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Consistency of response on a semantic memory task in persons with dementia of the Alzheimer type

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CONSISTENCY OF RESPONSE ON A SEMANTIC MEMORY TASK IN PERSONS WITH DEMENTIA OF THE ALZHEIMER TYPE

by

Peter Cyril Knotek

A Thesis Submitted to the Faculty of the

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ABSTRACT

The purpose of this investigation was to determine the test-retest response consistency rate on a semantic memory task in persons with dementia of the Alzheimer type (DAT). Ten mildly and 13 moderately impaired DAT subjects and 14 normal controls matched for age, years of education, and estimated IQ participated in this study. The Peabody Picture Vocabulary Test (PPVT) was administered twice to each subject with a seven day inter-test interval. The mild and moderate DAT subjects responded inconsistently to significantly more PPVT items than normal controls. When the effects of guessing were considered, moderate DAT subjects gave significantly more inconsistent PPVT responses than normal controls and mild DAT subjects showed a trend towards giving more inconsistent responses. These results substantiate the conclusion that the impairment of specific conceptual knowledge in DAT subjects cannot be reliably measured with a single administration of a semantic memory task such as the PPVT.

INTRODUCTION

Of growing interest to speech-language pathologists and neuropsychologists is the communicative impairment present in individuals with dementia of the Alzheimer type (DAT). A consensus exists that persons with mild to moderate DAT show relatively preserved phonologic, syntactic, and lexical knowledge while semantic and pragmatic knowledge are markedly impaired (Appell, Kertesz, & Fisman, 1982; Bayles, 1982; Emery & Emery, 1983; Murdoch, Chenery, Wilks, & Boyle, 1987). Because knowledge of grammar is relatively spared, the communicative impairment in persons with DAT has been characterized as the particular impairment of semantic memory and a subsystem of semantic memory referred to as episodic memory (Bayles & Kaszniak, 1987).

Semantic memory is defined as generic or conceptual memory, within which is stored factual information about the world. A subcomponent of semantic memory is episodic memory, that domain in which is represented personally experienced events and their temporal-spatial coordinates (Squire, 1987; Tulving, 1985). To know that dogs are animals that can chase people down the street is knowledge represented in semantic memory. To know that your son was chased down the street last week by a dog is knowledge represented in episodic memory.

The theory that semantic memory is particularly

impaired in DAT is generally accepted (Ober, Dronkers, Koss, Delis, & Friedland, 1986; Weingartner, Grafman, Boutelle, Kaye, & Martin, 1983; Wilson, Bacon, Kaszniak, & Fox, 1982), but a debate has developed over whether it is the structure or function of semantic memory that is most impaired (Bayles & Kaszniak, 1987). Some investigators suggest that semantic memory structure is disrupted (e.g., Huff, Corkin, & Growdon, 1986; Martin & Fedio, 1983; Schwartz, Marin, & Saffran, 1979). For example, Huff, Corkin, and Growdon (1986) conducted a study in which they asked DAT patients and normal elderly subjects to complete naming and recognition tasks. The naming tasks consisted of generative and confrontation naming. The recognition tasks were of two types: category and name recognition. The category recognition task assessed the ability of subjects to recognize the category membership of pictures and words. Object items were presented in picture and word form on separate trials and before each item was presented, the experimenter asked, "Is this a kind of X?" where X was one of four categories. The subjects responded "yes" or "no." The name recognition task assessed recognition of names of pictures and words. The stimulus items were the same as those used in the category recognition task. Before each item was presented, the examiner asked, "Is this called (a/an) X?" where X was the correct or incorrect name drawn from other words in the same category as the target. Again,

subjects responded "yes" or "no." DAT patients were significantly impaired on both of the naming tasks and on the name recognition task. Huff et al. (1986) concluded that specific semantic information is lost in DAT patients because errors were consistently made on the same items in the name recognition and the confrontation naming tasks.

