CHAPTER

14

Exemplar Verification for Common and Ad Hoc Categories in Aphasia

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Categorization research has been a major source of information on normal and brain-damaged populations' knowledge of concepts. Investigations of semantic/lexical disorders in aphasia have focused on individuals' awareness and knowledge of the structure of common categories (Grober et al., 1980; Grossman, 1981; Hough, 1988), which are natural object concepts such as birds and fruit (Rosch, 1975; Rosch and Mervis, 1975). These categories have been observed to have graded structure, which indicates that all members of a category are not equally representative of the category, with some members being better examples than others. Grossman (1981) observed that subjects with nonfluent aphasia were strongly anchored to the central portion of a category's referential field, producing primarily highly typical common category examplars. Subjects with fluent aphasia named many out-of-set but related items. On a category verification task, Grober et al. (1980) found that subjects with posterior aphasia demonstrated difficulty with categorization of atypical members and related nonmembers. They suggested that the underlying representation of common categories is preserved in adults with anterior aphasia but disrupted in persons with posterior aphasia.

Barsalou (1983, 1985) has investigated the structure of goal-derived ad hoc categories. These consist of highly specialized sets of items constructed for use in particular contexts, such as things to take on a picnic. In normal adults, goal-derived ad hoc categories have been observed to possess graded structures as salient as those structuring common categories. However, these categories are not as well established in memory as common categories because people have had less experience with them.

Recently, Hough (1988, 1989; Hough and Pierce, 1988) has begun a series of investigations examining aphasic adults' awareness and knowledge of goal-derived category structure. On an exemplar generation task, fluent and nonfluent aphasic subjects were as sensitive to graded structure as non-brain-damaged adults for both goal-derived ad hoc and common categories even though they generally produced fewer exemplars. Furthermore, on a category concept generation task, fluent and nonfluent aphasic groups were able to utilize context in priming category labels for goal-derived ad hoc categories as effectively as non-brain-damaged adults. Contrary to the findings of Grossman (1981) and Grober et al. (1980) these results suggest that the semantic organization of common as well as goal-derived ad hoc categories is intact for persons with fluent and nonfluent aphasia. However, in order to make a more conclusive determination of the underlying cause of lexical retrieval impairment in aphasia, it is necessary to examine categories in several different task contexts (Hough, 1988).

Therefore, the present study investigated the verification of goal-derived ad hoc and common category exemplars by both adults with

fluent and nonfluent aphasia and non-brain-damaged adults. The primary concern was aphasic adults' sensitivity to graded structure, particularly for functional, goal-oriented categories. Specifically, the accuracy of identification of category exemplars and latency of response were examined in the verification of category membership. In addition, the relationships between comprehension level, naming scores, and experimental task performance were explored.

METHOD

SUBJECTS

Ten fluent and 10 nonfluent adults with aphasia, subsequent to a unilateral, single, left cerebrovascular accident, were tested. Ten neurologically intact control individuals, matched to the brain-damaged adults for age and education, also were examined. Subject characteristics and clinical test data are summarized in Table 14-1.

All brain-damaged subjects were administered the Boston Naming Test (BNT) (Kaplan, Goodglass, and Weintraub, 1983) and portions of the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass and Kaplan, 1983). Individuals who provided at least three items on a naming screening test and achieved at least 70 percent accuracy on reading and auditory screening tests were included in the study. There were no statistically significant differences (0.05) between the two aphasic groups on auditory comprehension level and naming ability as measured by the BNT.

MATERIALS

Four common and four goal-derived ad hoc categories were presented to each subject. The common categories were 4 of the 10 categories for which Rosch (1975) established typicality norms. They included vehicles, clothing, weapons, and vegetables. The goal-derived ad hoc categories had typicality norms that were developed in a pilot study with normal middle-aged adults. They were things to take on a camping trip, things that have a smell, things that can be folded, and things to sell at a garage sale. Fifteen items, which varied in their degree of category membership, were presented per category, consisting of (1) three highly typical exemplars, (2) three moderately typical exemplars, (3) three atypical or low typical exemplars, (4) three unclear cases, and (5) three non-

