Measures of internal category structure: A correlational analysis of normative data

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Normative data were collected from samples of students from The City University, London, and other London colleges, for 12 semantic categories. Measures of typicality, familiarity and associative frequency are listed. These data are published as a research tool for semantic memory research in the UK. The reliability and intercorrelation of the measures are reported, and their correlation with previous American measures is discussed. The results permit certain important conclusions to be drawn about the role of familiarity in typicality ratings, and about the determinants of associative frequency.

Much research in semantic memory has been directed at the nature of categories of words. Theories have been propounded of how category information is stored in memory (Anderson & Bower, 1973; Collins & Loftus, 1975; Glass & Holyoak, 1975), how category statements are verified (Glass & Holyoak, 1974; Smith *et al.*, 1974; McCloskey & Glucksberg, 1979), and how the words within a category may be structured in particular ways (Rosch, 1975; Rosch & Mervis, 1975; Hampton, 1976, 1979, 1981). Within this last area of research, attention has been drawn to three interrelated dimensions of internal category structure. The present paper presents normative data for these three dimensions, and analyses their interdependence.

The first dimension, *associative frequency* (also known as production frequency, or item dominance), is a measure of the probability of a subject producing an item when asked to generate members of a particular category. Battig & Montague (1969), repeating an earlier study by Cohen *et al.* (1957), allowed subjects 30 seconds to list items in each of 56 categories, using a total sample of 442 US college students, and tabulated the resulting responses with their frequencies of production. The associative frequency measure based on these norms has been shown to predict categorization times (Wilkins, 1971; Conrad, 1972; Loftus, 1973), and was the sole measure of internal category structure until work by Rips *et al.* (1973) and Rosch (1973) introduced the notion of *typicality*. Typicality (also known as goodness-of-example, representativeness, or sometimes prototypicality) is measured by asking subjects to make a direct rating (on an appropriate numerical scale) of the degree to which a category item is a good, typical, representative member of a category. Rips *et al.* (1973) found that rated typicality correlated well with the 'distance' of an item from the category concept. Distance was measured using a metric space constructed from pairwise judgements of the similarity of each category item to every other item and to the category name itself. Rated typicality has also been shown to correlate strongly with measures of the featural overlap between an item and either the set of other category items (Rosch & Mervis, 1975) or the category concept itself (Hampton, 1979, 1981). Rated typicality also predicts categorization time (Smith *et al.*, 1974; Hampton, 1979; McCloskey & Glucksberg, 1979), and associative frequency (Mervis *et al.*, 1976; Hampton, 1979).

Interest in comparing these two measures (associative frequency and typicality) lies in the fact that they reflect the proposed category structure of two rival sets of theories. Network-search models of semantic memory (e.g. Collins & Loftus, 1975) suggest that associative frequency is the most direct measure of category structure since 'typicality' effects are determined by the strength and search order of pathways linking the category

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node to its subordinate item nodes. On the other hand, rated typicality is the more direct measure for featural, prototype models (e.g. Rosch, 1978), as this measure has been shown to correlate with measures of feature overlap, and typicality effects are assumed to be due to the featural similarity among category members. Attempts to separate out the effects of each measure (e.g. Keller & Kellas, 1978) have, however, been forced to use severely restricted sets of materials because of the strong correlation between the two measures. In fact, since neither theory explicitly states how the other theory's measure relates to its own, the discovery of which measure is most critical may not actually have strong theoretical implications. The problems of discriminating between the predictions of the two theoretical approaches have been discussed elsewhere by Hollan (1975), Rips *et al.* (1975) and Smith (1978):

A recent paper by McCloskey (1980) has introduced a third measure to be considered in category research. He pointed out that *familiarity* with the meanings of the words being categorized may be a confounding factor in the other two measures, and so may possibly be responsible for some of the effects observed. He showed that when rated familiarity was held constant, part (although not all) of the effect of typicality on categorization time was removed. Glass & Meany (1978) had also provided evidence that there are two different kinds of atypical category members – those which are well-known but unrepresentative (such as *tomatoes* as *fruits*) and those which are not well known (such as *persimmons*). Ashcraft (1978) and Malt & Smith (1982) have also considered the question of familiarity as a component in typicality ratings. Some discussion of their results may be found below in the light of our own data.

The work presented here had several purposes. The first one was methodological. In order for researchers to study semantic categories in a controlled fashion, measures of all three dimensions are needed for the *same* set of category items based on the *same* population of subjects: such data do not exist at present. In addition, our aim was to provide such normative data for a population of *British* subjects. Work on semantic memory in Britain is made more difficult (in our experience) by the fact that norms collected in the USA are sometimes unreliable as predictors of the responses of British subjects (even allowing for the translation of nearly equivalent terms such as *lift* for *elevator*). For example, sets of materials matched for rated typicality on the American norms may turn out to be unmatched for a sample of British students. More worrying is the fact that 'imported' norms may appear unpredictive of 'home-produced' dependent measures because of unidentified cross-cultural variation. There may also be temporal variation; Battig & Montague's data were collected in 1965, and Rosch's in the early 1970s. A comparison of our data with these two previous studies was used to assess the degree to which rated typicality and associative frequency are subject to such cross-cultural variation.

As well as these practical considerations, the work had clear theoretical aims. The most important aim was to elucidate the relationship between the three measures of category structure described above. McCloskey's (1980) result suggested that rated familiarity should be strongly correlated with the other two measures. Furthermore, if familiarity is at the base of all category item variation, then when familiarity is held constant there should be no residual correlation between rated typicality and associative frequency. As an alternative approach, we also assessed the importance of rated familiarity in internal category structure by taking the associative frequency measure as a dependent variable to be predicted by the other two measures. Partial correlational analysis was used to identify the importance of each rating measure in determining associative frequency, independent of the effect of the other.

A third way of examining the role of familiarity involved a *post hoc* comparison with

data published by Malt & Smith (1982). Ashcraft (1978) had found that the number of properties of an item that people could generate was a better predictor of rated typicality than a number of other variables, including featural overlap. Malt & Smith (1982) tested the generality of his result and concluded that, although the relationship is present, there can still exist variations in rated typicality that are not accounted for by the number of properties generated. Publication of their data allowed a *post hoc* comparison with our data to discover whether number of properties is yet a *fourth* variable to be taken into account by researchers investigating category structure.

Method

Materials

In order to keep the data collection within manageable bounds, just 12 categories were selected from the sample of 56 categories used by Battig & Montague (1969). They were: *birds*, *clothing*, *fish*, *flowers*, *food flavourings*, *fruit*, *furniture*, *insects*, *sports*, *vegetables*, *vehicles* and *weapons*. These 12 included 8 of the 10 used by Rosch (1975) and were chosen to represent a range of different semantic fields. Lists of category items were compiled for each of the 12 categories by selecting between 34 and 55 words from Battig & Montague (1969) and Rosch (1975), as well as including words used in other experiments for which we needed normative data. The samples of words covered the range of goodness-of-example for each category, but words which were clearly outside the category were not included.

[To provide a more complete set of category items, we could have selected the item sample *after* first collecting the associative frequency tables. This was not done because it was felt that the sample should not be biased in any way to reflect the variance of one measure rather than another, and the large number of items usually generated with very low frequencies in category production tasks would make sampling problematic. We therefore selected samples *before* collecting any data. Those items generated by more than three subjects but omitted from the item sample are listed in the Appendix after each category list. It can be seen there that on average only 4·3 omitted items (out of about 100 items in each category) were produced by more than 10 per cent of the subjects, if synonyms and subvarieties of listed words are not counted.]

Typicality

Subjects. Ninety-three subjects took part, of whom 71 were students at The City University, London, and 22 were at other London colleges. They were unpaid. About half of the subjects were psychology students.

Procedure. Testing booklets were prepared by typing all the items for each category in a random order in a column headed by the category name. Next to each word was the scale numbered 1–6 for the rating of typicality. The scale was explained at the top of each page. To reduce testing time to a convenient period, each subject rated six categories, sampled at random from the 12, and presented in a random order. A paired subject then rated the remaining six categories, also in a random order. The instructions largely followed those used by earlier researchers with the following modifications, introduced to make the task clearer and less ambiguous for subjects: (*a*) subjects were given a separate rating response for denying that an item belonged in the category, (*b*) they could also leave a line blank if they did not know a word, and (*c*) instructions stressed that frequency of occurrence should not be used as a basis for the judgement.

The following instructions were printed on the top sheet of the booklet:

> In the following pages you will find lists of items belonging to six different categories. The items are arranged by category and your task will be to rate each word according to how typical or atypical an instance it is of the category it belongs to. In other words, you have to decide whether each word is a good or a bad example of the category named. For instance, most people would say that Churches are very typical examples of the category Buildings; more typical than, say, Telephone boxes, which some people would classify as very atypical examples. The above example also serves to illustrate the fact that, just because a specific word is more typical than another, it does not mean that it occurs more often in your experience than an atypical word.

Telephone boxes are probably seen much more often than Churches, but they are still less *typical* of the category Buildings than Churches are.

At the top of the next page you will find the key to the rating method you must use. You will have to rate each word along a scale going from 1 to 5, where 1 represents a very typical instance of a category, and 5 represents a very atypical instance. The numbers in between should be used to represent gradations in typicality of the words being rated. In some cases, you may feel that the item being rated simply does not belong to the category you are considering. You should then ring the number 6 on the scale. Borderline cases, such as items which sometimes belong to the category named, but not always, should be given a 5. If you do not know the word, leave the rating line blank.

Proceed as follows: Make sure you known how to use the scale, using the key at the top of the page. Read the category name given below that. You can start rating each word given under the category name according to its typicality, by ringing the number, from 1 to 5, which you think best expresses its goodness-of-example. If you do not think that the word belongs to the category used, ring 6.

Subjects completed the booklets in their own time and were asked to use their own judgement without consulting other people. Completing a booklet took about 20 minutes. Because not all booklets were returned, not all categories had the same number of ratings. Of about 130 booklets distributed, 93 were returned (72 per cent). Of these, 66 were in matched pairs and 27 were unmatched. Since all booklets used a different random order of six randomly selected categories, the varying number of subjects in different categories should have no systematic effect. The numbers of subjects contributing to each category were as follows: *food flavourings*, *fruit* and *insects* (43), *birds* and *weapons* (44), *clothing* and *sports* (45), *vehicles* (46), *vegetables* (48), *fish* and *flowers* (50), and *furniture* (51).

Familiarity

Subjects. Sixty-three students at The City University, London, acted as unpaid volunteer subjects. About one-third of them were psychology students. Five of the subjects who did familiarity ratings had also done typicality ratings (the interval between the two tests was about eight months). In view of the long inter-test interval, and the small overlap (overlap only occurred for seven of the categories, for which on average the overlap was 2·6 subjects) the samples can be viewed as essentially independent.

Procedure. The testing booklets used for the typicality ratings were modified as follows: the scale at the top of each page now ranged from 1 (very familiar) to 5 (very unfamiliar), with 6 now meaning that the word was unknown. For convenience, the order of words within the category lists was the same as for typicality ratings. It should therefore be stated that familiarity as measured here refers to familiarity *within the context of other category items.* Since most experimenters will wish to use words in the context of other category members, this was deemed an appropriate procedure. The following instructions (adapted from McCloskey, 1980) were given as the top page:

On the following pages you will find collections of words grouped together by category. There are six categories in all. Your task will be to rate the words according to how familiar you are with their meaning. Please make your ratings on a scale from 1 to 5, with 1 meaning that the word is highly familiar to you and 5 meaning that it is highly unfamiliar. There is also an additional number 6, which you may use to indicate that you do not know the particular word. You will probably encounter few or no words whose meaning you do not know. A highly familiar word is one whose meaning is immediately obvious to you, while a less familiar word is one that you may have to think about for a moment.

The words are grouped by category for our convenience only – it was easier for us to present the words by category rather than, say, alphabetically. So you should not let yourself be influenced by whether you think that a particular word is a good or bad example of the category mentioned. Rate the words simply on how familiar they are to you, as words. Finally, try to spread your ratings out over the whole of the scale – in other words don't use all 1s or 2s; or 4s and 5s. At the top of the first page, and at the top of any subsequent new category headings, you will find the key to the rating scale, so please always check that you know how to use it.

To reduce testing time, subjects again each completed six of the categories in their own time. The randomization procedure was the same as before. Sixty-four booklets were distributed, and 61 were returned, of which all but three were matched pairs. In the final sample there were between 30 and 32 subjects rating each category.

Associative frequency

Subjects. The subjects were 72 first- and second-year students at The City University, London. They were tested either individually or in large groups, as part of a psychology laboratory class. They were unpaid. Roughly two-thirds were psychology students.

Procedure. Subjects were given a booklet containing 12 pages, each page headed by the name of a different category, and otherwise blank. Order of presentation of the pages was randomized for each subject. A cover sheet contained the following instructions (similar to those used by Battig & Montague, 1969, with the provision of 60 s rather than 30 s per category):

> We are running this experiment to try and find out which items or objects people commonly give as belonging to various categories. The procedure is very simple. This booklet contains 12 pages. Each page has, written on the top left-hand corner, the name of a category. When I signal 'Begin', turn over this page and read the name of the category on the first page. I will then say 'Start'. You will then have one minute to write down as many words as you can think of which in your opinion belong to that category. When the minute is up, I will say 'Stop'. This means that you must stop writing and turn over the page and read the name of the *next* category. You will again be given one minute to write down as many members of that category as you can think of. We will do the same thing for all 12 categories represented in the booklet. Just two final points: always wait for me to say 'Start' and 'Stop' before writing anything down and turning the page, respectively. Secondly, please write clearly and write each word or phrase in full.

Subjects were given time to read the instructions, and any queries were answered. The procedure was then followed as described in the instructions.

Results and discussion

Tables of mean rated typicality (TYP), mean rated familiarity (FAM) and associative frequency (AF) are presented in the Appendix, together with the number of category rejections (NR) (a rating of 6 on the typicality scale) and the number of 'unknown' responses (NU) (taken from both of the rating scales). In parentheses after associative frequency is given the number of times an item was generated as the first item. Associative frequency scores were derived using a strict criterion of the given word exactly matching the word in the list. Synonyms and subvarieties were not included, but obvious misspellings were corrected. Words generated by more than three subjects, but not included in the lists, are given below each category list in the Appendix, together with their associative frequencies and the number of subjects giving them first. Mean typicality was calculated for all subjects who knew the item, including the rating of 6 as the extreme end of the scale. Similarly, mean familiarity was calculated including the 'unknown' rating of 6 as the extreme.* Table 1 shows the mean and standard deviation across category items for mean typicality and familiarity ratings, and the total number of category items generated in the production task. It may be seen that the two rating measures had on average very similar standard deviations. The distributions of the three measures were examined across all categories together. All three were positively skewed (typicality 0·79, familiarity 1·85, associative frequency 1·58). Familiarity had a relatively high kurtosis (3·66), indicating a narrow clustering of items at the high familiarity end of the scale (68 per cent of words had

* Mean scale values were also calculated treating ratings of 6 as 'missing values', and were found to correlate at 0·94 or better with the scales used. Sixes were included for the analysis in order to increase the range of the scales and the size of the subject sample. This decision had minimal effect on the results of the analyses reported. Employing a separate response for non-members and unknown items thus served mainly to increase the face validity of the rating task for subjects, as well as providing information on how many subjects consider an item not to belong to a category – information that can also be useful in selecting semantic materials.

Table 1. Number of items (n), means and standard deviations for mean typicality (TYP) and mean familiarity (FAM) ratings, and number of items generated in the production task (I) for each category

		Means		Standard deviations		
Category	n	TYP	FAM	TYP	FAM	I
Birds	52	2·07	1·78	0·62	0·66	129
Clothing	55	2·39	1·69	0·86	0·63	114
Fish	37	2·18	2·34	0·75	0·98	112
Flowers	46	1·92	2·33	0·60	1·13	107
Food flavourings	40	2·39	2·42	0·68	1·35	116
Fruit	43	2·30	1·93	1·00	0·73	69
Furniture	41	2·90	1·73	1·50	0·52	86
Insects	34	2·10	2·18	0·84	1·29	64
Sports	48	2·42	1·58	0·97	0·39	108
Vegetables	41	2·21	1·89	0·85	1·03	74
Vehicles	54	3·20	1·65	1·09	0·45	107
Weapons	40	2·22	1·64	0·98	0·88	146
Means:		2·36	1·93	0·89	0·84	103

mean familiarities between 1 and 2 on the scale). Kurtosis for typicality was 0·04 and, for associative frequency, 1·78. For typicality, 41 per cent of the words were given a mean rating between 1 and 2 on the scale.