Although numerous investigators suggest that conceptual knowledge deteriorates in DAT subjects, other researchers argue that semantic memory structure remains intact but the processes whereby semantic memory contents are accessed and manipulated are impaired (e.g., Grober, Buschke, Kawas, & Fuld, 1985; Nebes, Boller, & Holland, 1986; Nebes, Martin, & Horn, 1984; Ober & Shenaut, 1986). Nebes, Boller, and Holland (1986) studied the integrity of semantic memory structure using a category membership decision task. DAT subjects, young normal subjects, and old normal subjects were presented with the name of a semantic category in the form of a question such as: "Bird, is this a bird?" Subsequently a single noun was presented tachistoscopically and remained visible until subjects responded as to whether the word was an example of the category. The dependent variable was the time taken to make a judgment. The stimulus words were either highly associated examples of the category, minimally associated, or unrelated. The effect of stimulus word associative strength on decision time was found to be the same in DAT subjects as in normal subjects.

Nebes et al. (1986) interpreted this finding to mean that in DAT, as in normal aging, knowledge about category membership is preserved.

Regardless of whether semantic memory structure or function is impaired in DAT subjects, an issue of importance in the assessment of specific conceptual knowledge is the degree to which the performance of subjects on semantic memory tasks is representative of their ability. Considerable variability in the performance of DAT subjects controlled for severity has been reported on semantic memory and other types of tasks (Kaszniak & Wilson, 1985; Martin, Cox, Brouwers, & Fedio, 1985; Nebes et al., 1986; Schwartz et al., 1979) and raises the question of the reliability of subjects' performance. Nevertheless, the data used by theorists have typically come from a single administration of a task or tasks in a battery. A case in point is a study by Martin and Fedio (1983) who asked DAT patients and healthy elderly subjects to complete a generative naming task, the Boston Naming Test, and a receptive vocabulary task. DAT subjects performed significantly poorer than normal subjects on all of these tasks. Martin and Fedio concluded that the DAT subjects' performance is best understood as resulting from "disruption in the organization of semantic knowledge, possibly characterized by a loss of knowledge or an inability to retrieve and properly utlize specific attributes." These conclusions are founded on the

assumption that the performance of the DAT subjects on a single administration of tasks was representative of their ability. However, Martin and Fedio, like other investigators, provide no rationale for the validity of such an assumption. Support for the aforementioned assumption would be evidence that DAT subjects show a high rate of test-retest response consistency on individual items of semantic memory tasks.

At present, only limited information is available about the test-retest consistency of response in dementia subjects. One report comes from a case study published by Schwartz, Marin, and Saffran (1979). Their demented subject was asked to identify the name of a picture from a set of five written choices including the target, two unrelated object-names, a phonologically and orthographically similar distractor, and one that was semantically related. Additionally, the subject completed a verbal match-to-sample task which required her to match individual photographs with written labels consisting of "dog," "cat," and "bird." On each trial, the subject was presented with a photograph, the "sample," and below it, two typed "choices" that consisted of a correct label and an incorrect label (e.g., when the sample was a photograph of a dog, the choices were "dog" and "cat"). The subject's task was to indicate which of the choices named the sample by moving the choice alongside the sample. On a second occasion the subject was tested with

these two tasks to allow the investigators to assess response consistency. The inter-test interval was one month for the picture-naming task and two weeks for the match-to-sample task.

The subject was found to respond inconsistently on individual task items, although Schwartz et al. (1979) reported that she responded correctly to approximately the same number of items from each task at both testings. On 33% (23/70) of the items from the picture-naming task, the target was selected on one occasion and a distractor was selected on the other. The distractor chosen most often was the semantic distractor. On the match-to-sample task, the subject also responded inconsistently. For example, on 21% (3/14) of the samples consisting of dog photographs, the photographs were labeled "dog" on one occasion and "cat" or "bird" on the other. Schwartz et al. (1979) did not offer an explanation for their subject's response inconsistency.

A report of response consistency comes from Warrington (1975) who published case studies of three demented subjects. Among the semantic memory tasks administered were the Peabody Picture Vocabulary Test (PPVT) (Dunn, 1965) and object and picture naming tasks. Although Warrington did not report data regarding test-retest consistency for items on the semantic memory tasks, she did anecdotally report that "each patient showed a remarkable degree of internal consistency." In addition, she mentioned that each

subject's "repertoire of known and unknown words hardly fluctuated with time or fatigue."

Thus, within the meagre anecdotal literature (Schwartz et al., 1979; Warrington, 1975), substantially different reports exist regarding response consistency on semantic memory tasks in dementia patients. Whereas Warrington's (1975) subjects were reportedly consistent in their responses, Schwartz and associates' (1979) subject was inconsistent. To date, published accounts of systematic studies of response consistency on individual items of semantic memory tasks in DAT patients are unavailable. The purpose of this investigation was to determine the test-retest response consistency rate on a semantic memory task in DAT subjects controlled for severity of dementia.

