free recall as well as production of an instance while given another instance as a cue were tested. Due to their

manipulation of category size effect and the fact that category size has not been confirmed as a psychological variable, Freedman and Loftus' (1974) results cannot be directly compared to the rest of the category size experiments in this area.

Smith and his associates (Smith and Haviland, Buckley and Sack, 1972) sought to solve the controversy between hierarchial and category size effect. In two experiments subject judged the truth or falsity of previously learned artificial facts, each fact consisting of a noun from a natural language hierarchy paired with an arbitrary digit, e.g. Bird-2. Experiment 1 used a two-level hierarchy and the results were consistent with Collins and Quillian's (1969) model. Experiment 2 used a three-level hierarchy and the results were inconsistent with Collins and Quillian's model, but rather supported a model in which all properties of a noun are stored with and retrieved from that noun (Landauer and Freedman's model, 1968). Comparable results were found by Conrad (1972) who found that when associative frequency among properties was held constant hierarchial effects were present for statements about supersets but absent for statements about the properties of items. In summary, these findings support that portion of the Collins and Quillian model of semantic memory which suggests that words are organized hierarchially in memory. On the other hand, the hypothesis of cognitive economy of storage has received little or no support. And an additional problem for a hierarchial model, as was previously mentioned, is that it cannot explain the reaction times for refuting negative statements.

Finally, Smith, Shoben and Rips (1974) found that category size,

as manipulated by nested categories, had no significant effect on categorization time. However, when an index of the degree of similarity between the nested categories was obtained through production frequency norms, it was found that reaction time varied inversely with the degree of similarity, that is, when overall similarity increased, reaction time decreased while when overall similarity decreased, reaction time increased.

The Smith, Shoben and Rips Model

This model emerges from a set-theoretic tradition in semantic memory research (Meyer, 1970; Schaeffer and Wallace, 1970). The first assumption about the meaning of a word is based on a semantic theory outlined by Lakoff (1972) which proposes that meaning is not an unanalyzable unit but rather can be represented as a set of semantic features. Smith et al. suggest that the features associated with a given category vary in the extent to which they define that category. In other words, there is a continuum along which some features will be more incidental or "characteristic" features. This variation in definingness plays a role in a categorization situation if accurate judgments are to be made. Specifically, the defining features must be given greater emphasis than the characteristic features. While the features for each item are presumed to be ordered from top to bottom in degree of definingness, there is presumed to be an explicit boundary distinguishing defining from characteristic features. The number of defining features contained in an item's meaning are assumed to decrease as the item becomes increasingly abstract.

Based on these assumptions the mechanisms of a categorization

task, "a subject (S) is a predicate (P)" sentence were outlined. A semantic categorization is believed to require two distinct comparison stages. In the first stage, lists of features for the instance and category are retrieved, including features drawn from characteristic as well as defining dimensions, yielding a measure, x , of overall similarity. This measure takes into account the proportions of the category's dimensions which are shared by the test item and the proximity of values (features) on each of these common dimensions. But as Smith et al. pointed out, it is difficult at this point to be more specific about the exact combination rule used to compute overall similarity.

The x value of overall similarity is compared to two preset criterial levels, one, a high level called c_1 and the other, a low level called c_0 . If x exceeds c_1 , then a positive response (true) can be made, while if x is less than c_0 , a negative response (false) is executed. When x falls in the intermediate range between c_0 and c_1 , a second comparison stage is necessary before a response can be determined. In this stage, only the defining features of instance and category are retrieved and compared. A positive response can be made if (a) each defining dimension of the category is also a defining dimension of the instance, and (b) the particular features on these dimensions which the instance possesses are within the range of allowable values for the category.

A number of predictions follow from this model: First, for any target category, "true" reaction time should decrease as the typicality of the test instance increases. Typicality, assumed to measure overall similarity, is a term introduced by Rosch (1973) who asked subjects to

judge how good an example of a certain category various instances of that category were. This prediction has been partially supported by Smith (1967), Wilkins (1971), Loftus (1973), Rips, Shoben and Smith (1973) and Rosch (1973).

