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False Memories and Semantic Lexicon Arrangement

Lori Buchanan, Norman R. Brown, Roberto Cabeza,
and Cameron Maitson

University of Alberta, Edmonton, Alberta, Canada

A description of semantic lexicon arrangement is a central goal in examinations of language processing. There are a number of ways in which this description has been cast and a host of different mechanisms in place for providing operational descriptions (e.g., feature sharing, category membership, associations, and cooccurrences). We first review two views of the structure of semantic space and then describe an experiment that attempts to adjudicate between these two views. The use of a false memory paradigm provides us with evidence that supports the notion that the semantic lexicon is arranged more by association than by categories or features. © 1999 Academic Press

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One of the major unresolved issues in the study of the mental lexicon(s) is the fundamental organization of the semantic lexicon. Current models can be categorized as one of two broad classes.

Feature-based semantic arrangement models: In a feature-based view of the semantic system, representations are arranged in a manner that reflects nearness in terms of feature overlap; CAT and FOX are near-semantic neighbors because they share a number of features (e.g., four legs, fur, tail, etc.). Plaut and Shallice (1993), for example, implemented semantics as patterns of activation across a number of feature nodes. In such a view, activation of representations such as ''it purrs,'' ''it has fur,'' ''it has a tail'' provides a reader with knowledge that the word is ''cat.'' Words that share many features are semantic neighbors and the spread of activation reflects the number of shared features (e.g., as features for CAT are activated, several features of its near-neighbor FOX become activated).

Associated semantic arrangement models: In contrast to the feature-based view of the semantic space, another class of theories has been developed on

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Address correspondence and reprint requests to Lori Buchanan, Biological Sciences P220, University of Alberta, Edmonton, Alberta, Canada T6G 2E9. Fax: (780) 492-1768. E-mail: lori@psych.ualberta.ca.

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the basis of associates or cooccurrence in text or conversation. In this view, words like CAT and DOG are near-neighbors not because they share features, but because they have some other conceptual link. Thus, although CAT and SCRATCH do not have obvious feature overlap, they are highly associated and as such reside in the same semantic neighborhood. As residents of the same neighborhood, activation from one is likely to spread to the other representation. Exemplars of this view of semantic space are presented by Nelson, Bennet, and Leibert (1997) and Lund and Burgess (1996).

These two views of the fundamental organization of the semantic lexicon differ in the predictions regarding the spread of activation in the lexicon. The feature-based models imply that activation spreads to representations with similar features while an associate view holds that activation spreads to words that are highly related, but not necessarily similar in terms of their features.

Support for the associate view can be found in both developmental and dementia studies. In examinations of recall ability in children, Bjorklund and Jacobs (1985) and Ackerman (1986) have shown that associated lists result in facilitation for both young and older subjects (age span from 8 to 20 years old) but lists with a categorical organization do not. The ability to take advantage of categorical organization appears to develop over time. Relatedly, patients in the early stages of Alzheimer's disease produce associative priming effects equal to elderly control subject but show reduced or eliminated facilitation for category member primes (e.g., Glosser et al. 1998; Ober, Shenaut, & Bruce, 1995). Thus, associations appear to develop before categories and they appear to remain resistant to semantic degradation symptomatic of Alzheimer's disease. These findings are consistent with the idea that associative relations are more fundamental than are categorical relations or feature overlap.

The preceding argument equates category membership with the notion of feature overlap. This is based on the observation that most category members share features. With this in mind, the data seem to support the associate view of semantic organization to the extent that associations appear to be a more fundamental and enduring organizational property of the semantic lexicon than do features. However, in a different line of research, models appear to favor the feature-based view of semantic arrangement: Several models of memory ascribe false memories or memory intrusions to feature overlap (e.g., Eich, 1982). These models take the position that false memories arise as a function of activation of neighbors and the spread of activation can be predicted on the basis of feature overlap. These models are therefore predicated on the often-implicitly held belief that the semantic lexicon is arranged by feature. In fact, this question remains open and is the subject of the present attempt to adjudicate between existing views of semantic lexicon arrangement.

THE FALSE MEMORY PARADIGM

False memories for words often occur during recognition tests if a list of converging associates is presented during a study phase (Deese, 1959). For example, people report that they previously encountered a nonpresented word like *mug* if the study phase contains words that are highly related to *mug* (e.g., *cup, beer, bowl, coffee*). These false memories have been found for a number of target items (e.g., Roediger & McDermott, 1995) and are indistinguishable from veridical memories in a wide range of tasks such as voice of presentation (Payne, Elie, Blackwell, & Neuschatz, 1996), confidence ratings (Read, 1996), and frequency judgement (Brown, Buchanan, & Cabeza, in preparation). One explanation for these false memories is that the activation of presented words spreads to the representation for nonpresented but related targets (Roedigger & McDermott, 1995). The false memory paradigm therefore provides a potentially powerful method of assessing the relative validity of the feature-based and the associate-based views of semantic representation.