METHODS

Subjects. Ten mildly and 13 moderately impaired DAT subjects and 14 normal controls matched for age, years of education, and estimated IQ participated in this study. Estimates were made of IQ using Wilson, Rosenbaum, and Brown's (1979) regression equation which differentially weights age, sex, race, years of formal education, and occupation. This equation was derived from analysis of the original WAIS standardization data (Wechsler, 1955). Use of the formula for estimation of premorbid intelligence has been supported in two validation studies (Karzmark, Heaton, Grant, & Matthews, 1985; Wilson et al., 1979).

All subjects met the following subject selection criteria:

1. were native speakers of English;
2. could see well enough to read a type written sentence;
3. could hear well enough to pass a speech discrimination test with 80% or better accuracy;
4. had no history of alcohol abuse;
5. had no history of drug abuse;
6. did not experience a change in medication from one test session to the next; and
7. could see well enough to complete the first ten items on the PPVT with 80% or better accuracy.

The last selection criterion was included to insure that participants did not have a visual-perceptual deficit sufficient to interfere with task administration. The presence of a visual-perceptual deficit could confound the assessment of knowledge of concepts on the receptive vocabulary test used in this study.

All DAT subjects met the criteria for clinical diagnosis of Alzheimer's disease that were established by the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association work group under the auspices of the Department of Health and Human Services Task Force on Alzheimer's Disease (McKann, Drachman, Folstein, Katzman, Price, & Stadlan, 1984). DAT subjects also met the criteria for dementia described in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1980).

Because the collapsing of data across dementia severity levels obscures the nature of the changes in semantic memory during the course of the dementing disease, it was necessary to control for dementia severity in the DAT subjects of this study. The severity of dementia was determined using the Global Deterioration Scale (GDS) of Reisberg, Ferris, and Crook (1982). The GDS defines seven stages in the course of dementia with well specified observational criteria. Use of the GDS in a study of language and communication is

appropriate because the criteria for determining dementia severity are largely independent of language and communicative function. Reisberg et al. (1982) provide data that indicate that GDS ratings correlate well with various independent psychometric measures of cognitive impairment. Those DAT subjects who received a rating of three or four on the GDS were categorized as mildly impaired and those DAT subjects who received a rating of five or six were categorized as moderately impaired.

Mean age, years of education, and estimated IQ for each subject group are shown in Table 1. Intergroup comparisons of subject characteristics were made using one-way analysis of variance. No significant intergroup differences were obtained for age, years of education, or estimated IQ.

TABLE 1
SUBJECT CHARACTERISTICS

Subject Group	$\bar{X}$ Age	$\bar{X}$ Yrs. Education	$\bar{X}$ Est. IQ
Controls (n = 14)	76.1	14.6	113
Mild DAT (n = 10)	79.4	15.2	116
Mod. DAT (n = 13)	80.6	13.8	113
F	1.68	.54	.44
p	.20	.58	.65

Procedures. The semantic memory task used in this

study was the PPVT (Dunn, 1965). The PPVT is a validated and frequently used measure of receptive vocabulary that has been found to be sensitive to the presence and severity of DAT (Bayles, Boone, Tomoeda, Slauson, & Kaszniak, 1988; Kaszniak & Wilson, 1985). The PPVT consists of several example items and 150 test items arranged in empirically determined order of difficulty. The subjects' task on the PPVT is to select the correct representation of a word spoken by the examiner from among four line drawings.

The PPVT (Form B) was administered twice to each subject with a seven day inter-test interval. Test administrations occurred within two hours of the same time each test day and the examiner and testing location were the same at both testings. Testing began with item number 1 for DAT subjects and item number 75 for normal subjects. The decision to begin testing normal subjects at item 75 was made because the results of a pilot study revealed that they typically performed error free up to that point. In accordance with standard rules for test administration, a basal of 8 consecutive correct answers was established for all subjects and testing continued until 6 errors were made on any 8 consecutive items. The last item presented was counted as the subject's ceiling.

The following instructions were given with an example PPVT plate in view: "I have some pictures to show you. I will say a word, then I want you to point to the picture

that best shows me the meaning of the word." Subjects were given up to one minute to respond and the examiner restated the stimulus word as needed. If no choice was made within one minute, the response was scored as incorrect. Subjects were not told the correct answers to test items and were instructed not to look up the definitions of any PPVT stimulus words during the week between testings.

Because the PPVT involves a four-alternative, forced-choice paradigm, it was necessary to consider the effect of guessing on responses. To do so, a judgment of certainty task was administered concurrently with the PPVT. After responding to a PPVT stimulus word, subjects were asked to state their degree of certainty as to the accuracy of their response. Three cards imprinted with the words "Very Sure," "Somewhat Sure," and "Not Sure" were placed in front of the subject and the examiner read each card after each PPVT response. Subjects were asked to point to or say the words that best expressed their degree of certainty. For those PPVT items for which subjects did not respond with a selection of a line drawing within one minute, their certainty responses were scored as "Not Sure."

Response Analysis. For each subject, the lower of the two ceilings obtained in the two administrations of the PPVT was noted. Responses for the 40 items preceding this ceiling item were analyzed for test-retest response consistency. It was reasoned that these 40 items would be

of similar relative difficulty for all subjects. A tally was made of the number of items answered inconsistently (i.e., items for which a correct answer was provided on the first testing and an incorrect answer on the second testing or vice versa). The 40 PPVT items analyzed for response consistency were also analyzed for patterns of certainty judgments.

RESULTS

Results of the statistical analysis of the question of whether the presence and severity of DAT affect the test-retest consistency of response on individual items of a semantic memory task are presented in Part A of this section. Research questions that arose as a consequence of this analysis are presented with the results of their statistical analysis in Part B.

Part A: Rate of Response Inconsistency in DAT Subjects

Intergroup comparison of the mean number of PPVT items to which subjects responded inconsistently was made using a one-way analysis of variance (Table 2). Results indicated a significant main effect of group ($F = 15.51$, $df = 2, 34$, $p<.001$) with planned contrasts indicating that both groups of DAT subjects had a significantly higher rate of response inconsistency than the normal control group ($p<.01$). Further, contrasts revealed a significant difference between the rates of the mild and moderate DAT groups ($p<.05$) with the moderate DAT group having a higher rate of response inconsistency than the mild DAT group.

TABLE 2
MEAN NUMBER OF PPVT ITEMS RESPONDED TO INCONSISTENTLY BY CONTROLS AND DAT SUBJECTS

Groups	n	$\bar{X}$	SD	F	p
Controls	14	4.07	3.25	15.51	<.001
Mild DAT	10	8.50*	4.03		
Moderate DAT	13	12.00*+	3.92		

*Performed significantly different from controls at $p<.01$.

+Performed significantly different from mild DAT subjects at $p<.05$.

Part B: Secondary Research Questions

It was necessary to consider the effect of guessing on subjects' total number of inconsistent items because subjects were forced to select one of four possible responses on each item of the PPVT. The presence of guessing on an item at both testings could confound the assessment of knowledge of concepts over time. Data from the judgment of certainty task were analyzed to determine which of the inconsistent PPVT items already identified did not involve guessing on both testings. For each item, a number of different combinations of PPVT responses (i.e., correct and incorrect) and judgment of certainty task responses (i.e., "Very Sure," "Somewhat Sure," or "Not Sure") were observed. A tally was made of the number of PPVT items for which the following response combinations occurred:

1. A correct PPVT response at the first testing (T_1) and an incorrect PPVT response at the second testing (T_2) with certainty task responses indicative of greater certainty at T_1 than at T_2 (e.g., correct/"Very Sure" at T_1 and incorrect/"Not Sure" at T_2).

2. A correct PPVT response at T_1 and an incorrect PPVT response at T_2 with certainty task responses indicative of less certainty at T_1 than at T_2 (e.g., correct/"Not Sure" at T_1 and incorrect/"Very Sure" at T_2).

3. A correct PPVT response at T_1 and an incorrect PPVT response at T_2 with certainty task responses of "Very Sure" or "Somewhat Sure" at both testings.

4. A correct PPVT response at T_1 and an incorrect PPVT response at T_2 with certainty task responses of "Not Sure" at both testings.

5. An incorrect PPVT response at T_1 and a correct PPVT response at T_2 with certainty task responses indicative of less certainty at T_1 than at T_2 (e.g., incorrect/"Not Sure" at T_1 and correct/"Very Sure" at T_2).