Second, for correct "false" response reaction time is predicted to decrease as relatedness decreases. Relatedness is hypothesized as measuring overall semantic similarity for "false" responses. However, the exact mechanism of measuring relatedness is not specified. This term, semantic relatedness, was introduced by Collins and Quillian (1970c) in an attempt to explain why some negative instances (i.e. tulip vs. dog or bird) took longer to be rejected than others (i.e. magnisium vs. dog or bird). He hypothesized that relatedness was a major variable. Therefore, instances that are closely related require more time than instances that are not closely related. Ratings of relatedness were obtained by Rips et al. (1973) who asked subjects to indicate the degree of relatedness of a standard word to a group of comparison words on a 4-point scale. A relatedness effect using this criterion has been partially documented by Collins and Quillian (1970c), Meyer (1970), Wilkins (1971) and Rips, Shoben and Smith (1973).

Considering the issue of category size, Smith et al. (1974) propose that in terms of the feature-comparison model, an increase in category size should affect both stages of their model, because of changes in the number of defining and characteristic features. Defining features are supposed to decrease as category size increases, because the terms become more abstract. Hence, if only the second stage is considered, an increase in category size should lead to a decrease in

"true" reaction time. But as one increases category size, there might be a substantial change in the overall similarity which determines whether the second stage will need to be executed. An increase in overall similarity decreases "true" reaction time, while a decrease in overall similarity increases "true" reaction time. Moreover, since "false" reaction time is known to increase with relatedness, it follows that an increase in category size can lead to an increase in "false" reaction times.

These predictions for a category size effect were supported by Smith et al. (1974). In that study category size was manipulated through nested categories and a measure of the category's overall semantic similarity to the instance was indexed by production frequency as measured by Loftus and Scheff (1971). Loftus and Scheff obtained a set of norms by instructing a group of subjects to list three superordinates for each of 50 instances. To support the assumption that production frequency (as measured by Loftus and Scheff, 1971) is a measure of the category's overall semantic similarity to the instance, Smith et al. reported a correlation $r=.85$ ($df=10$, $p<.01$) obtained by Rips et al. (1973) between ratings and production frequencies. However, that correlation was inappropriately obtained between Battig and Montague's norms (1969) of category-instance frequency and ratings of degree of relatedness on a 4-point scale between the standard word and a comparison word. Battig and Montague's norms were collected by reading category names to subjects and asking them to write down in 30 seconds as many members of each category as they could. Thus, Battig and Montague's norms measure instance dominance (the fre-

quency with which an instance is given to a particular category) while Loftus and Scheff's norms measure category dominance (the frequency with which a superordinate is given to a particular instance). Loftus (1973) offered evidence that supported the differential nature of these measures. In a verification task requiring whether the instance was a member of a category, when the instance preceded the category (e.g. robin-bird) category dominance determined reaction time, but when the category preceded the instance (e.g. bird-robin) the instance dominance determined reaction time.

Smith et al. (1974) offered further evidence to support the assumption that production frequency measures semantic relatedness of the instance-category pair. Correlation was obtained for the difference score for ratings between statement pairs of the form "an S is a P_L " and "an S is a P_S " (where P_L is the larger category of S and P_S is the smaller category) and production frequencies. However, the type of production frequency utilized was not specified. The resulting correlation was $r=.47$ ($df=24$, $p<.05$) which is rather low. Clearly, the category size predictions of the feature-comparison model need more convincing evidence.