TABLE 14-1. SUBJECT CHARACTERISTICS AND CLINICAL TEST DATA

Subjects	*Normal*	*Fluent*	*Nonfluent*
Age:			
Range	53–70	53–76	46–75
Mean	61	67.9	63.5
SD	5.12	6.98	9.07
Years of education:			
Range	10–18	10–16	9–14
Mean	13.5	12.9	11.9
SD	2.72	1.66	1.79
Months after CVA:			
Range		2–67	3–94
Mean		19.5	40.3
SD		21.57	27.41
BNT:*			
Range		23–55	7–50
Mean		39.9	31.2
SD		12.4	12.16
BDAE† Subtests			
Oral commands:			
Range		4–15	8–15
Mean		12.4	12.9
SD		3.57	2.33
Complex:‡			
Range		5–12	5–12
Mean		9	9.3
SD		2.16	2.16
Word repetition:			
Range		8–10	8–10
Mean		9.3	8.9
SD		0.82	0.88
Repeating phrases:			
Range		1–15	4–16
Mean		10.6	8.3
SD		5.6	3.53

*Boston Naming Test.
†Boston Diagnostic Aphasia Examination.
‡Complex ideational material.

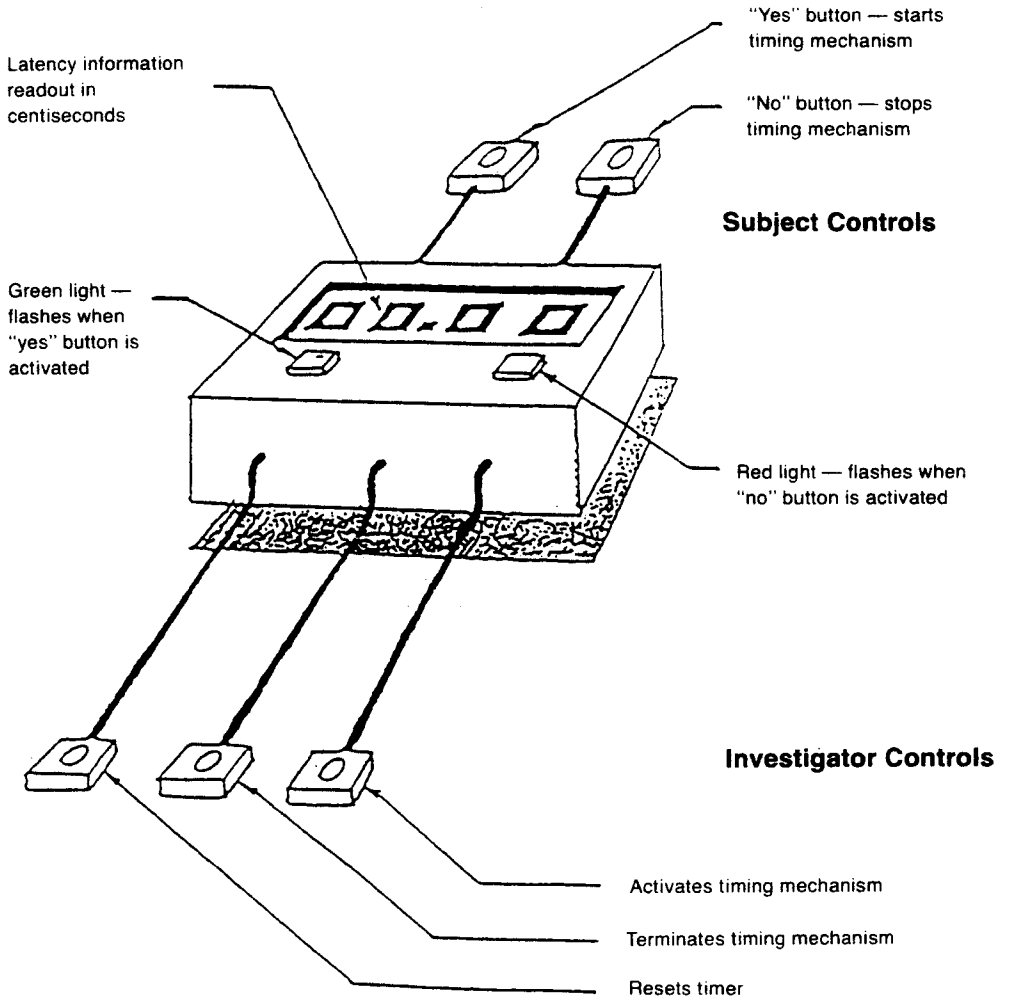

Fig. 14-1. Schematic of timing apparatus.

members. Items were chosen based on Rosch's (1975) typicality norms and pilot-data typicality norms for the common and goal-derived ad hoc categories, respectively. On a 7-point rating scale, highly typical exemplars had typicality ratings between 1.00 and 2.00. Moderately typical exemplars had ratings between 2.50 and 3.50, and atypical exemplars had ratings between 4.00 and 5.00. Unclear cases had ratings between 5.50 and 7.00. Nonmembers were items that were clearly not members of the specified category.

