19. The Effect of Context on Aphasic Adults' Category Structure

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A category represents a number of distinguishable items that are considered equivalent. Research in categorization has been a primary source of brain-damaged and normal adults' conceptual knowledge. A structural characteristic common to many categories is the presence of graded structure (Armstrong, Gleitman, & Gleitman, 1983; Barsalou, 1983; Rosch & Mervis, 1975), or goodness-of-example distribution (Roth & Shoben, 1983; Whitney & Kellas, 1984). Essentially, this indicates that members of a category vary in how good an example they are of their category, with some examples being more representative than others. These representative or better examples have been referred to as more typical members of a category. Graded structure, therefore, is a continuum of category representativeness, going from the most typical category members to atypical members to those nonmembers that are least similar to category members.

Rosch (1978, 1983) has suggested the need to examine the contexts in which items occur in order to determine their category representativeness. Specifically, Barsalou (1982) and Greenspan (1986) have investigated the effect of context on the properties associated with concepts. Context-independent properties are those that are activated by a word on all occasions independent of relevant context, whereas context-dependent properties are rarely activated by a word for a concept and are only activated by relevant contexts in which the word appears. In fact, Barsalou (1983) demonstrated that there are categories that are context independent and others that are context dependent. Common categories are a type of context-independent category. They are groups of natural object concepts such as "birds" and "fruit" that have graded structure (Rosch, 1975; Rosch & Mervis, 1975). Goal-derived categories are context dependent. These categories are instrumental to achieving goals, such as "things to take on a camping trip." Furthermore, they have been observed to have graded structures as salient as those for common categories.

However, goal-derived categories have been found to be dependent on a specified context for their realization by normal adults (Barsalou, 1983). Hough (1989) and Hough and Pierce (1989) observed that fluent and nonfluent aphasic adults were able to use context to prime category labels for these goal-derived categories as effectively as non-brain-damaged adults.

Roth & Shoben (1983) and others (Whitney, 1986; Whitney & Kellas, 1984) also have examined the effect of contextual information on the categorization skills of young normal adults, specifically by examining the representativeness ordering of exemplars of a category. Context has been observed to change the relationship between a category label and a possible exemplar. That is, the representativeness distribution associated with a concept is restructured when context is introduced. Goodness-of-example ordering that is obtained when contextual information is presented is not derived from the same semantic space representation as that obtained when a category label is presented in isolation.

Both fluent and nonfluent aphasic adults are apparently sensitive to graded structure for common categories in the absence of context (Grossman, 1981; Hough & Pierce, 1989). It is unknown, however, whether aphasic adults' typicality distributions for categories vary in the presence of explicit context. The present investigation examined fluent and nonfluent aphasic adults' sensitivity to context-constrained common categories. Specifically, we examined whether aphasic adults were able to alter their goodness-of-example representation for a common category in the presence of explicit context in order to determine the best example of a category term.

METHOD

Subjects

Ten aphasic adults, five fluent and five nonfluent, subsequent to unilateral left cerebrovascular accident, participated in the study. Five non-brain-damaged age-controlled subjects were also tested. Subject characteristics are summarized in Table 19.1. The brain-damaged subjects were administered the *Boston Naming Test* (*BNT*) (Kaplan, Goodglass, & Weintraub, 1983) and portions of the *Western Aphasia Battery* (*WAB*) (Kertesz, 1982) to verify the presence and extent of aphasic involvement. The *WAB* subtests administered included Auditory Word Recognition, Sequential Commands, and Repetition. Performance on these tasks is summarized in Table 19.2. The Spontaneous Speech subtest from the *WAB* was admin-

TABLE 19.1. SUBJECT CHARACTERISTICS

Subjects	*Age*	*Gender*	*Years of Education*	*Months Post-Onset*
Fluent				
1	70	Male	16	2
2	60	Female	12	3
3	63	Male	12	5
4	73	Female	16	2
5	73	Female	8	3
Range	60–73		8–16	2–5
Mean	67.8		12.8	3.0
SD	6.0		3.3	1.2
Nonfluent				
1	62	Female	12	4
2	64	Female	12	4
3	71	Male	10	24
4	53	Female	12	5
5	67	Female	9	12
Range	53–71		9–12	4–24
Mean	63.4		11.0	9.8
SD	6.7		1.4	8.6
Normal				
1	69	Male	16	
2	70	Male	11	
3	53	Female	12	
4	67	Female	11	
5	75	Female	16	
Range	67–75		11–16	
Mean	66.8		13.2	
SD	8.3		2.6	

istered as a means of determining fluency. The two aphasic groups did not differ significantly on auditory comprehension level as measured by the two *WAB* subtests (Auditory Word Recognition and Sequential Commands) ($p > .10$).

Ten yes/no questions from the Auditory Verbal Comprehension subtest from the *WAB* were used as an auditory screening test. A visual screening test was developed in which the subjects were presented with four words from the experimental stimuli. The subjects were instructed to point to the printed item that matched the word presented orally. A categorization

TABLE 19.2. CLINICAL TEST DATA

Subjects	BNT[a]	WAB *Subtests* AUD. WORD REC.[b]	SEQ. COMM.[c]	REP.[d]
Fluent				
1	46	60	80	96
2	8	55	63	60
3	10	42	32	80
4	33	54	78	100
5	25	54	71	90
Range	8–46	42–60	32–80	60–100
Mean	24.4	53.0	64.8	85.2
SD	16.0	6.6	19.5	16.0
Nonfluent				
1	42	58	76	100
2	14	37	21	54
3	45	55	62	96
4	43	60	72	85
5	25	60	72	82
Range	14–45	37–60	21–76	54–100
Mean	33.8	54.0	60.6	83.4
SD	13.7	9.7	22.7	18.0

[a]*Boston Naming Test.* [b]Auditory Word Recognition. [c]Sequential Commands. [d]Repetition.

screening test was developed in which the category labels used in the contextual sentences from the experimental task were presented in isolation, both visually and aurally. The category label was followed by four exemplars, two in-set items (one typical and one atypical) and two out-of-set responses (one related and one unrelated). Subjects were asked to choose the best example of the category. Aphasic individuals who achieved at least 70% accuracy on the visual, auditory, and categorization screening tests were included in the investigation.

Experimental Task

Materials. In the experimental task, subjects were presented with 20 sentences. Each sentence was followed by six items, consisting of four in-set exemplars of a common category label that was mentioned in the sentence and two out-of-set items. The specific exemplar of the category label was inferred by the meaning of the contextual sentence. An example of a stimulus item is presented in Figure 19.1. The four in-set exemplars

Context sentence: The hunter shot at the "bird" flying high overhead.

In-Set Items

False Items

Related exemplar: Chicken
Unrelated exemplar: Penguin

True Items

Related exemplar: Duck
Unrelated exemplar: Crow

Out-of-Set Items

Related exemplar: Rabbit
Unrelated exemplar: Apple

Figure 19.1. Stimulus item example.

differed in their relatedness to the category label; two of the exemplars were possible referents (true items) and two were not referents (false items). The false items were referents of the category term in isolation. However, in the context sentence, the false items either violated explicitly mentioned constraints or violated constraints that could be validly inferred from the context sentence. For both true and false items, one item (related exemplar) was more related to the category representation in the context than the other (unrelated exemplar). The out-of-set items consisted of one related and one unrelated item. The context sentences, exemplars, and relatedness ratings were taken from norms established by Roth and Shoben (1983).

Procedure. The stimuli were presented aurally through live voice and were simultaneously presented visually. The category term was visually highlighted within the context sentence and was emphasized aurally by saying "The category term is _____" after presentation of each stimulus item. Subjects were asked to indicate the best example for the category term by either pointing to the visually presented item or verbally providing the response. Subjects were presented with two practice items. For the experimental task, a 2-minute time limit was provided to respond to each of the 20 stimulus items. Subject responses were evaluated in terms of the accuracy of identification of the category exemplar.

RESULTS

A one-way analysis of variance on the accuracy of identification of the best category exemplar for the three subject groups yielded a significant main

effect for group (F [2,12] = 8.35; $p < .01$). Accuracy scores for the three groups are presented in Table 19.3. Tukey's Honestly Significant Difference test revealed that the fluent aphasic subjects were significantly less accurate than the other two groups ($p < .01$). There was no significant difference between the nonfluent and non-brain-damaged groups.

The percentage of errors for each type of response was examined for the three groups. These data are presented in Table 19.4. Analysis of the errors revealed that 70% of the errors produced by the fluent subjects were in-set true responses that were unrelated to the sentence category term. Approximately 12% of their errors were out-of-set responses. This was equivalent to only five out-of-set errors, only three of which were unrelated. For the nonfluent subjects, over 88% of the errors were in-set true unrelated responses with no out-of-set responses. Non-brain-damaged subjects, as a group, produced only eight errors, all of which were true unrelated responses.

Pearson product-moment correlations were conducted among experimental task performance, age, education, months post-onset, *BNT* scores, and the two *WAB* Auditory Comprehension scores for the aphasic groups and among task performance, age, and education for the non-brain-damaged group. The only significant finding was a positive relationship between Experimental Task score and Auditory Word Recognition scores on the *WAB* for the fluent group ($r = .899$).

DISCUSSION

In general, adults with nonfluent aphasia performed similarly to normal adults on the exemplar identification task. The nonfluent aphasic subjects were able to use contextual constraints to determine category representativeness as effectively as the non-brain-damaged subjects. These results are similar to those observed with younger normal adults (Roth & Shoben, 1983) in which it was found that contextual information completely restructured these individuals' goodness-of-example category distributions. Although the present findings are too limited to allow similar conclusions to be drawn for the nonfluent aphasic and non-brain-damaged aged adults, both of these groups appeared to alter their typicality distribution due to the introduction of specific context that allowed them to identify the best example of a category. It appears that once context is introduced, typicality as it is determined in isolation no longer plays an important role in determining category-graded structure.

Subjects with fluent aphasia were less sensitive to the context-constrained categories than the nonfluent subjects in that they did not consistently identify the best example inferred by the category term in the

TABLE 19.3. ACCURACY SCORES ON EXPERIMENTAL TASK

	Group		
Subjects	FLUENT	NONFLUENT	NORMAL
1	15	15	18
2	16	14	17
3	6	14	20
4	12	16	17
5	11	15	20
Range	6–16	14–16	17–20
Mean	12.0	14.8	18.4
SD	3.9	.84	1.5

TABLE 19.4. PERCENTAGES FOR TYPES OF ERRORS

	Group		
Error Type	FLUENT	NONFLUENT	NORMAL
True Unrelated	70.0	88.5	100
False Related	12.5	11.5	
False Unrelated	5.0		
Out-of-Set Related	5.0		
Out-of-Set Unrelated	7.5		

contextual sentence. However, as a group, the fluent subjects committed only five out-of-set errors. This is of interest because fluent aphasic subjects have been found to produce many out-of-set related responses on a word fluency task (Grossman, 1981), basically exhibiting an insensitivity to category boundaries. In the present investigation, the fluent subjects consistently chose in-set true responses, even though they were frequently the unrelated items. Therefore, it appears that these individuals *did* use the context to determine category representativeness and altered their goodness-of-example distribution accordingly.

The significant relationship between experimental task performance and the *WAB* Auditory Word Recognition subtest suggests that comprehension level as measured by this standardized test was related to accuracy of category exemplar identification. This is of interest because previous investigations have found nonsignificant correlations between aphasic individuals' performance on auditory experimental tasks and tests of auditory comprehension (Hough, 1989; Hough, Pierce, & Cannito, 1989; Wilcox, Davis, & Leonard, 1978). These other investigations

used the *Token Test* (DeRenzi & Vignolo, 1962) and subtests from the *Boston Diagnostic Aphasia Examination* (Goodglass & Kaplan, 1983) as measures of auditory comprehension. Use of the *WAB* Auditory Word Recognition subtest, as in the present investigation, may involve items that occur more frequently in the environment, thereby providing a more accurate measure of functional auditory comprehension skills.

It is not surprising that the contextual sentences positively influenced the performance of the aphasic adults. Individuals with aphasia have been found to benefit from the effects of context in syntactic comprehension (Deloche & Seron, 1981; Hough et al., 1989; Pierce & Wagner, 1985), semantic processing (Gardner, Albert, & Weintraub, 1975; Pierce & Beekman, 1985), and categorization skills (Hough, 1989). In all of these studies, however, context aided the subjects in comprehending or responding to a linguistic task that they would have been unable to perform otherwise. It was therefore difficult to determine the exact nature of the impact context had on performance except that it improved linguistic behavior. In the present investigation, the contextual influence was more specific than in previous context studies in that it could at least be inferred *how* context was used by the subjects. Investigating the specific nature of contextual benefits on categorization is of value because it provides information on how aphasic individuals organize their environment.

Barsalou (1987) has suggested that graded structure of categories is altered with context because of the nature of the process itself. Essentially, graded structure reflects a similarity comparison process that operates on exemplar and category concepts in working memory. The graded structure of a category within a context results from (a) the establishment of a concept in working memory to represent the category, (b) a comparison of exemplar concepts to the current category concept, and (c) a typicality judgment of the exemplars to the extent that they are similar to the current category concept. Therefore, graded structure changes across contexts because different category concepts are used in different contexts for the same category.

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