Evaluation of the Category Size Effect

Having reviewed the major findings regarding category size, it should be clear that the category size effect is a variable phenomenon and such evidence is not adequate to verify any particular model. More methodologically rigorous experiments are needed that will include a proper procedure for estimating category size. Category size has usually being manipulated by nested categories such as "word", "noun",

"living thing", "animal" and "bird". Every category includes by definition everything that belonged in all smaller categories. Thus, it is assumed that "word" includes "noun", "living thing", "animal" and so on. Another commonly used manipulation of category size is by enumerating the instances of a category as they appear in a popular thesaurus. Neither procedure offers evidence on whether category size is indeed a psychological variable. One possible procedure would be to have subjects give lists of words that they can produce as members of a category. However, as Landauer and Meyer (1972) pointed out, we cannot be sure that the number of different members that a subject or group of subjects emit in a production task would be necessarily related to the number that they can recognize. Therefore, the most promising procedure is, as Johnson-Laird (1974) remarked, to utilize the number of items individual subjects actually recognize as members of a category.

The Kintsch Model

A different approach to the structure of memory is offered by Kintsch (1972, 1974). His model is a psycholinguistic one that attempts to connect distinct meanings of words with sentence derivations. The model assumes that the basic units of meaning are propositions. Propositions are n-tuples of word concepts (n-tuple is a set of n elements where the order of elements is important) one of which serves as a predicator and the remaining cues as arguments, each fulfilling a unique semantic role. The predicator specifies a relationship among the arguments of a proposition. To use Kintsch's (1975) example, in the proposition (LOVE, Experiencer: GREEK, Object: ART)¹ there are two

¹Propositions in Kintsch's terminology are always written in capital letters and enclosed in round brackets.

arguments, GREEK and ART, and the predicator LOVE; in English this proposition could be realized with the sentence "the Greeks love art". The arguments of a proposition are concepts rather than words. Word concepts are stored in a person's semantic memory, which indicates the combinations of word concepts that form acceptable propositions. Word concepts are defined by the propositions in which they are used.

Kintsch used the linguistic theory of Fillmore (1968, 1969) to transform propositional expressions into English sentences. Though the lexical entries in the structure of lexical memory may be phrases, they are characterized by a list of propositions. The appropriate propositions are connected through the operations of conjunction ($\wedge$) and disjunction ($\vee$). For instance, suppose one wants to represent a person's concept of APPLE by means of the following combination of propositions: $(\text{FRUIT, APPLE}) \wedge (\text{DELICIOUS, APPLE}) \wedge (\text{RED, APPLE}) \vee (\text{YELLOW, APPLE}) \vee (\text{GREEN, APPLE})$. Conjunction has its usual meaning (and). Disjunction is to be understood as exclusive disjunction; that is, it asserts one, but not both, or the disjoint elements.

After discussing the structure of the set of all propositions, Kintsch presents a classification system for nouns and verbs. The structure of the noun system is a set-inclusion hierarchy that cannot be represented as a tree, because each element may have two immediate successors rather than a unique successor required for tree representation. Furthermore, it is not a lattice, because any pair of elements A and B have at least upper bound, but not all pairs have greatest lower bounds. Furthermore, special classification rules of the following form are required to partition a category in more than one

way:

$$\{N_1 V N_2 V \dots V N_n\} \rightarrow C$$

where the N_i 's are the sets of nouns that partition the category C .

Kintsch describes the organization of the verb system as being more complex. While for the noun hierarchy nominal propositions are the building blocks of memory, for the verb structure there are all kinds of propositions. The structure of the verb system is again a partially-ordered set with a unique maximal element and many minimal ones. Similarly, it is not a lattice, because not all pairs of elements have greatest lower bounds. Verb-propositions participate in a large network of relationships merely by virtue of the fact that the nouns that they take as arguments are themselves members of various lexical structures. In addition, complex dependencies may exist among the arguments of a verb, so that a given verb may be characterized not just by its obligatory or deletable case, but by certain alternative patterns of cases (such as human or non-human object, or the object may be combined with an agent in some cases but not in others, etc.). Kintsch further considers that classification of propositions through the arguments they take is insufficient in itself. Special rules to establish antonymous n -tuples are needed. These rules are of the form:

$$[(V_1, X) V (V_2, X) V \dots V (V_n, X)] \rightarrow (C, X)$$

where X is a noun (or more precisely, a class of nouns, since nouns in general possess various subordinate terms) and (C, X) is a superordinate proposition. The set of propositions $(V_1, X) V \dots V (V_n, X)$ forms a

partition of (C,X) in much the same way that the set of nouns forms a partition of a superordinate noun class.