A timing apparatus capable of timing events to the nearest centisecond was used to measure subject latency of response. A schematic of the timing apparatus is presented in Figure 14-1.

PROCEDURES

Subjects were asked to perform a categorizing operation in which they were instructed to indicate whether an instance was a member of a category for the eight categories, each consisting of the 15 items. Subjects were instructed to perform the task as quickly and as accurately as possible.

Subjects initially were provided with two practice categories, one goal-derived ad hoc and one common, to familiarize them with the task and use of the timing mechanism. For the experimental task, a category label was presented followed by the 15 exemplars that varied in their degree of category membership. The order of presentation of category exemplars within a category was randomized. Category labels were presented auditorily and visually on a card that was displayed throughout the presentation of the 15 category exemplars. Category exemplars were presented auditorily.

The timer was activated simultaneously with the beginning of each item presentation. Subjects indicated if an item was or was not a category member by pressing the "yes" or "no" button, respectively, which stopped the timer. The accuracy and latency of each response were recorded by the examiner prior to presentation of the succeeding item.

RESULTS

The number of correct responses for all subjects was analyzed in an analysis of variance (ANOVA) (Myers, 1979) with one between (group) and two within (category type, category member) subject variables. Unclear cases were evaluated for this ANOVA in terms of the number of "yes" responses. The results revealed a statistically significant main effect for category member [$F(4,108) = 108.205$, $p < .001$] and a statistically significant category type X category member interaction [$F(4,108) = 5.704$, $p < .001$]. For the significant category member main effect, mean accuracy scores for each of the five category members are as follows: high = 11.83, mid = 10.60, low = 9.83, unclear = 6.68, and nonmember = 11.50. For the significant interaction, mean accuracy scores for the two category types for each of the five category members are as follows: goal-derived ad hoc: high = 11.83, mid = 10.73, low = 10.53, unclear = 6.73, and nonmember = 11.47; and common: high = 11.83, mid = 10.87, low = 9.13, unclear = 6.93, and nonmember = 11.53. Figure 14-2 shows the mean number of correct responses as a function of category type and category member across groups.

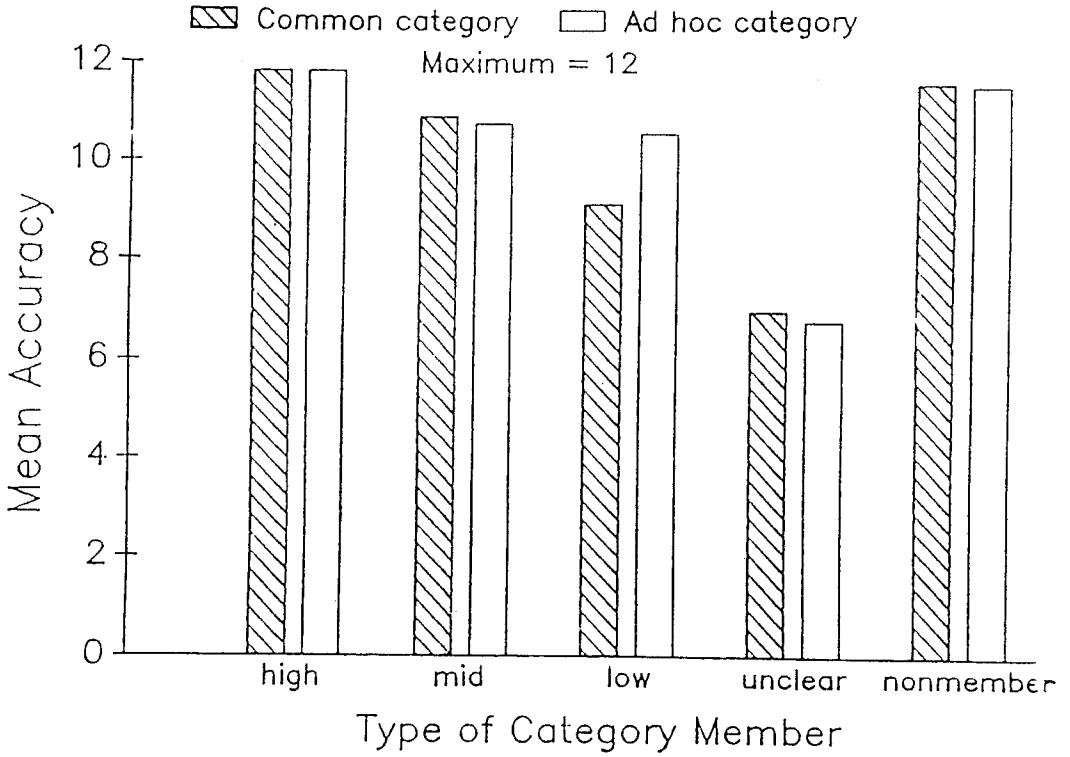

Fig. 14-2. Mean number of correct responses for goal-derived ad hoc and common categories as a function of category member.