6. An incorrect PPVT response at T_1 and a correct PPVT response at T_2 with certainty task responses indicative of greater certainty at T_1 than at T_2 (e.g., incorrect/"Very Sure" at T_1 and correct/"Not Sure" at T_2).

7. An incorrect PPVT response at T_1 and a correct PPVT response at T_2 with certainty task responses of "Very Sure" or "Somewhat Sure" at both testings.

8. An incorrect PPVT response at T_1 and a correct PPVT response at T_2 with certainty task responses of "Not Sure" at both testings.

The patterns described above in (1) and (5) are seen as reflecting the responses of subjects who were more certain of the accuracy of their responses when they were correct, and less certain when they were incorrect. It was reasoned that subjects did not guess on a PPVT item at both testings if their responses fit these patterns.

Similarly, it was reasoned that there was a greater possibility that subjects did guess on PPVT items when they indicated they were "Not Sure" on both test days (patterns [4] and [8] described above). It was difficult to make conclusions with regard to guessing for those responses that fit the patterns described above in (2), (3), (6) and (7).

Thus, to assess the effects of guessing on subjects' mean number of inconsistent PPVT items, response consistency was analyzed using only those items on which subjects were more certain of the accuracy of their responses when they were correct, and less certain when they were incorrect (i.e., items which fit response patterns [1] and [5] mentioned above).

Intergroup comparison of the mean number of PPVT items to which subjects responded inconsistently but expressed greater certainty when they were correct was made using a one-way analysis of variance (Table 3). Results indicated a

significant main effect of group (F = 8.56, df = 2, 34, p = .001) with planned contrasts indicating that the moderate DAT group had a significantly higher rate of response inconsistency than the normal control group ($p<.01$). Further, contrasts revealed a significant difference between the rates of the mild and moderate DAT groups ($p < .05$) with the moderate DAT group having a higher rate of response inconsistency than the mild DAT group.

TABLE 3
MEAN NUMBER OF PPVT ITEMS RESPONDED TO INCONSISTENTLY BY CONTROLS AND DAT SUBJECTS WHEN GUESSING WAS CONSIDERED

Groups	n	$\bar{X}$	SD	F	p
Controls	14	1.57	1.40	8.56	.001
Mild DAT	10	3.30	3.27		
Moderate DAT	13	6.54*+	4.24		

*Performed significantly different from controls at $p<.01$.

+Performed significantly different from mild DAT subjects at $p<.05$.

These analyses indicate that the presence and severity of DAT significantly affect test-retest consistency of response on the PPVT when the effects of guessing are considered. Response consistency data for individual subjects including the total number of PPVT items for which inconsistent responses were given and the number of items

for which inconsistent responses were given when guessing was considered can be found in Appendix A. For readers interested in judgment of certainty task response patterns on PPVT items for which there was not an increase in certainty when a correct selection had been made, descriptive statistics for all subject groups can be found in Appendix B.

Another question that arose during the data analysis was whether the difficulty of a PPVT item affected the likelihood that subjects would be inconsistent in their responses. Information of this type is important because of its value in future research on semantic memory function. It has been reported that on semantic memory tasks, concept difficulty has a greater effect on the performance of DAT subjects than on the performance of normal controls (Kaszniak, Bayles, Tomoeda, & Slauson, 1988). In a study by Kaszniak et al. (1988), DAT subjects, but not normal control subjects, made more errors as items from a number of semantic memory tasks gradually increased in difficulty. It was concluded that concept difficulty was an important variable to be considered in the evaluation of DAT patients. Therefore, it would be of interest to know whether the difficulty level of PPVT items affects test-retest response consistency and the following research question was posed:

> What effect does PPVT item difficulty have on the response consistency of mild DAT, moderate DAT, and control subjects?

According to Dunn (1965), PPVT items are arranged in an empirically determined order of difficulty. Thus, the 40 PPVT items completed by each subject and analyzed for response consistency were reanalyzed in two groups: items 1-20 and 21-40. The second 20 items are, as a group, relatively more difficult than the first 20 items. The number of inconsistent items in the easier and harder groups were tallied for each subject. The mean number of items responded to inconsistently from both groups are presented in Table 4. These descriptive statistics show that whereas most of the normal control subjects' inconsistent responses were from the harder group of items analyzed, mild and moderate DAT subjects' inconsistent responses were spread out over both groups of items analyzed.