Since propositions are a central assumption of this model, Kintsch (1972) attempted to obtain evidence concerning their status as basic lexical elements. He gave subjects simple sentences and asked them to tell if the sentences conveyed information not explicitly stated. Two types of sentences were selected. One type of sentence was incomplete, in the sense that cases that could and often would be part of such a sentence were omitted. An example of the first type sentence was "the secretary types" which could be completed with "on the paper" or "with a typewriter" etc. For the other type of sentences no additional cases could be part of these sentences, but for each sentence there were some more or less specific semantic implications. Such sentences were "it rains" which implies wet, clouds, water falling, etc.

The results showed that there were more idiosyncratic responses ($\bar{X}_1=4.4$) than common responses ($\bar{X}_2=3.2$). That is, although no single response occurred with high frequency, for every sentence one or more dominating responses existed. Based on these results, Kintsch concluded that propositions are the building blocks of memory. However, to the present author it seems obvious that if "missing" sentences or sentences with many semantic implications have a dominant response, this only signifies that we speak in propositions and that we tend to fill in incomplete sentences when given the opportunity to do so. Furthermore, the dominant response was not overwhelmingly "dominant". Therefore, this evidence is not conclusive for Kintsch's model.

Support for Kintsch's model was sought through an experiment conducted by Kintsch and Keenan (1973). They demonstrated that the number of propositions in a text base increased monotonically with reading time even if the length of the corresponding texts was controlled. However, this variable only accounted for 21% of the variance. In a later experiment Kintsch, Kozminsky, Streby, McKoon and Keenan (1975) found that reading times were longer and recall was less for texts with many different word concepts than for texts with fewer word concepts. The number of words and number of propositions were controlled. Superordinate propositions were recalled better than subordinate propositions and forgotten less when recall was delayed. The probability that a word concept was recalled increased as a function of both the number of repetitions of that concept in the text base and the number of repetitions of the corresponding word in the actual text.

Whether propositions which contain word concepts are stored in a person's semantic memory is still questionable. Kintsch has shown that reading time is affected by number of propositions and word concepts, but such an effect could be due to an interaction of short-term memory and semantic memory. Presenting subjects with paragraphs and asking them to recall immediately involves both short-term memory and semantic retrieval. Further, whether reading time can be equated with semantic retrieval is questionable, if one takes into account the fact that the subject knows that he will be immediately tested for recall. The semantic retrieval is confounded with the fact that material is to be recalled and the subject could reread some parts of the paragraph but not others. Determining if propositions are the building blocks of

memory requires more well-controlled experiments that involve only semantic retrieval. But even more important will be a clear delineation of his model from the existing psychological models; that is, a clear specification of what it means for propositions rather than a word or a concept to be stored.

APPENDIX II

TABLE a

Stimuli Words

<u>Words</u>	<u>Rosch's Relatedness Norms</u>	<u>Küçera- Francis Frequency</u>	<u>Battig & Montague Production Frequency</u>
<u>Vegetable</u>	--	10	-
Spinach	1.22	2	163
Tomato	2.23	4	215
Parsley	3.32	1	15
Dandelion	5.20	1	1
<u>Fruit</u>	--	35	-
Plum	1.37	1	167
Watermelon	2.39	1	47
Gooseberry	3.33	-	1
Avocado	5.37	11	17
<u>Bird</u>	--	31	-
Sparrow	1.18	1	237
Parrot	2.07	1	72
Vulture	3.05	4	44
Penguin	4.53	-	14
<u>Furniture</u>	--	39	-
Table	1.10	198	408
Bookcase	2.15	2	43
Stool	3.13	8	72
Wastebasket	5.34	2	1
<u>Vehicle</u>	--	35	-
Car	1.24	274	407
Trolley	2.19	5	30
Scooter	3.24	-	44
Skates	4.99	1	10

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