Newman-Keuls analysis (Winer, 1971) of the statistically significant interaction revealed that the pattern of response for both category types across the different types of category members was very similar, except that subjects were significantly more accurate in their identification of low typical members of goal-derived ad hoc categories than those of common categories.

Latency of response in centiseconds was examined for only accurate identification responses. The latency data were analyzed in an ANOVA (Meyers, 1979) with one between (group) and two within (category type, category member) subject variables. The results revealed statistically significant main effects for group [$F(2,27) = 11.726$, $p < .001$] and category member [$F(4,108) = 20.827$, $p < .001$]. There were no statistically significant interactions. Newman-Keuls analyses (Winer, 1971) were conducted on the two significant main effects. For the group effect, overall mean latencies for the three groups are as follows: non-brain-damaged subjects = 1.50 seconds, subjects with fluent aphasia = 3.15 seconds, and subjects with nonfluent aphasia = 3.31 seconds. Post hoc analysis revealed statistically significant differences between the normal subjects and both groups with aphasia, indicating that the normal subjects were faster than both groups with aphasia, with no significant differences

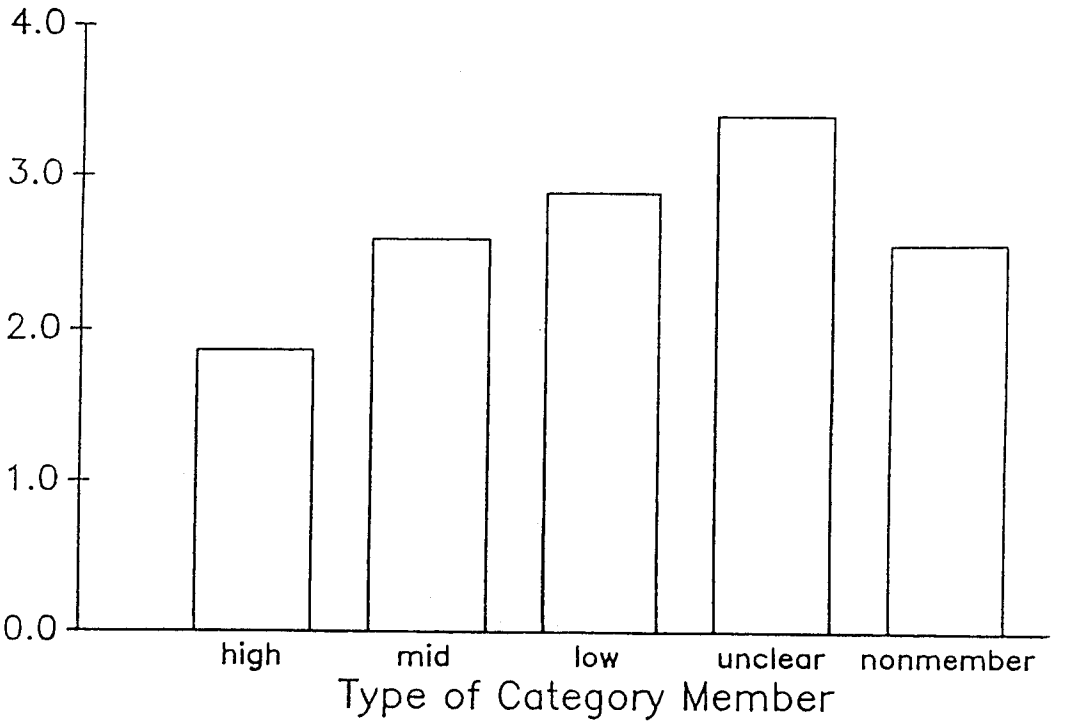

Fig. 14-3. Mean latency in centiseconds as a function of category member.

between the fluent and nonfluent groups. For the category member effect, Figure 14-3 displays the mean latency data for the verification task as a function of type of category member. Since there were no significant interactions, data were combined across groups and category types. All the subject groups demonstrated increased latency with decreases in typicality.

Pearson product-moment correlations (Winer, 1971) were conducted between latency and accuracy data for both category types, age, education, months after onset, BNT performance, and summated BDAE auditory comprehension scores for the two groups with aphasia. Statistically significant correlations are presented in Table 14-2. A number of significant relationships were identified between accuracy and latency, between comprehension level and accuracy and latency, and between naming performance and accuracy and latency, particularly for the subjects with nonfluent aphasia.