Reliability

To assess the inter-subject reliability of the three measures, the method of split-half correlation was used. For each measure, the subjects were divided at random into two equal groups, and values of the same measure were obtained for each item for each group separately. Table 2 shows the product moment correlation across the items in each category between the two groups. The mean correlation for all three measures was 0·92 or 0·93, indicating a high level of reliability. (It is interesting that our levels of reliability compare very favourably with those achieved by earlier researchers who used far larger samples of subjects.) It can also be concluded that the reliability of the three measures is equivalent, thus allowing further analysis of their intercorrelation with each other and with other measures (see below). It may be noted in Table 2 that there is a connection between the reliability of the typicality and familiarity measures across categories. The more reliable typicality is, the less reliable familiarity becomes ($r = -0{\cdot}66$, $P < 0{\cdot}05$). Although the range of variation in reliabilities is small, this significant negative correlation may be taken as some evidence for the independence of the two measures. It probably arises because the judgement of typicality for very unfamiliar items is erratic, depending on the subject's depth of knowledge about the item. Hence categories with very unfamiliar items will have lower reliability coefficients for typicality judgements, while the greater number of clearly unfamiliar items in such categories will render familiarity judgements *more* reliable. In support of this, the standard deviation of familiarity ratings is also correlated with the reliability of typicality, and the partial correlation between the reliability measures holding the standard deviation of familiarity ratings constant was near zero ($r = 0{\cdot}08$). There is no such relationship apparent between associative frequency and either of the other two measures.

Table 2. Reliability coefficients for typicality (TYP) and familiarity (FAM) ratings and associative frequency (AF) for each category list

	Reliability *r*		
Category	TYP	FAM	AF
Birds	0·91	0·92	0·91
Clothing	0·95	0·92	0·94
Fish	0·92	0·95	0·94
Flowers	0·90	0·96	0·93
Food flavourings	0·83	0·96	0·86
Fruit	0·95	0·90	0·93
Furniture	0·99	0·90	0·94
Insects	0·88	0·97	0·96
Sports	0·95	0·82	0·94
Vegetables	0·90	0·95	0·96
Vehicles	0·92	0·90	0·97
Weapons	0·94	0·90	0·91
Means:	0·92	0·92	0·93

Table 3. Correlations between rated typicality and Rosch's (1975) typicality norms, and between associative frequency and Battig & Montague's (1969) norms

Category	Typicality	*n*	Associative frequency	*n*
Birds	0·82	38	0·76	52
Clothing	0·90	32	0·76	55
Fish	—	—	0·48	37
Flowers	—	—	0·77	46
Food flavourings	—	—	0·85	40
Fruit	0·86	34	0·90	43
Furniture	0·92	21	0·81	41
Insects	—	—	0·85	34
Sports	0·80	37	0·53	48
Vegetables	0·72	31	0·75	41
Vehicles	0·90	29	0·76	54
Weapons	0·92	26	0·91	40
Means:	0·85		0·76	

Comparison with American norms

Given that the reliabilities of the measure of typicality and associative frequency are the same for our data, a comparison can be made with previously published American norms of typicality (Rosch, 1975) and associative frequency (Battig & Montague, 1969). Table 3 shows the product moment correlations between the British and American norms. For associative frequency the correlations were calculated for the whole of our sample. For typicality only those words in both sets of norms could be used. A comparison of Tables 2 and 3 shows that the correlations are less than the split-half reliability measures given in Table 2, thus providing some justification for collecting norms based on a British sample. It may also be seen in Table 3 that the correlations for typicality were higher

(mean = 0·85) than for associative frequency (mean = 0·76). This difference is significant across the eight categories for which the typicality comparison could be made. It is interesting to note that this result is consistent with Rosch's (1978) theory of typicality effects. Typicality depends more on the family resemblances among items, whereas associative frequency may be expected to reflect local differences in language use and item familiarity. Typicality would therefore be less sensitive to transatlantic variation. Other explanations of this result could of course be found (for instance in the difference in date and region between the two USA studies), but the result certainly suggests that associative frequency is more sensitive to cultural differences than is rated typicality.

The role of familiarity in category internal structure

The final set of analyses investigated the intercorrelation of the three measures, and the role of familiarity in category structure. Scatterplots of associative frequency with typicality and familiarity showed a marked non-linearity. This is largely due to the positive skewness of all three measures, coupled with the *negative* correlation between associative frequency and the other two measures (as they were scaled). Since correlations measure the linear relationship between two variables, associative frequency was transformed to reduce the curvilinearity by defining LOGF = $\log_{10}(AF+1)$, where AF is the associative frequency. LOGF had skewness −0·05 and kurtosis −1·13, thus slightly reversing the skew of the distribution. Scatterplots revealed no obvious further curvilinearity. All references to associative frequency hereafter refer to the transformed variable.

Table 4 shows the product moment correlations for each pair of measures, and the partial correlations for each pair holding the third measure constant. The most highly correlated pair was typicality with associative frequency (mean −0·76). Familiarity was about equally correlated with the other two measures (means of 0·54 with typicality and −0·61 with associative frequency). The correlations were all below the levels of reliability shown in Table 2, indicating that the variance *not* common to any pair is not solely attributable to error in measurement.

If McCloskey (1980) was correct in hypothesizing that most of the internal variation of category items is attributable to differences in familiarity, then it follows that, if familiarity is held constant, the correlation between typicality and associative frequency should be substantially reduced. Table 4 shows that this was not the case. Partial correlations of rated typicality with associative frequency while holding familiarity constant were all significant at 0·01 on a two-tailed test. The mean was −0·63 (compared with a mean simple correlation of −0·76). Familiarity does not therefore play a central role in internal category structure

Another way to interpret the partial correlations is to ask what the best predictor of associative frequency was. Thus the generation task can be taken as the dependent variable, while the two sets of ratings are then used to predict the probability of an item being produced. Table 4 then shows that typicality is a reasonably good predictor of associative frequency (mean partial $r = -0{\cdot}63$), whereas familiarity is much worse (mean partial $r = -0{\cdot}35$).

Considering the individual categories separately, the partial correlations reveal an intriguing difference between three of the categories and the rest, in the level of the partial correlation of familiarity with associative frequency, holding typicality constant. What makes the difference intriguing is that the three categories with high values for this correlation are all types of *creature* (*fish*, *birds* and *insects*). Table 4 shows mean values of the partial correlations for creatures versus the remaining categories. If this *post hoc* analysis is accepted, then the conclusion appears to be that for categories of creatures, typicality and familiarity are both involved in determining associative frequency, whereas

Table 4. Simple and first-order partial correlations between typicality (TYP), familiarity (FAM) and log associative frequency (AF)

Category	*n*	Simple correlations			First-order partial correlations		
		TYP-FAM	TYP-AF	FAM-AF	TYP-FAM ·(AF)	TYP-AF ·(FAM)	FAM-AF ·(TYP)
Birds	52	0·58*	−0·70*	−0·75*	0·12	−0·49*	−0·59*
Clothing	55	0·60*	−0·71*	−0·63*	0·28	−0·54*	−0·36*
Fish	37	0·76*	−0·79*	−0·85*	0·27	−0·42*	−0·62*
Flowers	46	0·82*	−0·90*	−0·79*	0·41*	−0·71*	−0·21
Food flavours	40	0·51*	−0·77*	−0·44*	0·30	−0·71*	−0·09
Fruit	43	0·52*	−0·87*	−0·52*	0·16	−0·82*	−0·16
Furniture	41	0·40*	−0·81*	−0·53*	−0·06	−0·77*	−0·39*
Insects	34	0·51*	−0·70*	−0·82*	−0·16	−0·57*	−0·75*
Sports	48	0·27**	−0·75*	−0·35*	0·01	−0·72*	−0·23
Vegetables	41	0·67*	−0·86*	−0·66*	0·27	−0·75*	−0·22
Vehicles	54	0·52*	−0·71*	−0·55*	0·22	−0·59*	−0·30*
Weapons	40	0·37*	−0·57*	−0·47*	0·14	−0·48*	−0·34*
Means:		0·54*	−0·76*	−0·61*	0·16	−0·63*	−0·35*
Creatures:		0·62*	−0·73*	−0·81*	0·08	−0·49*	−0·65*
Others:		0·52*	−0·77*	−0·55*	0·19	−0·68*	−0·26