TABLE 4
MEAN NUMBER (AND S.D.) OF PPVT ITEMS
RESPONDED TO INCONSISTENTLY FROM THE
EASIER AND HARDER GROUPS OF ITEMS ANALYZED

		Easier Items	Harder Items
Groups	n	$\bar{X}$	$\bar{X}$
Controls	14	1.00 (1.17)	3.07 (2.34)
Mild DAT	10	3.80 (2.25)	4.70 (2.95)
Moderate DAT	13	6.31 (2.29)	5.69 (2.49)

Another secondary research question that was of interest was whether the presence and severity of DAT

affected subjects' overall scores on the PPVT. Intergroup comparisons of mean overall PPVT scores from the first and second test sessions were made using one-way analysis of variance (Table 5). Results indicated significant main effects of group (first session: $F = 60.89$, $df = 2, 34$, $p<.001$; second session: $F = 60.88$, $df = 2, 34$, $p<.001$). Planned contrasts revealed that both groups of DAT subjects had a significantly lower mean overall PPVT score than the normal control group at both test sessions ($p<.001$). Further, contrasts indicated that the moderate DAT group had a significantly lower mean overall PPVT score than the mild DAT group at both test sessions ($p<.001$).

TABLE 5
MEAN OVERALL PPVT SCORES (AND S.D.) FROM THE FIRST AND SECOND TEST SESSIONS FOR CONTROLS AND DAT SUBJECTS

Session	Controls	Mild DAT	Mod. DAT	F	p
First Test	141.14 (4.61)	109.90* (19.20)	67.77*+ (22.06)	60.89	<.001
Second Test	142.57 (3.67)	112.60* (18.07)	71.85*+ (22.98)	60.88	<.001

*Significantly different from controls at $p<.001$.

+Significantly different from mild DAT subjects at $p<.001$.

DISCUSSION

The motivation for this study was an interest in determining whether reliable inferences can be made regarding the integrity of specific conceptual knowledge in DAT patients following one-time administration of a semantic memory task. The noteworthy finding was significant inconsistency in the responses of mild and moderate DAT groups on two administrations of the PPVT. Without considering the effects of guessing, mild and moderate DAT subjects responded inconsistently to an average of 21% and 30% of PPVT items respectively. By contrast, normal subjects responded inconsistently to an average of 10% of PPVT items.

When the effects of guessing were taken into consideration, moderate DAT subjects still gave significantly more inconsistent PPVT responses than normal subjects and mild DAT subjects showed a trend towards giving more inconsistent responses. Mild and moderate DAT subjects responded inconsistently to an average of 8% and 16% of PPVT items respectively, whereas, normal subjects responded inconsistently to an average of 4% of items.

These findings are important because of their implications regarding the assessment of conceptual knowledge in persons with DAT. Although overall scores on the PPVT appeared to be a useful indicator of the presence

and severity of DAT in the present study, the relatively high degree of response inconsistency shown by DAT subjects suggests that theoreticians and clinicians should refrain from making conclusions about DAT patients' knowledge of individual concepts based on a single administration of the PPVT.

The findings of this study are consistent with the report of Schwartz et al. (1979) whose dementia patient was inconsistent over time in her responses on a picture-naming and verbal match-to-sample task. The rates of response inconsistency observed in subjects in the present study (when guessing was not taken into account) are remarkably similar to the rates of 33% on the picture-naming and 21% on the match-to-sample task reported by Schwartz et al. (1979).

It is important to note that the semantic memory tasks used by Schwartz et al. (1979) were substantially different from the PPVT. Their picture-naming task required the subject to identify the name of a picture from among five written choices and their match-to-sample task required the subject to match a label with a sample photograph. By contrast, the PPVT requires subjects to identify the picture from among four choices that best shows the meaning of a spoken stimulus word. Therefore, the finding of similar rates of response inconsistency in very different types of semantic memory tasks suggests that it was not the type of task used in this study that accounted for the significant

inconsistency in DAT subjects' responses.