DISCUSSION

The results revealed that both groups with aphasia consistently required additional time to verify category members than the non-brain-damaged

TABLE 14-2. SIGNIFICANT CORRELATIONS FOR THE GROUPS WITH APHASIA

r Value	*Behavior*
Fluent aphasic group:	
−.732	Accuracy and latency for high common scores
.709	BNT and mid goal-derived accuracy scores
.638	BDAE comprehension and high common accuracy scores
Nonfluent aphasic group:	
−.866	Accuracy and latency for high goal-derived scores
−.697	Accuracy and latency for high common scores
−.660	Accuracy and latency for common nonmembers
.732	Accuracy and latency for unclear common scores
−.668	BNT and goal-derived nonmember latency scores
−.755	BNT and high common latency scores
−.819	BNT and mid common latency scores
.699	BNT and high common accuracy scores
.671	BNT and high goal-derived accuracy scores
−.685	BDAE comprehension and high goal-derived latency scores
−.711	BDAE comprehension and goal-derived nonmember latency scores
−.798	BDAE comprehension and high common latency scores
−.819	BDAE comprehension and mid common latency scores
.847	BDAE comprehension and high goal-derived accuracy scores
.736	BDAE comprehension and high common accuracy scores

subjects for both goal-derived ad hoc and common categories. Differences were not observed between the fluent and nonfluent groups. Overall performance accuracy, however, was similar for all three groups regardless of category type.

The longer latencies for the adults with aphasia were not a surprising finding and have been observed by other investigators in a variety of linguistic tasks (Blumstein, Milberg, and Shrier, 1982; Goodglass and Baker, 1976; Grober et al., 1980; Milberg and Blumstein, 1981). Greater reaction times may be indicative of (1) reduced speed of processing of auditory stimuli, (2) slower accessing of the semantic system, and/or (3) increased response initiation time. The subjects with aphasia, as a group, exhibited mild to moderate auditory comprehension deficits and

minimal or no limb apraxia, thereby reducing the contribution of the first and third variables. In light of the subjects' consistent accuracy performance and previous findings for exemplar generation (Hough and Pierce, 1988) and category concept generation (Hough, 1989), it is possible that some individuals with aphasia may display a generalized impairment in semantic access rather than disruption to the semantic system itself. However, significant differences in latency between non-brain-damaged and aphasic adults also may be indicative of other deficits.

Although adults with aphasia required additional response time, all groups accessed instances of goal-derived ad hoc categories as quickly and efficiently as they did common category exemplars. Goal-derived ad hoc category instances may prime the recognition of "belongingness" to a particular category in much the same manner as common category exemplars. The effective accessibility of goal-derived ad hoc categories appears to be related to Barsalou's (1983) finding that these categories possess graded structure in a similar manner as common categories. In fact, all groups appeared to be as sensitive to graded structure for goal-derived as for common categories. This was exemplified by the many significant correlations between the latency and accuracy data and the similar pattern of response across types of category members for both category types.

The present findings on the common categories deviated from those of Grober et al. (1980), particularly for subjects with fluent aphasia. The fluent subjects of Grober et al. had significantly more difficulty than the nonfluent subjects in the accuracy of categorizing atypical category members. The different findings between the two investigations may be the result of methodological differences, particularly due to the comprehension level of the participating subjects with fluent aphasia. In the present investigation, there were no statistically significant differences between the fluent and nonfluent groups on standardized auditory comprehension performance. However, Grober et al. (1980) reported that the comprehension skills of their fluent subjects were "limited." Since degree of semantic impairment has been observed to be related to auditory comprehension level (Butterworth, Howard, and McLoughlin, 1984), it is not surprising to find discrepancies between the two investigations with regard to the performance of the fluent aphasic adults.

Goal-derived ad hoc category construction involves a generate test process in which individuals rely on previous experience and knowledge to produce dimensions relevant to the goal of a particular category. This may explain why adults with aphasia are effective in the construction of goal-derived categories. In general, lesions resulting in aphasia do not appear to affect the utilization of acquired conceptual knowledge and experience. Furthermore, goal-derived ad hoc categories reflect a

functional and unique way to organize the environment. Persons with aphasia have been observed to be more responsive and successful on tasks that are functional in achieving daily activities (Chapey, 1981; Holland, 1982; Lubinski, 1981). Goal-derived ad hoc categories provide ways to accomplish old or new goals in a novel manner. Once a goal-derived ad hoc taxonomy has been constructed, additional use may result in increased representation of the category in memory.

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