* $P < 0{\cdot}01$; ** $P < 0{\cdot}05$.

for the other categories, only typicality is important. An explanation for this may be found in a distinction introduced by Rosch *et al.* (1976) between basic and superordinate levels of concepts. According to their data, *fish*, *birds* and *insects* are all categories at the basic level, that is, they have a high degree of inter-item similarity, can be visualized as a generic image, and are the first level of a semantic hierarchy that children learn. (For other correlated distinctions see Rosch *et al.*, 1976). All of our remaining categories, with the exception of *flowers*, are at the superordinate concept level. It is tempting to suggest that, because of the higher inter-item similarity, the basic level categories show less marked typicality effects, and therefore the familiarity with different items is more crucial in determining which category members are generated. Superordinate categories are a more heterogeneous collection of items, and therefore featural overlap (and hence rated typicality) is more critical in generating category members. It only remains then to explain why *flowers* do not fall into the expected group of categories. The answer may lie in the strong collinearity of the three measures in this category (*r*s of −0·79, 0·82 and −0·90) which renders partial correlations particularly unstable. It is the case that, on the simple correlations, the four highest values for the correlation of familiarity with associative frequency occur in the categories of *fish*, *insects*, *flowers* and *birds*.

Our final analysis investigated the role of familiarity in category structure in a different way. Malt & Smith (1982) investigated the finding of Ashcraft (1978) that the number of properties a person can generate for a word is a good predictor of that word's rated typicality. Malt & Smith (1982) argued that this could be a better measure of familiarity than the ratings used by McCloskey (1980), since it measures the familiarity of the referred-to object, rather than the familiarity of the object's name. Malt & Smith (1982) provide values of this variable in seven of our categories based on a sample of 240 students. They also provide mean typicality ratings. We can therefore compare their data with our own to test this fourth variable. One of the categories (*furniture*) was dropped

Table 5. Correlations between rated typicality (TR) and number of properties (NP) taken from Malt & Smith (1982), and typicality (TYP), familiarity (FAM) and log associative frequency (AF) from the present study.

		TR correlated with				NP correlated with			TYP with		FAM with
Category	*n*	NP	TYP	FAM	AF	TYP	FAM	AF	FAM	AF	AF
Birds	12	0·63*	−0·71*	−0·67*	0·86*	−0·14	−0·67*	0·66*	0·42	−0·70*	−0·72*
Clothing	10	0·12	−0·82*	−0·09	0·15	−0·42	−0·38	0·59	0·35	−0·53	−0·93*
Fish	9	0·07	−0·89*	−0·37	0·38	0·07	−0·87*	0·84*	0·27	−0·25	−0·94*
Flowers	12	0·66*	−0·86*	−0·64*	0·88*	−0·82*	−0·89*	0·81*	0·84*	−0·94*	−0·84*
Fruit	13	0·49	−0·94*	−0·59*	0·87*	−0·47	−0·42	0·40	0·74*	−0·93*	−0·65*
Vehicles	9	0·60	−0·89*	−0·90*	0·88*	−0·33	−0·66	0·57	0·72*	−0·71*	−0·99*
Means:		0·43	−0·85	−0·49	0·67	−0·35	−0·65	0·65	0·56	−0·68	−0·85

* $P < 0·05$, two-tailed.

Note. TR and TYP were scored in opposite directions.

because the degree of sample overlap was very small and the range of number of properties within this overlap was too small to allow a reliable analysis. In the remaining six categories, the overlap sample ranged from 9 to 13 words, and the range of number of properties was at least 2·5. Correlations were calculated for each category between all pairs of the following five variables: Malt & Smith's typicality ratings (TR) and number of properties measure (NP), and the measures of typicality (TYP), familiarity (FAM) and associative frequency (AF) presented here. Table 5 shows the results. The two sets of typicality ratings (TR and TYP) were correlated at −0·85 (cf. the similar result in Table 3) and each correlated with familiarity and associative frequency in an equivalent way. The correlations of TR with NP were also broadly the same on these reduced sample sizes as those reported for the complete sample used by Malt & Smith (1982). The reduction in sample size does not therefore appear to have introduced any new sampling bias.

Number of properties correlated highest with familiarity (−0·65) and associative frequency (0·65) and least with typicality (−0·35). *Flowers* were the only category in which number of properties was significantly correlated with rated typicality. Partial correlational analysis confirmed the lack of involvement of NP in rated typicality. The mean correlation of NP with TYP holding familiarity constant was 0·04, whereas the mean correlation of NP with familiarity holding typicality constant was −0·55 (significant in three of six categories). While accepting the *post hoc* nature of the analysis and the small numbers of items, the important conclusion can nevertheless be provisionally drawn that number of properties is *not* a confounding variable in typicality ratings. Its apparent correlation with rated typicality can be entirely attributed to its correlation with rated familiarity. From our data, a direct rating of familiarity appears to be a better measure of the effects of familiarity on typicality than the number of properties people can generate. Confirmation of this finding requires data to be obtained that will confront this question more directly.

General discussion

As expected, the three measures of category internal structure were intercorrelated. However, there was also evidence that they reflect different sources of variance and do not derive from a single underlying factor. It is of course impossible to decide on the basis of the present data which, if any, of the measures should be considered as more reflective of the way memory for category items is structured. Nevertheless, the provision of these norms will allow researchers to attempt to separate out the effects of each dimension on other dependent variables, and to avoid confounding of one measure with another when selecting experimental materials. It must also be noted that familiarity as defined operationally in the norms relates to familiarity *in the context of a category list*. The relation of this measure to familiarity in a broader context requires empirical clarification if the words are to be used for between-category designs.

Analysis of the results has revealed a number of interesting patterns. These may be summarized as follows. The reliability of typicality and familiarity ratings was inversely correlated across categories; this was attributable to differences in the variance of familiarity ratings for different categories. Rated typicality may be more consistent between Britain and the USA than measures of associative frequency. Familiarity was shown *not* to be the critical variable in category structure. Rated typicality was still well correlated with associative frequency when rated familiarity was held constant. Rated typicality was also a better predictor of associative frequency than familiarity was, although this was not true for basic level categories, where both variables independently predicted associative frequency. Finally, when rated familiarity was held constant, the number of properties people can generate for an item was not related to rated typicality or associative frequency, so that the rating procedure is to be preferred to the property generation task as a familiarity measure.

It is hoped that the normative data presented in the Appendix, and the pattern of correlations they reveal, will be of use to other researchers in their attempts to discover the structure underlying all the different measures of intra-category variation.