In addition to the effects of guessing, a number of plausible explanations exist for response inconsistency on the PPVT in DAT subjects. Visual-perceptual deficits, disease progression, learning of PPVT concepts, and changes in medication, examiner, time of day tested, and testing location from one test day to the next can be cited as factors that could account for response inconsistency. However, all study participants were able to read a type-written sentence and perform with 80% or better accuracy on the first ten items of the PPVT, thereby demonstrating that a visual-perceptual deficit did not interfere with task completion. Then, too, Bayles et al. (1988) addressed the question of whether visual-perceptual deficits were associated with PPVT error responses in DAT subjects by having them orally define words missed. Because only three out of thirty-five subjects were able to provide a correct definition of a word missed, Bayles et al. (1988) concluded that lack of knowledge of word definitions, rather than visual-perceptual problems, accounted for the majority of PPVT errors.

Alzheimer's disease progresses slowly over a number of years and the ability of patients may remain the same for months in the absence of other disease or injury (Bayles & Kaszniak, 1987). Therefore, in the present investigation, it is most unlikely that disease progression over the seven

days between PPVT administrations affected response consistency rates of DAT subjects. Additional evidence that disease progression did not affect response consistency rates comes from the similarity of the DAT subjects' mean overall scores on the PPVT from the first and the second test days. If disease progression had significantly affected DAT subjects' performance, a marked decrease in overall scores would be expected. No such decrease in scores occurred.

The well documented learning deficits (Martin, Brouwers, Cox, & Fedio, 1985; Wilson et al., 1983; Wilson et al., 1982) of DAT subjects make it unlikely that they learned any of the concepts they missed at the first testing. Moreover, many of the DAT subjects failed to remember the first meeting with the examiner (DAT subjects frequently commented "I've never done this before," during the second test administration). Thus, it is improbable that the explicit learning of PPVT concepts affected response inconsistency rates.

As stated previously under Methods, no subjects experienced a change in medication from one testing to the next, and the examiner, approximate time of day of testing, and testing locations were the same at both testings for all subjects. Therefore, these factors cannot have accounted for the relatively high response inconsistency rates observed in DAT subjects.

Other factors that may have influenced the response inconsistency rates of subjects in this study are impaired attention and an inability to access semantic memory contents. Attentional deficits (Miller, 1973; Ober et al., 1986; Wilson, Bacon, Fox, & Kaszniak, 1983) and an inability to access semantic memory contents (Nebes et al., 1984; Weingartner, Kaye, Smallberg, Ebert, Gillin, & Sitaram, 1981; Weingartner et al., 1983) in DAT subjects have been noted by numerous investigators. Thus, in the present investigation, DAT subjects may have performed with response inconsistency rates that were significantly greater than normal controls because of a limited and variable ability to attend to stimuli presented during PPVT administration and to access concepts tested by the PPVT.

Effect of Item Difficulty on Response Consistency Rate

Analysis of the effects of item difficulty on response consistency indicated that 75% of the PPVT items to which normal subjects provided inconsistent responses were from the second and more difficult 20 items analyzed. These results are consistent with the expectation that subjects would be more likely to guess as the items increased in difficulty. Surprisingly, inconsistent responses of mild and moderate DAT subjects were spread out more equally over the easier and harder groups of items analyzed. For mild DAT subjects, 45% of inconsistent PPVT items were from the

first and easier group analyzed and 55% were from the second harder group. For moderate DAT subjects, 53% of inconsistent PPVT items were from the easier group analyzed and 47% were from the harder group. These results can be interpreted as evidence that the observed rate of response inconsistency in DAT subjects was not due solely to subjects' guessing. Further, because researchers have suggested that, on a variety of semantic memory tasks, DAT subjects perform significantly more poorly than normal controls as a function of concept difficulty (Kaszniak et al., 1988), one might have expected DAT subjects to respond more inconsistently to harder PPVT items. This was clearly not the case in the present study. Perhaps differences between the PPVT and Kaszniak et al.'s (1988) semantic memory tasks in the grading of concept difficulty across items account for the lack of support for the aforestated expectation.

Use of the Judgment of Certainty Task

It was the impression of this researcher that the addition of a judgment of certainty task helped clarify the effect of guessing on response consistency rates. Comparison of PPVT item scores with subjects' statements as to how certain they were of the accuracy of their responses made it possible to identify those items on which the subjects guessed. However, the judgment of certainty task

appreciably lengthened testing time and appeared to be a difficult task for moderate DAT subjects. These subjects needed frequent reinstruction to provide the examiner with a judgment of certainty.