In the present study false memories were induced when participants studied word lists that were either categorical or associative in nature. The number of false memories in each condition was used to gauge the spread of activation and correspondingly, the most appropriate characterization of the organizing property in the semantic lexicon. The lists were either purely categorical (e.g., *banana, grapefruit,* and *peach*) or noncategorical associate lists (e.g., *pie, core,* and *tree*). The nonpresented *target-foil* (i.e., *apple*) was held constant across these conditions, thus allowing differences in false memory for the item to be attributable to the relationship of the items in the list.

METHOD

Subjects

Sixty University of Alberta undergraduate students participated for partial course credit. Thirty of the participants were randomly assigned to an Associate-list condition and 30 were assigned to a Category-list condition.

Materials and Procedures

Five lists were developed for the two study list conditions. The target-foil in the Associate-list condition was the head item in a large word association norm database (Nelson, McEvoy, & Schreiber, 1994). In the Category-list, the target-foil was the first exemplar of the category (Battig & Montague, 1969). The lists were chosen so that the five target-foils were identical for both lists (e.g., *apple* as the target associate and *apple* as the first exemplar for the fruit category list). The study list in the Associate-list condition contained nine words that were associated with the target-foil but were judged by the researchers to be relatively free of feature overlap (category members were eliminated). The study list in the Category-list condition contained nine category members of the relevant category and these were judged by the researchers to share a number of features with the target-foil. The test lists contained the nine studied items, the nonpresented target-foil, and two nonpresented but Related-foils (e.g., *pie, tree* in the associate list and *pear, orange* in the category condition).

The study and test phases were blocked according to the five stimulus sets. Each study phase was followed by a 2-min nonverbal distracter task (a maze task) and then the relevant test phase was presented. This sequence was followed until the participants studied and were tested on all five word lists. The order of word lists was counterbalanced across participants. The order of words within each list was random during study and test phases with the exception that the target-foil was presented in the middle third of the test phase. Altogether, five convergent lists of words were tested on each participant.

In the study phase, a blank screen was presented for half a second; then each word was preceded by a focusing set of two dashes for half a second; finally, the study word appeared between these dashes for 2 s. During the test phase for each list, the screen was blank for half a second; then each word was preceded by a focusing set of two dashes for half a second; finally, the test word appeared between these dashes. Participants used their dominant hand to indicate that the word had been previously presented and the other hand to indicate a new word by pressing a different key (in both cases responses were key presses using the ‘‘/’’ and ‘‘z’’ keys of a computer keyboard).

RESULTS AND DISCUSSION

The discussion is limited to the nonpresented items since that analysis is central to the question at hand. In addition, since our lists were limited to five of each type we lacked the power to analyze at the item level. Both list conditions resulted in false recognition of the nonpresented target-foil and of the nonpresented related-foils.

The results of a two × two ANOVA (study condition × foil type) on the proportion of falsely recognized foils can be seen in Table 1. This analysis revealed two significant main effects but no interaction [$F1(1, 58) < 1$]. Comparison of the means for the false alarms for target and related foils showed that there was a significant difference between the two [$F1(1, 58) = 4.71$, $p < 0.05$] with the targets more likely to be falsely recognized than the related foils. This suggests that the study lists produced a greater spread of activation to the target than to other, related items. This is not a surprising finding given that all of our target-foils were the central concept (in the associate condition) or the primary exemplar (in the category condition).

The critical finding in this experiment was the main effect of the study condition. Participants in the association study condition were much more

TABLE 1
Mean Number of Falsely Recognized Target-Foils and Related-Foils (in Percentages) as a Function of Study List Condition

	Category	Associate	Difference
Proportion of falsely recognized related-foils (out of a total of 300)	6	30	24
Proportion of falsely recognized target-foils (out of a total of 150)	19	37	18

likely to falsely recognize the nonpresented items than were subjects in the category list [$F1(1, 58) = 19.76$, $p < .001$]. This suggests that the spread of activation to nonpresented but associatively related items was greater than the spread of activation to nonpresented but categorically related items. Taken in conjunction with the developmental and dementia evidence discussed earlier, these findings provide support for the notion that associations form a basis for the organization of the semantic lexicon. However, these associative links appear to exist in concert with (albeit weaker) feature or category links since the category lists also produced some false memories in this experiment.

The use of the false memory paradigm to explore issues of semantic representation is new. The findings reported here suggest that this paradigm is very useful for examination of the semantic lexicon. This same technique can be used to study the organization of the phonological lexicon by contrasting lists with rhyming bodies versus lists with similar initial phonemes. We are presently pursuing this line of research and we continue to expand on the question of semantic organization by developing more word lists like those used in the present study.

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