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Appendix

Birds

Word	TYP	FAM	AF	NR	NU
Blackbird	1·000	1·097	45 (9)	—	—
Sparrow	1·047	1·032	48 (14)	—	—
Robin	1·093	1·129	45 (6)	—	—
Starling	1·182	1·484	23 (2)	—	—
Thrush	1·186	1·387	21 (2)	—	1
Pigeon	1·250	1·097	26 (3)	—	—
Crow	1·256	1·323	20 (2)	—	—
Seagull	1·364	1·226	25 (2)	—	—
Swallow	1·419	1·581	29 (7)	—	—
Wren	1·465	1·613	11 —	—	—
Dove	1·477	1·548	8 (1)	—	—
Cuckoo	1·535	1·290	6 —	—	—
Hawk	1·698	1·613	25 (1)	—	—
Woodpecker	1·727	1·452	9 —	—	—
Swift	1·732	1·903	6 —	—	2
Raven	1·744	1·645	7 —	—	—
Nightingale	1·773	1·903	9 (1)	—	—
Owl	1·773	1·161	22 —	—	—
Eagle	1·791	1·355	45 (3)	—	—
Lark	1·795	2·452	7 —	—	—
Parrot	1·837	1·290	20 —	—	—
Pheasant	1·930	1·516	4 —	—	—
Canary	1·953	1·258	14 —	—	—
Budgerigar	1·977	1·419	19 (1)	—	—
Swan	2·000	1·194	19 (3)	—	—
Chicken	2·070	1·097	8 —	—	—
Duck	2·159	1·194	21 —	—	—
Hen	2·182	1·129	7 (1)	—	—
Falcon	2·182	2·161	5 —	—	—
Albatross	2·205	2·097	4 —	—	—
Vulture	2·295	1·742	10 —	—	—
Peacock	2·295	1·516	2 —	—	—
Goose	2·302	1·452	10 —	—	—
Turkey	2·302	1·258	3 —	—	—
Warbler	2·310	3·032	3 —	1	2
Osprey	2·326	2·290	6 (1)	—	1
Heron	2·326	2·000	10 —	—	1
Grouse	2·372	2·258	— —	—	—
Stork	2·476	1·742	3 —	—	1
Buzzard	2·477	2·484	2 —	—	—
Cockatoo	2·548	2·194	2 —	—	2
Flamingo	2·651	1·806	8 (1)	—	—
Tern	2·714	3·677	1 —	2	5
Pelican	2·721	1·613	8 —	—	—
Puffin	2·905	1·968	4 —	—	1
Woodcock	2·905	3·161	— —	1	2
Quail	2·977	2·968	— —	1	1
Condor	3·023	3·516	1 —	2	5

Birds

Word	TYP	FAM	AF	NR	NU
Ostrich	3·047	1·742	12 —	—	1
Toucan	3·143	3·161	3 —	2	3
Penguin	3·227	1·323	9 —	1	—
Emu	3·512	1·839	4 —	2	1

Blue tit (34; 1), chaffinch (12; 0), finch (10; 1), magpie (10; 1), kingfisher (10; 1), house martin (8; 0), jay (8; 0), kestrel (8; 0), rook (8; 0), greenfinch (5; 0), jackdaw (5; 0), crane (4; 1), parakeet (4; 0).

Clothing

Word	TYP	FAM	AF	NR	NU
Dress	1·000	1·100	41 (7)	—	—
Skirt	1·022	1·233	49 (3)	—	—
Trousers	1·022	1·000	55 (2)	—	—
Shirt	1·044	1·033	57 (6)	—	—
Jeans	1·067	1·000	17 (4)	—	—
Jumper	1·178	1·133	44 (6)	—	—
Jacket	1·244	1·100	38 (3)	—	—
Suit	1·267	1·167	4 (1)	—	—
Blouse	1·289	1·133	36 (2)	—	—
Coat	1·289	1·067	45 (2)	—	—
Cardigan	1·422	1·500	24 (1)	—	—
Overcoat	1·467	1·500	6 —	—	—
Socks	1·600	1·067	60 (3)	—	—
Brassiere	1·756	1·433	— —	—	—
Slacks	1·778	2·100	1 —	—	—
Anorak	1·822	1·300	5 —	—	—
Pants	1·822	1·233	21 (2)	—	—
Dungarees	1·844	1·833	7 —	—	—
Tights	1·955	1·367	26 —	—	1
Vest	1·956	1·400	25 —	—	—
Shorts	2·000	1·233	20 —	—	—
Stockings	2·044	1·367	18 —	—	—
Parka	2·070	1·900	— —	—	2
Mackintosh	2·136	2·100	11 —	—	1
Pyjamas	2·205	1·300	2 —	—	1
Waistcoat	2·333	1·600	15 —	—	—
Bikini	2·444	1·433	2 —	—	—
Pinafore	2·444	2·167	1 —	—	—
Smock	2·523	2·767	1 —	—	1
Sari	2·545	2·767	— —	—	2
Scarf	2·644	1·333	24 —	1	—
Overalls	2·667	1·767	1 —	1	—
Shawl	2·733	1·800	2 —	—	—
Swimsuit	2·756	1·367	— —	1	—
Tie	2·800	1·167	32 —	1	—
Tunic	2·800	2·133	— —	1	—
Gloves	2·844	1·333	19 —	—	—

Clothing

Word	TYP	FAM	AF	NR	NU
Hat	2·844	1·467	37 (14)	1	—
Bathrobe	2·867	1·533	1 —	1	—
Romper suit	2·933	2·833	— —	—	—
Sandals	3·067	1·367	5 —	4	—
Belt	3·133	1·300	7 —	5	—
Mittens	3·133	2·000	1 —	—	—
Cravat	3·289	2·300	1 —	1	—
Slippers	3·289	1·367	1 —	4	—
Beret	3·333	1·733	— —	2	—
Bow tie	3·341	1·633	— —	1	1
Corset	3·356	2·300	2 —	—	—
Girdle	3·356	2·267	1 —	—	—
Apron	3·511	1·567	— —	5	—
School cap	3·600	1·767	— —	1	—
Cassock	3·614	3·667	— —	3	2
Bolero	3·644	3·967	1 —	2	8
Cricket cap	3·978	2·067	— —	1	—
Turban	4·067	2·433	— —	3	—

Shoes (45; 6), bra (22; 2), T-shirt (22; 0), boots (15; 0), knickers (12; 0), pullover (11; 2), petticoat (11; 0), sweater (6; 1), leg warmers (6; 0), underpants (6; 0), underwear (6; 0), raincoat (4; 0), slip (4; 0).

Fish

Word	TYP	FAM	AF	NR	NU
Cod	1·040	1·129	53 (14)	—	—
Trout	1·120	1·290	43 (11)	—	—
Salmon	1·120	1·161	47 (5)	—	—
Herring	1·140	1·613	32 (3)	—	1
Mackerel	1·160	1·516	32 (1)	—	1
Plaice	1·260	1·355	42 (2)	—	—
Haddock	1·260	1·355	31 (2)	—	—
Sole	1·640	1·645	13 (1)	—	—
Whiting	1·688	2·452	8 —	1	3
Halibut	1·688	2·032	15 (1)	—	3
Tuna	1·700	1·484	14 (1)	—	—
Sardine	1·720	1·355	18 —	—	—
Pike	1·735	2·097	21 (5)	—	1
Bass	1·771	2·258	5 —	1	3
Pilchard	1·816	1·548	9 —	—	2
Carp	1·920	2·290	10 (2)	—	2
Perch	1·980	2·452	14 —	—	2
Whitefish	2·020	3·000	— —	—	4
Bream	2·222	3·032	12 (2)	—	8
Stickleback	2·306	2·097	12 —	—	2
Minnow	2·320	2·387	5 —	—	—
Piranha	2·340	1·677	6 —	—	—

Fish

Word	TYP	FAM	AF	NR	NU
Flounder	2·400	3·452	1 —	—	12
Mullet	2·413	3·129	3 —	—	7
Tench	2·477	3·097	4 (1)	—	10
Swordfish	2·560	1·677	10 (1)	—	—
Shark	2·580	1·161	34 (3)	2	—
Chub	2·591	3·129	2 —	1	10
Sturgeon	2·694	3·290	2 —	2	5
Guppy	2·696	3·323	6 —	—	9
Anchovy	2·878	2·355	1 —	5	3
Barracuda	2·915	2·710	1 —	1	5
Ray	3·020	2·548	1 —	1	2
Eel	3·240	1·742	17 (1)	3	—
Turbot	3·583	4·484	— —	4	28
Lamprey	3·591	4·258	— —	5	16
Shad	3·917	5·129	— —	4	29

Goldfish (26; 5), roach (14; 2), dogfish (14; 1), catfish (12; 0), angel-fish (11; 0), skate (9; 0), prawn (8; 0), whale (7; 1), shrimp (7; 0), whitebait (6; 1), hake (5; 1), crab (5; 0), dace (5; 0), dolphin (5; 0), kipper (5; 0), rock-fish (5; 0), coley (4; 0), jellyfish (4; 0), lobster (4; 0), sprat (4; 0).

Flowers

Word	TYP	FAM	AF	NR	NU
Rose	1·040	1·032	64 (22)	—	—
Daffodil	1·100	1·194	48 (9)	—	—
Carnation	1·120	1·129	20 (1)	—	—
Tulip	1·140	1·194	39 (3)	—	—
Daisy	1·180	1·194	46 (12)	—	—
Buttercup	1·240	1·161	32 (1)	—	—
Chrysanthemum	1·260	1·516	26 —	—	—
Pansy	1·306	1·645	20 (5)	—	1
Primrose	1·340	1·645	11 (4)	—	—
Snowdrop	1·340	1·419	13 —	—	—
Poppy	1·380	1·387	11 (1)	1	—
Marigold	1·400	1·645	12 —	—	—
Violet	1·420	1·774	14 —	—	—
Bluebell	1·460	1·581	15 (1)	—	—
Crocus	1·460	1·581	12 —	—	—
Orchid	1·531	1·452	11 —	—	1
Geranium	1·560	1·742	10 —	—	1
Dahlia	1·560	1·968	16 (1)	—	—
Iris	1·680	2·194	14 (1)	—	—
Lily	1·700	1·935	16 —	—	—
Gladioli	1·735	2·484	7 (1)	—	2
Hyacinth	1·776	2·129	9 (9)	—	2
Narcissus	1·854	2·774	6 —	1	2
Petunia	1·854	2·774	6 —	—	3
Azalea	1·959	3·065	3 (1)	1	4

Flowers

Word	TYP	FAM	AF	NR	NU
Rhododendron	1·980	1·645	7 —	1	1
Begonia	2·063	2·710	6 (1)	—	3
Freesia	2·091	2·871	5 —	—	8
Magnolia	2·140	2·774	— —	1	—
Nasturtium	2·239	3·484	6 —	1	10
Lilac	2·280	1·903	3 —	1	—
Sweetpea	2·300	1·581	5 —	2	—
Anemone	2·319	2·645	5 (1)	2	7
Cowslip	2·340	2·290	4 —	—	—
Lavender	2·340	1·903	4 —	—	—
Dandelion	2·360	1·226	17 —	3	—
Peony	2·364	3·935	2 —	1	18
Waterlily	2·500	1·710	1 —	2	—
Aster	2·500	3·581	2 —	1	15
Gardenia	2·522	3·968	1 —	—	7
Jasmine	2·532	2·871	— —	2	3
Camellia	2·605	3·774	1 —	—	12
Lotus	2·813	2·645	— —	2	3
Jonquil	3·139	5·419	— —	2	35
Zinnia	3·229	5·419	— —	2	37
Phlox	3·270	5·226	— —	2	33

Sunflower (12; 2), hydrangea (8; 1), fuchsia (6; 0) lily of the valley (6; 0), cornflower (5; 1), forget-me-not (5; 0), honeysuckle (5; 0), wallflower (5; 0), foxglove (4; 0).

Food flavourings

Word	TYP	FAM	AF	NR	NU
Garlic	1·186	1·516	27 —	—	—
Salt	1·233	1·000	51 (13)	—	—
Pepper	1·256	1·065	44 (3)	—	—
Sugar	1·558	1·000	17 (4)	1	—
Ginger	1·674	1·419	10 —	—	—
Mustard	1·814	1·258	12 —	—	—
Vanilla	1·814	1·226	25 (13)	—	—
Cinnamon	1·860	2·000	18 (3)	—	—
Allspice	1·878	3·323	3 —	1	9
Sage	1·884	2·000	19 —	—	—
Mint	1·884	1·258	4 (1)	—	—
Nutmeg	1·953	2·032	11 —	—	—
Curry	2·000	1·387	21 (4)	3	—
Thyme	2·047	2·290	27 —	—	—
Cloves	2·070	2·129	8 —	—	—
Vinegar	2·093	1·065	13 (1)	—	—
Rosemary	2·233	2·484	17 —	—	—
Paprika	2·238	2·968	16 (2)	1	4
Bayleaf	2·302	2·355	4 —	—	—
Chives	2·302	2·065	2 —	—	—

Food flavourings

Word	TYP	FAM	AF	NR	NU
Basil	2·333	2·774	7 —	—	2
Peppercorn	2·415	2·161	— —	1	4
Peppermint	2·442	1·226	5 (3)	2	—
Cayenne	2·452	3·452	2 —	1	8
Saccharin	2·535	1·806	— —	5	—
Oregano	2·576	3·710	10 —	2	15
Cocoa	2·674	1·290	2 —	3	—
Tarragon	2·744	3·581	5 —	2	13
Turmeric	2·763	4·452	3 —	1	20
Chocolate	2·791	1·032	9 (1)	3	—
Pickle	2·837	1·258	— —	3	—
Dill	2·846	3·097	5 —	2	7
Cardamon	2·966	5·387	1 —	1	35
Cumin	2·972	5·161	1 —	5	27
Marjoram	3·024	3·710	5 —	2	11
Sesame	3·171	3·387	1 —	3	7
Mayonnaise	3·233	1·290	— —	4	—
Borage	3·607	5·484	— —	2	35
Chervil	3·645	5·290	— —	3	30
Oil	4·326	1·226	1 —	13	—

Spices (20; 2), herbs (20; 1), chilli (13; 1), lemon (13; 0), tomato puree (9; 1), coffee (9; 0), orange (8; 2), almond (7; 1), rum (6; 2), sauces (6; 1), tomato sauce (6; 1), Oxo (5; 1), beef stock (5; 0), monosodium glutamate (4; 2), black pepper (4; 1), Bovril (4; 0), cochineal (4; 0), essences (4; 0), peppers (4; 0), strawberry (4; 0), wine (4; 0).

Fruit

Word	TYP	FAM	AF	NR	NU
Apple	1·023	1·063	69 (30)	—	—
Orange	1·023	1·031	63 (18)	—	—
Pear	1·163	1·188	61 (3)	—	—
Banana	1·233	1·125	53 (4)	—	—
Grapefruit	1·256	1·281	24 —	—	—
Strawberry	1·256	1·219	30 —	—	—
Grape	1·279	1·406	38 —	—	—
Plum	1·302	1·281	33 (1)	—	—
Pineapple	1·419	1·438	29 (1)	—	—
Cherry	1·419	1·469	19 —	—	—
Peach	1·419	1·469	39 —	—	—
Lemon	1·512	1·188	31 —	—	—
Tangerine	1·512	1·719	17 —	—	—
Mandarin	1·605	2·031	7 —	—	—
Satsuma	1·643	2·094	7 —	—	1
Raspberry	1·651	1·438	27 —	—	—
Blackberry	1·721	1·469	26 —	—	—
Melon	1·814	1·406	26 (3)	—	—
Apricot	1·814	1·656	10 —	—	—

Fruit

Word	TYP	FAM	AF	NR	NU
Blackcurrant	1·881	1·594	13	—	1
Gooseberry	2·047	1·688	13	—	—
Lime	2·093	1·906	17	—	—
Water-melon	2·140	1·594	2	—	—
Damson	2·195	3·000	6	—	4
Redcurrant	2·429	2·438	4	—	3
Nectarine	2·615	3·125	16	2	7
Avocado	2·714	2·063	11	—	1
Elderberry	2·714	2·906	3	1	2
Mango	2·791	2·750	17 (4)	—	1
Blueberry	2·814	2·844	7	—	—
Cranberry	2·814	2·781	—	—	—
Pomegranate	2·837	2·594	16	—	—
Fig	2·837	2·031	7	—	—
Prune	2·884	1·781	3 (1)	2	—
Date	2·929	1·625	7	—	1
Raisin	3·093	1·563	1	2	1
Greengage	3·103	3·469	3	—	8
Guava	3·485	4·469	2	2	23
Coconut	3·581	1·688	3	5	—
Olive	3·907	2·063	1	6	—
Pumpkin	4·093	2·313	—	7	—
Almond	4·721	1·719	—	20	—
Acorn	5·023	2·000	—	21	1

Passion-fruit (16; 0), kiwi-fruit (6; 0), loganberry (6; 0), lichi (4; 0), pawpaw (4; 0).

Furniture

Word	TYP	FAM	AF	NR	NU
Chair	1·000	1·065	66 (45)	—	—
Armchair	1·039	1·097	22 (3)	—	—
Table	1·039	1·032	67 (15)	—	—
Sofa	1·098	1·323	22 (1)	—	—
Settee	1·098	1·516	23	—	—
Bed	1·176	1·032	50 (2)	—	—
Wardrobe	1·216	1·258	40 (1)	—	—
Couch	1·216	1·935	4	—	—
Suite	1·471	1·903	—	—	—
Dresser	1·510	1·839	8	—	—
Desk	1·529	1·323	31 (1)	—	—
Sideboard	1·569	1·677	23	—	—
Cupboard	1·647	1·258	26	1	—
Stool	1·706	1·355	28 (1)	—	—
Cabinet	1·765	1·774	17	—	—
Bookcase	1·824	1·419	13	—	—
Bureau	2·000	2·226	5	1	—
Cot	2·118	2·065	—	—	—

Furniture

Word	TYP	FAM	AF	NR	NU
Chest	2·216	1·742	4 —	1	—
Bench	2·235	1·484	3 —	—	—
Bunk	2·392	1·677	— —	2	—
Shelves	2·627	1·355	10 —	2	—
Tallboy	3·000	3·935	4 —	2	9
Sink unit	3·588	1·645	4 —	6	—
Deckchair	3·725	1·548	1 —	5	—
Wall mirror	3·961	1·581	— —	10	—
Bar	4·039	1·452	1 —	11	—
Screen	4·039	2·355	— —	5	—
Bottle rack	4·118	2·129	— —	7	—
Pew	4·294	2·452	— —	11	—
Spice rack	4·314	2·032	— —	9	—
Trolley	4·471	1·774	1 —	15	—
Wastepaper basket	4·471	1·290	— —	14	—
Counter	4·480	2·032	— —	13	1
Hammock	4·529	2·258	— —	15	—
Painting	4·804	1·677	1 —	21	—
Garden swing	4·824	1·968	— —	19	—
Park bench	5·000	1·935	— —	25	—
Ashtray	5·137	1·452	1 —	23	—
Altar	5·176	1·935	— —	27	—
Library steps	5·380	2·258	— —	31	1

Lamp (25; 0), chest of drawers (24; 0), dressing-table (20; 0), carpet (17; 0), coffee-table (13; 0), television (9; 0), bedside table (8; 0), rug (7; 0), pouffe (5; 0), bath (4; 0), cooker (4; 0), curtains (4; 0), drawers (4; 0), fridge (4; 0).

Insects

Word	TYP	FAM	AF	NR	NU
Fly	1·116	1·031	44 (15)	—	—
Ant	1·116	1·031	49 (22)	—	—
Beetle	1·214	1·156	34 (3)	1	1
Cockroach	1·349	1·875	28 (4)	—	—
Earwig	1·349	1·750	10 —	—	1
Gnat	1·372	2·063	8 —	—	—
Mosquito	1·429	1·625	29 —	—	1
Wasp	1·442	1·250	41 (3)	1	1
Flea	1·465	1·375	14 (1)	—	—
Bee	1·465	1·000	45 (3)	1	—
Cricket	1·512	1·625	3 —	—	—
Ladybird	1·595	1·375	17 (2)	1	1
Termite	1·643	2·344	7 —	—	2
Dragonfly	1·651	1·469	24 —	—	—
Locust	1·651	1·469	7 —	—	—
Moth	1·674	1·156	19 —	1	—

Insects

Word	TYP	FAM	AF	NR	NU
Mite	1·707	2·969	3	—	3
Hornet	1·814	2·250	9	1	1
Whitefly	1·927	4·094	—	—	12
Caterpillar	2·070	1·219	10	2	—
Tick	2·071	2·844	5	1	4
Aphid	2·079	3·000	3	2	9
Butterfly	2·093	1·063	30 (2)	1	—
Spider	2·214	1·031	40 (9)	8	1
Louse	2·302	2·344	7	3	1
Centipede	2·674	1·781	10	7	—
Lacewings	2·750	4·906	1	1	19
Silverfish	3·108	4·313	1	6	9
Mantis	3·154	3·344	—	5	7
Tarantula	3·262	2·125	1	8	1
Cicada	3·517	5·281	—	6	34
Scorpion	3·651	1·500	3	13	—
Thrip	3·714	5·438	—	4	44
Worm	4·209	1·063	4	20	—

Housefly (13; 2), woodlouse (9; 0), daddy-long-legs (8; 0), grasshopper (8; 0), bluebottle (7; 0), greenfly (7; 0), stick-insect (7; 0), horsefly (5; 0), midge (4; 0), millipede (4; 0).

Sports

Word	TYP	FAM	AF	NR	NU
Soccer	1·000	1·129	11 (2)	—	—
Rugby	1·000	1·097	47 (3)	—	—
Tennis	1·022	1·032	53 (15)	—	—
Badminton	1·133	1·097	41 (3)	—	—
Basketball	1·178	1·355	19	—	—
Hockey	1·200	1·387	45 (5)	—	—
Squash	1·267	1·226	42 (9)	—	—
Swimming	1·400	1·129	49 (3)	—	—
Baseball	1·523	2·065	13	—	1
Running	1·556	1·226	19 (1)	—	—
Golf	1·733	1·419	17 (3)	—	—
Volleyball	1·756	1·710	17	—	—
Ping-pong	1·844	1·742	—	—	—
Boxing	1·956	1·516	9 (1)	—	—
Sailing	1·956	1·194	9	—	—
Javelin	1·978	1·613	7	—	—
Discus	2·000	1·677	5	—	—
Racing	2·044	1·419	—	1	—
Lacrosse	2·089	3·000	15	—	—
Skiing	2·111	1·387	14 (1)	—	—
Gymnastics	2·178	1·710	12 (1)	—	—
Rowing	2·182	1·258	6	—	1
Polo	2·356	2·226	4	—	—

Sports

Word	TYP	FAM	AF	NR	NU
Riding	2·378	1·484	17 (1)	—	—
Fencing	2·400	1·645	7 —	—	—
Handball	2·409	2·774	2 —	—	2
Archery	2·444	1·613	6 —	—	—
Canoeing	2·467	1·226	13 —	—	—
Wrestling	2·489	1·742	5 —	—	—
Judo	2·545	1·677	6 (1)	—	1
Diving	2·556	1·677	5 —	—	—
Bowls	2·578	1·581	6 —	—	—
Snooker	2·689	1·290	1 —	3	—
Skating	2·689	1·419	3 —	—	—
Mountaineering	2·711	1·484	3 —	1	—
Rifleshooting	2·756	1·548	2 —	—	—
Karate	2·867	1·645	5 —	—	—
Trampolining	2·978	1·903	— —	—	—
Billiards	3·044	1·806	1 —	5	—
Fishing	3·156	1·258	6 —	1	—
Pool	3·244	1·548	1 —	9	—
Surfing	3·267	1·581	1 —	—	—
Croquet	3·356	2·097	4 —	2	—
Hunting	3·911	1·742	2 —	7	—
Potholing	4·156	1·968	— —	6	—
Hiking	4·156	1·452	1 —	10	—
Ballet	5·133	1·710	— —	26	—
Dancing	5·156	1·419	1 —	24	—

Cricket (36; 6), athletics (24; 0), rounders (11; 1), long jump (9; 0), darts (8; 0), high jump (8; 0), hurdling (7; 0), ice hockey (6; 0), wind-surfing (6; 0), cross-country (5; 0), hang-gliding (5; 0), parachuting (5; 0), climbing (4; 0), cycling (4; 0), ice-skating (4; 0), jogging (4; 0), motor racing (4; 0), scuba-diving (4; 0), water polo (4; 0).