Summary

The intent of this study was to determine the test-retest response consistency rate on a semantic memory task in DAT subjects controlled for severity of dementia. The major finding was significant inconsistency in the responses of mild and moderate DAT groups on two administrations of the PPVT. When the effects of guessing were taken into account, moderate DAT subjects still gave significantly more inconsistent PPVT responses than normal controls and mild DAT subjects showed a trend towards giving more inconsistent responses. A secondary finding was that DAT subjects did not respond more inconsistently as a function of PPVT item difficulty.

The results of this study substantiate the conclusion that the impairment of specific conceptual knowledge in persons with DAT cannot be reliably measured with a single administration of a semantic memory task such as the PPVT. The apparent variability in attention and/or ability to access semantic memory contents seen in DAT subjects who participated in this study supports the suggestion that one should look to data from different tests or repeated

administrations of the same test for information regarding the structural integrity of specific concepts (Bayles & Kaszniak, 1987).

APPENDIX A

RESPONSE CONSISTENCY DATA FOR INDIVIDUAL SUBJECTS

Included are the total number of PPVT items for which subjects gave inconsistent responses and the number of PPVT items for which subjects gave inconsistent responses when the effects of guessing were considered.

INDIVIDUAL SUBJECT DATA

(NC = Normal Control Subject; MILDDAT = Mild DAT Subject; MODDAT = Moderate DAT Subject)

Subjects	Total Number of Inconsistent Items	Number of Inconsistent Items when Guessing was Considered
NC01	1	1
NC02	2	2
NC03	0	0
NC04	2	0
NC05	8	2
NC06	6	2
NC07	5	4
NC08	5	0
NC09	12	4
NC10	4	0
NC11	3	2
NC12	2	1
NC13	6	3
NC14	1	1
MILDDAT01	11	4
MILDDAT02	5	1
MILDDAT03	9	4
MILDDAT04	4	0
MILDDAT05	13	4

Subjects	Total Number of Inconsistent Items	Number of Inconsistent Items when Guessing was Considered
MILDDAT06	12	3
MILDDAT07	15	11
MILDDAT08	4	0
MILDDAT09	6	1
MILDDAT10	6	5
MODDAT01	13	8
MODDAT02	12	10
MODDAT03	11	5
MODDAT04	11	4
MODDAT05	9	8
MODDAT06	9	1
MODDAT07	17	14
MODDAT08	18	12
MODDAT09	16	10
MODDAT10	14	3
MODDAT11	3	0
MODDAT12	11	6
MODDAT13	12	4

APPENDIX B

DESCRIPTIVE STATISTICS FOR INCONSISTENT PPVT ITEMS FOR WHICH SUBJECTS DID NOT EXPRESS GREATER CERTAINTY WITH A CORRECT PPVT RESPONSE

Included are group means for the number of inconsistent PPVT items for which subjects: were less certain of their correct responses than their incorrect responses (Table 1); were "Not Sure" of both their correct and incorrect responses (Table 2); and were "Very Sure" or "Somewhat Sure" of both their correct and incorrect responses (Table 3).

TABLE 1
MEAN NUMBER OF INCONSISTENT PPVT ITEMS
FOR WHICH SUBJECTS WERE LESS CERTAIN OF THEIR
CORRECT RESPONSES THAN THEIR INCORRECT RESPONSES

Groups	n	$\bar{X}$	SD
Normals	14	.21	.43
Mild DAT	10	.90	.99
Moderate DAT	13	.53	.88

TABLE 2
MEAN NUMBER OF INCONSISTENT PPVT
ITEMS FOR WHICH SUBJECTS WERE "NOT SURE"
OF BOTH THEIR CORRECT AND INCORRECT RESPONSES

Groups	n	$\bar{X}$	SD
Normals	14	1.36	1.82
Mild DAT	10	1.80	1.69
Moderate DAT	13	.92	1.26

TABLE 3
MEAN NUMBER OF INCONSISTENT PPVT ITEMS
FOR WHICH SUBJECTS WERE "VERY SURE" OR "SOMEWHAT
SURE" OF BOTH THEIR CORRECT AND INCORRECT RESPONSES

Groups	n	$\bar{X}$	SD
Normals	14	.93	1.27
Mild DAT	10	2.50	2.27
Moderate DAT	13	4.00	2.97

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