Appendix B

Norms for recognition experiments and cuing experiments using rhyme, stem, and fragment completion cues

Table 1

Quick reference for definitions of column names

Column Label	**Definition**
Targets	Normed Word
Sample Size	Number of participants
Set Size	Number of different target associates, or network size
Set Size + Idiosyncratic	Target set size + idiosyncratic responses
Frequency (K&F)	Printed frequency in Kucera & Francis (1967) norms
Concreteness (Scale 1-7)	Concreteness ratings for the target word
Homograph? (Letter=Yes)	Is the target a homograph? Letter indicates norms used
Part of Speech	Part of speech of the target determined by dictionary
Mean Connectivity	Mean number of associate-to-associate links for target
Connectivity Strength	Summed strength of target's associate-to-associate links
Resonance Probability	Probability that target's associates produce it as an associat
Resonance Strength	Summed strength of target's associate-to-target links
Accessibility Index	Number cues that produce the target as a response
Non-Responses	No response, illegible responses, swear words

Ending Stem Set Size	Number of different words produced in free association after hearing end of target as a rhyme cue
Ending Stem Strength	Probability of producing target in free association after hearing end of target as a rhyme cue
Beginning Stem Set Size	Number of different words produced in free association after hearing beginning letters of target as a cue
Beginning Stem Strength	Probability of producing target in free association after hearing beginning letters of target as a cue
Ending Fragment Cues	Words with missing letters replaced by spaces presented as free association cues
Ending Fragment Set Size	Number of different words produced in free association for visually presented ending fragment cue
Ending Fragment Strength	Probability of producing target in free association for visually presented ending fragment cue
Beginning Fragment Cues	Words with missing letters replaced by spaces presented as free association cues
Beginning Fragment Set Size	Number of different words produced in free association for visually presented beginning fragment cue
Beginning Fragment Strength	Probability of producing target in free association for visually presented beginning fragment cue

Appendix B presents the 5,000+ words normed in free association in Appendix A, along with columns of data that describe these words as individual entities as well as rhyme, stem, and fragment completion cues. The words are called targets here because the list is designed for use in single –item recognition experiments, and in cued recall experiments using non-semantic cues. As in cued recall experiments, higher degrees of control can be achieved in recognition memory experiments by selecting items that vary in one feature and simultaneously controlling other features likely to affect recognition performance. The same principle holds for non-semantic cues. As with meaning cues, non-semantic cues vary in set size and in the a priori strength of the cue-to-target link. Each of these variables has been shown to affect target recovery in cued recall and primed free association tasks.

The first 12 columns are obvious or were described in more detail in Appendix, and this information will not be repeated here. The ***Accessibility Index*** is new and it indicates the number of normed cues that produce the target as a response. For example, responses of FOOD, MONEY and WATER, were produced as associates, respectively, by 324, 302 and 276 of the normed words appearing in the database. We refer to these values as an accessibility index because they provide a measure of the ease with which a given word comes to mind in free association to a variety of different cues. High accessibility words are the ones that, in network terminology, form the hubs that organize free association responses into "small world networks" (Steyvers & Tenenbaum, in press; Watts & Stogatz, 1998). The assumption is that some words, such as FOOD, are more generally accessible in memory because they are produced by a greater of variety of other words (e.g., Howes, 1957; Rubin & Friendly, 1986). The accessibility index is related to measures of printed frequency, and we have included frequency values from Kucera & Francis (1967) for the sake of comparison.

Any estimate of accessibility is biased because it depends upon its source. Kucera and Francis selected 2,000 paragraphs of 500 words resulting in a sample of one million words, whereas the present norms were based on a semi-random sample of 5,019 words producing about 600,000 free association responses. Despite these differences, the two measures are strongly related, r= .76, n = 10,470 (this correlation was computed on the log of each index, with zero values replaced with 1 before the logs were taken). Rubin and Friendly (1986) report similar results using other free association databases. Although our experience with cued recall suggests that printed frequency and accessibility appear to have similar effects (Nelson & Xu, 1995), Rubin and Friendly (1986) have shown that free recall is better predicted by accessibility. Regardless of the high correlation between these two measures, they may be capturing different aspects of experience.

