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The influence of personal familiarity on object naming, knowledge, and use in dementia

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Abstract

Reports of semantic dementia patients have shown more accurate identification and use for personal objects than unfamiliar analogs of the same objects (e.g., personal comb versus experimenter's comb) [Bozeat, S., Lambon Ralph, M. A., Patterson, K., & Hodges, J. R. (2002). The influence of personal familiarity and context on object use in semantic dementia. *Neurocase*, *8*, 127–134; Snowden, J. S., Griffiths, H., & Neary, D. (1994). Semantic dementia: Autobiographical contribution to preservation of meaning. *Cognitive Neuropsychology*, *11*, 265–288]. Despite potential clinical implications, the personal object advantage has not been explored in various dementia populations. Sixteen mild to moderate dementia patients were tested with 12–15 of their personal objects and laboratory analog objects. Four tasks were administered: Naming, Gesture, Semantic/Script Generation, and Personal Object Decision (i.e., Is this yours?). Although 25% of the sample performed at chance in identifying personal objects as their own, participants generated more specific information ($t = 2.3$, $p = .03$) and more accurate gestures ($t = 2.4$, $p = .03$) for personal objects. Thus, the personal object advantage was observed for script/semantic knowledge and movement sequences, and should be considered in residential planning for various dementia patients.

Keywords: Alzheimer's disease; Vascular dementia; Personal experience; Object knowledge; Praxis; Everyday objects; Long-term dementia care

1. Introduction

Individuals diagnosed with dementia often experience difficulty naming and using everyday objects (Giovannetti, Libon, Buxbaum, & Schwartz, 2002; Hodges, Salmon, & Butters, 1991). As these impairments progress, it often becomes necessary to move dementia patients to a new residence that offers assistance and supervision. Regrettably, relocation to a novel, unfamiliar environment may exacerbate cognitive and functional deficits (Castle, 2001; Lawton & Cohen, 1974). Previous case reports of individuals with semantic dementia (SD), however, suggest a relatively simple method to simulate aspects of the original home environment and smooth the transition to a new residence. These studies have shown that individuals with SD are better at identifying and using their personal objects (e.g., their comb) versus unfamiliar analogs of the same object (e.g., the examiner's comb; Bozeat, Lambon Ralph, Patterson, & Hodges,

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2002; Snowden, Griffiths, & Neary, 1994). Thus, preservation of personal belongings, which are an integral and easily transportable component of the home context, might facilitate everyday functioning following relocation. However, the personal object advantage has not been explored in individuals with dementia due to other causes. This paper examines the personal-object advantage on cognitive and motor tasks in a heterogeneous group of dementia patients.

The first report of the personal object advantage in SD described object identification in a single patient (Snowden et al., 1994). The authors wrote, "[The patient] had no difficulty recognizing her own new-style key-pad telephone, and gave an elaborate demonstration of its use. In contrast, she was perplexed by a traditional dial telephone, which she appeared to take to be a hair dryer." (p. 280). Snowden et al. (1994) drew on their previous studies showing preserved episodic memory in SD to explain these results; they proposed that both episodic and semantic memory contribute to our knowledge of objects. Individuals with SD demonstrate degraded semantic memory with relatively preserved episodic memory; therefore, object knowledge is informed by (and limited to) the episodic system. For this reason, object representations in SD are rigid and constrained to the specific object exemplars most recently and repeatedly encountered (Snowden, Griffiths, & Neary, 1996). This account implies that individuals with AD or other amnestic syndromes may not show the personal object advantage; however, there are no studies exploring this phenomenon with such patients.

More recently, Bozeat et al. (2002) have reported the personal object advantage for gesture production in two patients with moderate to severe SD. Bozeat et al. (2002) have proposed that repeated exposure to objects will elicit "automatic stereotyped responses," without boosting semantic knowledge. However, Bozeat et al. (2002) did not assess the personal object advantage on tasks of knowledge or naming; only gesture production was evaluated.

Finally, Funnell (2001) has ascribed the personal object advantage to preserved script knowledge, which includes the representation of task goals, task steps, and relevant objects (Schank & Abelson, 1977). According to Funnell (2001) scripts are represented on multiple levels along a continuum from abstract to concrete. Abstract representations include knowledge of objects independent of events or contexts. More concrete script knowledge represents action plans for familiar, recurring tasks, including details of the objects used in these tasks. This specific event knowledge is distinct from episodic memory or the ability to "recall specific autobiographical episodes set in the past." Funnell (2001) claims that while abstract concepts are impaired in SD, specific event knowledge for routine personal tasks remains relatively preserved and accounts for the personal object advantage. The integrity of script knowledge associated with personal versus laboratory analog objects has never been directly assessed in SD or other dementia populations.

The present study is the first to explore the personal object advantage in individuals with dementia syndromes other than SD. Performance on naming, gesture, and semantic/script generation tasks was assessed using personal and laboratory analog objects. We reasoned that a significant finding on one task, but not others might shed light on the process(es) responsible for the effect. For example, a significant finding on only the gesture task, would suggest personal objects were associated with automatic, stereotyped responses (Bozeat et al., 2002). On the other hand, a significant finding on only the semantic/script generation task would imply that personal objects have access to specific event knowledge or richer semantic representations than laboratory objects (Funnell, 2001). