Confrontation Naming and Auditory Comprehension in Alzheimer's Patients

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Abstract

Object presentation facilitated confrontation naming 27 percent of the time in mild Alzheimer's disease (AD) and 15.9 percent of the time in moderate AD patients who were unable to name the objects from pictures. Unnamed pictures and objects were nonetheless significantly likely to be identified in an auditory comprehension task, suggesting that confrontation anomia is not caused primarily by a loss of the object's name from the mental lexicon or perceptual dysfunction. Dissociation in performance on the object naming and auditory comprehension tasks is discussed in relation to the hypothesis that confrontation anomia in Alzheimer's dementia patients results from progressive deterioration of semantic memory.

Introduction

An integral part of an ongoing longitudinal investigation, conducted by Bayles and associates at the University of Arizona, of the effects of Alzheimer's disease (AD) on communicative function has been the study of confrontation naming. One hundred and eight (108) AD patients have been given a variety of tasks, among them a graduated confrontation naming task. Results of data analysis demonstrate that the majority of AD patients suffer progressive impairment in confrontation naming ability (Bayles & Trosset, 1989), a result that agrees with many published reports of progressive naming impairment in AD patients (Appell, Kertesz, & Fisman, 1982; Barker & Lawson, 1968; Bayles & Boone, 1982; Bayles & Tomoeda, 1983; Hart, 1988; Kaszniak, Wilson, Fox, & Stebbins, 1986; Kirshner, Webb, & Kelly, 1984; Lawson & Barker, 1968; Martin & Fedio, 1983; Rochford, 1971; Schwartz, Saffran, & Williamson, 1981; Skelton-Robinson & Jones, 1984). Loss of confrontation naming ability has been interpreted primarily as reflecting the deleterious effects of AD on secondary memory and perception.

A performance pattern suggesting that secondary memory deficit is the cause of confrontation naming impairment in AD patients is the tendency to produce names that are semantically related to the stimuli presented (Bayles & Tomoeda, 1983; Martin & Fedio, 1983; Wilson, Kaszniak, Fox, Garron, & Ratusnik, 1981). For example, the word 'cup' might be given for the stimulus plate or 'piano' for violin. The correct class of objects within semantic memory appears to have been activated but not the correct exemplar from the class.

Further support for the hypothesis that deterioration in secondary memory may explain misnaming in AD patients comes from data in the literature that suggests that AD patients misname because of a progressive loss of knowledge about the attributes associated with objects (Martin, 1987; Martin & Fedio, 1983; Schwartz, Marin, & Saffran, 1979; Warrington, 1975). Such knowledge is thought to be represented in the semantic memory subsystem of secondary memory (Tulving, 1985). This loss of attributive knowledge is said to render AD subjects unable to distinguish individual objects from others within the same class. For example, the AD patient might lose the ability to distinguish a pencil from a pen, yet continue to appreciate a pencil as a writing instrument. Without the correct identification of the stimulus object, retrieval of its name becomes simply a chance phenomenon.

Evidence for a perceptual dysfunction explanation of misnaming comes from reports that AD patients misname objects with a name of an object that looks like the stimulus (Kirshner, Webb, & Kelly, 1984; Lawson & Barker, 1968; Rochford, 1971). For example, the word 'ball' may be given when the pictured stimulus is an orange or 'tube' for watermelon.

Kirshner and colleagues (1984) reported that AD patients were more likely to name a real object correctly than a picture

or line-drawing. The effect of giving the real object to the patient after the misnaming of the pictured stimulus or line drawing was not assessed. Barker and Lawson (1968) administered a confrontation naming task to AD patients and compared the effect of demonstrating the object to the presentation of the picture alone. They reported a four percent decrease in confrontation naming errors when the use of the object was demonstrated. They did not, however, examine the effect of presenting or demonstrating the object when the picture stimulus failed to elicit the name.

The authors reasoned that if perceptual problems significantly influence the ability to name, then having the opportunity to see and hold the actual object might facilitate naming significantly. If, however, the inability to name results primarily from deterioration of conceptual knowledge within semantic memory, then having the object in hand will not be facilitating. Additionally, if both perceptual problems and deterioration of semantic memory influence naming, then having the object will not be facilitating.

It was also recognized that yet another deficit might account for failure to name, and that is the loss of the word from lexical memory. An individual could have knowledge of the object (intact semantic memory), be able to perceive the object stimulus (intact perception), but be unable to name the object because of loss of the link between the object and its name. Performance on an auditory comprehension task (subjects select correct picture for word named by the examiner from among four choices), in which the stimulus objects were the same as those used in the confrontation naming task, might help in the interpretation of the naming performance data because it would provide information about the integrity of the link between knowledge of objects and the words used to represent them. Also, if a subject could do the auditory comprehension task, which is perceptually more difficult than confrontation naming (subject must analyze four stimulus pictures), and not be able to name on confrontation, then there would be further evidence that the misnaming did not result from misperception.

An auditory comprehension task is part of the test battery used in the longitudinal study. Thus it was possible to compare performance on confrontation naming with performance on auditory comprehension. In the auditory comprehension task, subjects are given the name of the objects used in the confrontation naming task and asked to identify the colored photograph of the named object from among four alternatives. Subjects who correctly identify objects on the auditory comprehension task can be presumed to retain knowledge of these words and their referents.

The paradigm used in this study permitted the experimenters to measure the effect on confrontation naming of giving AD subjects the real objects and to evaluate the relationship of both picture and object naming to auditory comprehension of object names. Such information is of value to clinicians and caregivers who are anxious to facilitate naming and is of theoretical significance for understanding the effects of AD on various linguistic processes. The purposes of this article are: (1) to present the results of an analysis of the effect of object presentation on naming in AD patients and elderly control subjects who have failed to name the picture, (2) to compare the performance of AD patients on the confrontation naming and auditory comprehension tasks, and, (3) to relate results to current popular theories of the cause of misnaming in AD patients.

Methods

Subjects

The data from 168 individuals were analyzed to evaluate the effect of object presentation on confrontation naming ability. One hundred and eight (108) subjects were diagnosed with probable AD, and 60 were normal controls. All are participants in a longitudinal study of the effects of AD on communication and cognition. To be included in the study, all participants had to meet the following criteria: (1) have a minimum of eight years of education with no history of communication/reading problems; (2) have normal intelligence as estimated by a regression equation using demographic information (Wilson et al., 1978); (3) have no history of alcohol or drug dependency; (4) have vision adequate to read newsprint; and (5) pass a speech discrimination task with 80% or better accuracy. In the speech discrimination task (Bayles, Boone, Tomoeda, Slauson, & Kaszniak, 1989), subjects are asked to specify whether word pairs spoken by the examiner are the same words or different words.

Diagnosis of probable AD

Diagnosis of probable AD was made according to criteria established by the NINCDS-ADRDA task force (McKhann et al., 1984). All AD subjects had physical and neurological evaluations. The modified Hachinski scale (Rosen, Terry, Fuld, Katzman, & Peck, 1980) was administered to exclude individuals at risk for vascular dementia. Additionally, the Hamilton Depression Rating Scale (HDRS) (Hamilton, 1960) was given to mildly demented AD patients and normal controls to screen for the presence of depression. Using the cutoffs provided in the literature (Lazarus, Newton, Cohler, Lesser, & Schweon, 1987), that is, a score greater than 12, none of the mild AD subjects failed the depression screening test. Because of the severity of their memory deficits, the responses of moderate AD patients on the HDRS were considered unreliable.

Table 1. Subject characteristics.

		Normals	Mild AD	Moderate AD
N		60	56	52
Age	$\overline{X}^a$	72.0	75.1	78.2
	S.D.	7.3	8.0	7.4
Sex	Male	17	21	18
	Female	43	35	34
IQ (Est'd)	$\overline{X}$	113.2	111.2	110.8
	S.D.	7.4	8.5	7.1

AD = Alzheimer's disease patients
a = group means are significantly different (p = 0.0001)

Specification of dementia severity

Severity of dementia was determined by rating on the Global Deterioration Scale (GDS) (Reisberg, Ferris, de Leon, & Crook, 1982). AD patients with a rating of three or four were classified as mild, those with five were moderate. Fifty-six AD patients were mild; 52 were moderate.

Recruitment of normal controls

The 60 elderly control subjects were spouses or caregivers of AD patients, participants in the University Medical Center hospital volunteer program, or participants in a senior citizens' nutrition and socialization program. The demographic characteristics of normal control subjects and AD patients, categorized according to dementia severity, are presented in Table 1.

Significant intergroup differences were present for age but not for sex and estimated IQ. The moderate AD subjects were significantly older than subjects in the other two groups.

Tests

The data from the administration of the confrontation naming task (CN) and the auditory comprehension task (AC) serve as the basis of this study. Intertask comparison is possible because the same 13 objects were used as stimuli in both tasks. The objects were a subset of the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983) and were selected to represent the range of difficulty of the test. Selected objects were imageable, tangible, portable, and included: pencil, comb, hanger, mask, racquet, dart, harmonica, dominoes, knocker, stethoscope, compass, tongs, and abacus.

Confrontation naming task

The objective of this task was to name pictured objects. Stimuli were individually presented and remained in view for 15 seconds. If, after 15 seconds, the subject had failed to respond or misnamed the picture, the real object was handed to the subject. (When a response was given to pictured stimuli by AD subjects in this study, 99.2 percent of the responses were provided within 10 seconds.) Time constraints were not imposed on object naming. A separate score was calculated for the number of items correctly named to pictures and objects.

Auditory comprehension task

The objective of this task was to select, from among four, the correct colored photograph of the object named by the examiner. Subjects had to recognize the pictures after hearing their names spoken by the examiner, rather than generating the names themselves. All the items presented in the confrontation naming task were also presented in the auditory comprehension task. The foils for each stimulus item were either semantically related, visually similar, or phonetically similar to the target. The task was administered immediately after the confrontation naming task, thereby eliminating potential priming effects.

Data Analysis

A primary purpose of this investigation was the evaluation of the possible effect of object presentation when a picture failed to elicit the correct name. Therefore, it was necessary to control for the AD subjects' premorbid knowledge of the stimulus objects. If the name of a pictured object was unknown to the subject premorbidly, presentation of the real object would not be facilitating. Further, if object naming failures due to premorbid knowledge were grouped with object naming failures presumed to be the result of AD, then the facilitating effect of presenting the real object could not be measured accurately and could be underrated. If, however, a presumption could be made that AD patients were likely to have had premorbid knowledge of the names of all the objects, then the effect of object presentation could be assessed validly.

To justify such a presumption, object names used in the data analysis had to be known by all normal control subjects, or known by all but one. It is reasonable to presume that AD subjects, who were similar in estimated intelligence to normal controls, would have had premorbid knowledge of these objects. Seven objects met this criterion: pencil, comb, hanger, mask, racquet, harmonica, and knocker. Performance data related to these objects were used in all statistical analyses.

Number of subjects within each group who named objects

Before interpretations can be made of the effect of object presentation on naming, it is important to verify that the instances of object naming were not attributable to only a few subjects. Therefore, the individual performance data on the seven "known" concepts were scrutinized and the number of individuals who named objects were counted.

Table 2. Crosstabulation of instances of failure to name pictures of 7 "known" items by performance on naming objects, performance on auditory comprehension, and group membership.

		Naming Objects					
		Normals		Mild AD		Moderate AD	
		F	S	F	S	F	S
Auditory Comprehension	F	0	0	8	6	61	7
	S	4	9	57	18	82	20

F = Failure
S = Success
AD = Alzheimer's disease patients

Table 3. Significance tests of log linear model.

Model term	DF	χ^2	p
S	2	159.926	.0000
N	1	90.030	.0000
C	1	44.087	.0000
S*C	2	24.270	.0000
S*N	2	15.981	.0003

S = Subject group
N = Naming objects
C = Auditory comprehension
Goodness-of-fit $\chi^2(2) = 4.75$, $p = 0.093$

Within the normal control group, 10 subjects were presented with at least one object, and 8 were successful in naming at least one object. Thirty-six of the 56 mild AD subjects were shown at least one object and 20 had an instance of naming success. Similarly, 46 of 52 moderate AD subjects were presented with at least one object, and 21 had an instance of successful naming. In no case did one subject's performance account for more than two instances of object naming.

Statistical treatment

The primary data set consisted of 272 instances in which a subject failed to correctly name a picture. These instances were simultaneously categorized by dementia severity group, ability to name to object, and performance on the auditory comprehension task. Results of categorization are presented in a three-way contingency table, Table 2.

Statistical analysis consisted of inferring relationships between dementia severity, object naming ability, and performance on the auditory comprehension task using a log-linear model. A log-linear model is an equation that represents the logarithms of the individual cell probabilities as the sum of terms that depend on various combinations of the involved variables (Bishop, Fienberg, & Holland, 1975). The fundamental goal of log-linear analysis is to find the simplest (most parsimonious) model that adequately fits the data. The fit of competing models was tested using the likelihood ratio chi-square statistic. The present study rejected poorly fitting models at a significance level of $p \geq 0.05$. Computations were performed using SPSS/PC+ software (Norusis, 1986).

Results

In the most parsimonious log-linear model, five terms were found to be significant: (1) group; (2) naming objects; (3) auditory comprehension; (4) group by auditory comprehension; and (5) group by naming objects. The significance of each term is presented in Table 3.

Group Effect

The significance of the dementia severity group main effect (S) reflects the fact that the 272 instances of failure to name a picture were unequally distributed among severity groups. In fact, normals accounted for only 13 instances (4.8%), milds for 89 instances (32.7%), and moderates for 170 instances (62.5%). Since these instances are, by definition, picture naming failures, the significant group effect may be interpreted as dramatic evidence that the ability to name pictures decreases with an increase in dementia severity.

Naming Objects

A significant naming objects main effect (N) reflects the unequal distribution of object naming failures and successes. Considering all groups, naming objects succeeded in only 60 of 272 instances (22.1%).

Auditory Comprehension

The auditory comprehension main effect was significant, reflecting the unequal distribution of picture naming failures for success and failure categories of the auditory comprehension task. Seventy percent of the time, subjects were able to correctly select a photo representing the stimulus word spoken by the examiner (success on auditory comprehension). Thus, more often than not, the ability to name pictured objects was dissociated from the ability to recognize the pictured object when given the word.

Group by Auditory Comprehension

The significance of the group by comprehension interaction term (S*C) reflects the fact that performance on the auditory comprehension task varied among subject groups. Whereas normals succeeded in the auditory comprehension task in 13 of 13 instances (100%), mild AD patients succeeded in 75 of 89 instances (84.3%) and moderates in 102 of 170 instances (60.0%). Thus, the presence and severity of dementia affected the ability to recognize the referent of a spoken word stimulus.

Group by Naming Objects

The significance of the group by naming objects interaction (S*N) demonstrates the intergroup variability of the effect on naming of object presentation. Among normals, who named 9 of 13 objects, the facilitation effect was greatest. In mild AD patients, who successfully named the object on 24 of 89 occasions (27.0%), the facilitation effect was considerably less. Among moderate AD patients, who successfully named on 27 of 170 occasions (15.9%), the effect was modest.

The naming by comprehension (N*C) and group by naming by comprehension (S*N*C) interaction terms were evaluated because of an interest in the possible influence on confrontation naming ability of an individual's lexical knowledge of the relationship between a name and the thing it represents. Neither interaction term was significant (χ^2 = 4.75, p = 0.093), indicating that an inability to name is not necessarily indicative of a failure to appreciate the relationship between the name and the thing it represents.

Discussion

A primary research question of this study was whether object presentation facilitated naming in AD patients unable to name objects from pictures. Only a modest facilitation effect of 27% was observed in mild AD patients which diminished to 15.9% in moderate AD patients. Nonetheless, the finding of an object facilitation effect, however modest, in the absence of other confirming data demonstrates that it is inappropriate to conclude that misnaming and lack of naming in AD patients indicate a loss of knowledge of the object in semantic memory.

When it occurred, the object facilitation effect may have been due to the subject having extra time for conducting a lexical search, to the availability of additional cues associated with holding the real object, or both of these factors. Regardless of the cause, however, the rate of facilitation was sufficiently large to recommend presentation of objects.

The fact was, however, that object presentation did not generally facilitate naming. Among mild AD patients, failures to name objects were more than twice as common as successes; and among moderates, failures were almost five times more common. The inverse relation between object facilitation and degree of dementia severity suggests that dementia severity, like severity of aphasia, is an important variable in sensitivity to cues (Myers-Pease & Goodglass, 1978).

That subjects were often able to complete the auditory comprehension task successfully for items they did not name (pictures and objects) suggests that the lack of naming was not caused by either a perceptual problem or the loss of appreciation of the link between the object and its name. Clearly the name and the image of the object were still represented in the nervous system within lexical memory if not within semantic memory. What may have caused the confrontation naming failure was the greater effort involved in this task compared to the auditory comprehension task. Many subjects who were unable to retrieve the name still retained the ability to recognize the name and its referent when provided in the auditory comprehension task.

In confrontation naming, knowledge of the attributes of an object may be necessary for distinguishing it from other members of the same class, whereas such knowledge may be unnecessary for successful completion of the auditory comprehension task. In fact, it may be possible to complete the auditory comprehension task within lexical memory alone. Evidence exists that operations within lexical memory and semantic memory may be carried out independently (Forster, 1976; Forster, 1979; Lupker, 1984). Consider that in the auditory comprehension task the stimulus is a word, and therefore likely to activate lexical memory. Within lexical memory, associations are thought to exist between the visual representations of objects and their names (Forster, 1979). Thus, hearing the name activates its representation, and likely its associated visual representations. Among normals, in whom lexical and semantic memory systems are intact, word stimuli undoubtedly activate both lexical and semantic memory systems. If in AD patients semantic memory has deteriorated, lexical memory may remain intact. Hence, a deteriorated semantic memory and an intact lexical memory together may account for the successful performance on the auditory comprehension task and the failure on confrontation naming.

In summary, these cross-sectional data demonstrate progressive deterioration in confrontation naming of pictures with increases in dementia severity, and progressive deterioration in the naming of objects presented after picture stimuli have failed. A modest facilitation effect in confrontation naming was documented when objects, as opposed to pictures, were presented, though the effect diminished with increased dementia

severity. Nonetheless, the facilitation obtained by presenting objects suggests that clinicians should be cautious in concluding that a failure on confrontation naming indicates a loss of conceptual or lexical knowledge in Alzheimer's patients.

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