Appendix B presents 2,883 words in the norms which were produced by at least one of several types of non-semantic cues. These cues consisted of beginning stem sounds, ending stem sounds, beginning fragment cues, or ending fragment cues. Examples of each type of cue for the word BEST are, respectively, BE read aloud, EST read aloud, and both BE_ _, and _ EST presented visually with spaces for missing letters indicated by the dashes. For some words, such as BEST, non-semantic cues were normed for each of the four types of cues whereas for others only 1-3 non-semantic cues were normed.

The ***beginning stem set size and strength*** norms were collected from two samples of subjects (n = 113 and n= 135). Each subject was given a booklet containing a list of blank lines and they were given to understand that we wanted them to write the first word they thought of when they heard each sound. The sound was read to them over a tape recorder twice with a slight pause between repetitions, and they were asked to repeat it to themselves silently and then write the first word to come to mind that began with the same sound. Five seconds were allowed for writing each word and each person in each group was asked to respond to 90 beginning sounds, producing a total of 180 normed beginning sounds. These 180 sounds produced 1,296 of the target words appearing in the normative database. Of course, other words not appearing in the database were also produced but they are not presented here. The cues for targets produced by beginning sounds are also not presented in Appendix B because such cues can be easily inferred from the target itself by pronouncing the initial letters up through the initial vowel sound, as in BE for BEST.

The ***ending stem set size and strength*** norms were collected in the same manner. Given our greater interest in rhyme, these norms were actually collected first and in greater numbers. A total of 397 ending sounds were normed. In each of two samples (n = 184 and n = 201), 130 ending sounds that formed single rhymes (Woods, 1971) such as A, AB, AT, and so on, were presented. A total of 123 of these sounds were unique to each group and 7 were repeated to provide a small sample for checking reliability which averaged r = .79 according to a Spearman Rank Correlation. In two other samples (n = 153 and n = 242), 144 double rhymes such as A' BE, AB' IT and A' BER were normed. The single and double rhyme sounds produced a total of 2,120 words from the database. Finally, the same female (CM) read the beginning and ending sounds in all groups.

The ***word fragment cues*** were collected by presenting participants with printed letters and spaces for missing letters as in BE _ _ and _ EST in booklets. Letter fragments were defined in terms of the letters that were present in the cue, e.g., a beginning letter fragment has at least its first letter present in the fragment. Participants were asked to produce the first word to come to mind that fit with the letters and spaces provided as the cue. For example, as suggested above, some people responded with the word BEST to each of these non-semantic cues. Five different samples were involved in collecting these norms and the number of participants differed considerably (n = 148, n = 132, n = 79, n = 67 and n = 59). Totals of 279 and 283 beginning and ending fragments cues, respectively, were normed and they produced 1,274 and 1,110 of the words appearing in the normative database. Because fragment cues vary substantially, they are presented in Appendix B.

In addition to presenting the words produced by one or more non-semantic cues, Appendix B provides the set size associated with each cue as well as the probability of target production in the subject sample. For example, the sound produced by pronouncing the beginning letters BE as in BEST produced a total of 14 words sharing this sound. The probability of generating the word BEST from this sound provides an index of cue-to-target strength from the sound BE to the word BEST.

The ending sound EST as in BEST had a set size of 20 different words and the probability of producing BEST from this sound was .38. Similarly, the fragment cues BE _ _ and _ EST produced this word with respective set sizes of 19 and 7 and with respective strengths of 0.06 and 0.42. Hence, the non-semantic norms provide information concerning the number of readily available words generally given to four types of non-semantic cues as well as estimates of baseline cue-to-target strength in the absence of recent experimenter controlled study.