Vegetables

Word	TYP	FAM	AF	NR	NU
Carrot	1·000	1·033	62 (21)	—	—
Cabbage	1·021	1·000	56 (10)	—	—
Cauliflower	1·104	1·133	41 (3)	—	—
Bean	1·125	1·100	32 —	—	—
Pea	1·146	1·033	50 (2)	1	—
Potato	1·146	1·000	57 (11)	—	—
Sprouts	1·149	1·033	20 —	—	—
Onion	1·375	1·067	38 (7)	—	—
Lettuce	1·447	1·100	32 (1)	—	—
Swede	1·543	1·967	29 (1)	—	1
Turnip	1·604	1·300	31 —	—	—
Sweetcorn	1·622	1·067	10 —	—	2
Broccoli	1·638	1·700	20 (1)	—	1
Leek	1·667	1·367	18 (1)	—	—

Vegetables

Word	TYP	FAM	AF	NR	NU
Spinach	1·681	1·533	15 (2)	—	—
Parsnip	1·702	1·667	18 —	—	1
Beetroot	1·766	1·300	15 (1)	—	—
Cucumber	1·936	1·267	14 —	—	—
Celery	1·957	1·367	16 —	—	—
Asparagus	1·958	2·067	11 —	—	—
Courgette	1·977	1·867	12 —	—	5
Mushroom	2·021	1·100	5 —	4	—
Radish	2·125	1·500	7 —	—	—
Marrow	2·170	1·933	17 (2)	—	1
Aubergine	2·417	2·700	17 (2)	2	2
Watercress	2·457	1·600	3 —	2	2
Lentils	2·604	2·167	3 —	2	—
Artichoke	2·604	2·567	6 (1)	—	—
Shallot	2·689	3·700	1 —	—	9
Tomato	2·771	1·000	33 (1)	12	—
Gherkin	2·936	2·133	— —	—	1
Pepper	3·063	1·333	16 —	5	—
Kale	3·156	4·233	4 —	1	11
Pumpkin	3·292	2·333	2 —	4	—
Parsley	3·404	1·233	— —	7	—
Yam	3·435	3·600	2 —	3	5
Chicory	3·511	2·967	— —	6	—
Fennel	3·512	4·700	— —	4	19
Garlic	3·532	1·333	3 —	9	—
Chilli	3·565	2·333	2 —	5	1
Endive	3·575	4·833	1 —	5	22

Runner bean (13; 0), broad bean (8; 0), corn (8; 0), spring greens (6: 0), French beans (5; 0), green pepper (5; 0), spring onion (5; 0), kidney beans (4; 0).

Vehicles

Word	TYP	FAM	AF	NR	NU
Car	1·000	1·000	66 (58)	—	—
Bus	1·109	1·094	45 (2)	—	—
Taxi	1·174	1·219	5 (1)	—	—
Van	1·196	1·125	35 (1)	—	—
Lorry	1·370	1·125	50 (2)	—	—
Motorbike	1·522	1·031	34 (1)	—	—
Train	1·696	1·063	41 —	—	—
Jeep	1·696	1·781	2 —	—	—
Scooter	1·957	1·625	7 —	—	1
Tube-train	1·978	1·219	— —	—	—
Ambulance	2·089	1·219	3 —	—	1
Bicycle	2·109	1·031	45 —	1	—
Tram	2·435	2·125	18 —	—	—
Fire-engine	2·478	1·375	4 —	1	—

Vehicles

Word	TYP	FAM	AF	NR	NU
Aeroplane	2·630	1·094	23 —	2	—
Milk-float	2·778	1·594	4 —	2	1
Dustcart	2·804	1·969	— —	2	—
Carriage	2·848	1·656	4 —	—	—
Ferry	2·957	1·531	2 —	1	—
Hovercraft	2·978	1·531	9 —	1	—
Tractor	3·022	1·625	10 —	3	—
Boat	3·043	1·125	17 —	4	—
Cart	3·087	1·750	10 —	4	—
Helicopter	3·130	1·438	7 —	1	—
Tricycle	3·196	1·969	7 —	2	—
Ship	3·239	1·188	19 —	3	—
Car-ferry	3·283	1·625	— —	2	—
Bulldozer	3·391	1·969	1 —	2	—
Hydrofoil	3·432	2·469	1 —	2	4
Steamroller	3·478	1·938	2 —	2	—
Tank	3·478	1·563	12 —	3	—
Wheelchair	3·543	1·375	— —	4	—
Ocean liner	3·578	1·688	— —	4	1
Cablecar	3·696	1·938	— —	1	—
Rickshaw	3·773	2·906	3 —	4	5
Canoe	3·826	1·344	3 —	5	—
Pram	3·889	1·656	3 —	6	1
Spaceship	3·891	1·719	3 —	6	—
Airship	3·913	2·125	2 —	2	—
Sleigh	3·935	2·063	— —	5	—
Submarine	4·022	1·719	— —	8	—
Shuttle	4·023	2·563	— —	4	3
Glider	4·109	1·813	1 —	7	—
Sled	4·217	2·781	— —	6	3
Trolley	4·217	2·063	— —	8	—
Balloon	4·239	1·500	1 —	10	—
Toboggan	4·311	2·344	1 —	8	2
Dodgem	4·489	1·938	— —	9	1
Lift	4·500	1·313	— —	16	—
Hang-glider	4·565	1·656	— —	12	—
Raft	4·674	1·875	2 —	13	—
Skates	4·848	1·656	— —	15	—
Skateboard	4·891	1·594	3 —	17	—
Escalator	5·283	1·344	— —	28	—

Truck (20; 0), coach (17; 0), plane (13; 1), moped (10; 0), motorcycle (9; 0), horse (7;0), push-bike (7; 0), tandem (7; 0), wagon (6; 0) barge (5; 0), buggy (4; 0), Ford/Fiesta/Mini (4; 0), forklift truck (4; 0), juggernaut (4; 0), rocket (4; 0).

Weapons

Word	TYP	FAM	AF	NR	NU
Machine-gun	1·045	1·100	9	—	—
Revolver	1·068	1·233	6	—	—
Gun	1·068	1·000	59 (37)	—	—
Rifle	1·068	1·133	34 (4)	—	—
Pistol	1·091	1·100	22 (2)	—	—
Shotgun	1·273	1·200	3	—	—
Bomb	1·341	1·200	37 (3)	—	—
Sword	1·364	1·133	38 (5)	—	—
Grenade	1·386	1·600	15	—	1
Spear	1·535	1·400	24 (2)	—	1
Flick-knife	1·568	1·800	1	—	—
Bayonet	1·659	1·933	3	—	—
Arrow	1·705	1·267	15 (1)	—	—
Missile	1·773	1·300	7	—	—
Torpedo	1·818	1·567	5	—	—
Cannon	1·864	1·433	19	—	—
Knife	1·864	1·067	53 (7)	—	—
Crossbow	2·023	1·633	7	—	—
Explosive	2·068	1·333	2	—	—
Sabre	2·093	2·567	3	—	3
Landmine	2·114	1·900	—	—	—
Bazooka	2·119	2·567	3	—	6
Club	2·159	1·867	16	—	—
Axe	2·205	1·100	8	—	—
Mortar	2·205	2·133	5	2	1
Harpoon	2·591	1·967	1	1	—
Dynamite	2·614	1·300	—	2	—
Hatchet	2·628	2·167	3	1	1
Lance	2·682	2·267	6	2	—
Machete	2·744	2·967	2	2	5
Catapult	2·773	1·833	5	1	1
Cut-throat razor	2·864	1·833	—	2	—
Whip	3·045	1·400	3	—	—
Crowbar	3·114	1·833	1	—	—
Rocket	3·159	1·400	8	4	—
Sling shot	3·341	2·767	5	3	1
Chain	3·523	1·433	3	1	—
Laser	3·886	2·067	—	3	1
Dart	4·182	1·367	1	5	—
Hammer	4·205	1·300	5	6	—

Dagger (20; 1), bow and arrows (18; 0), truncheon (8; 0), nuclear bomb (7; 1), stick (7; 1), stone (7; 0), fist (6; 0), razor blade (5; 0), cutlass (5; 0), rope (5; 0), atom bomb (4; 1), airgun (4; 0), brick (4; 0), longbow (4; 0).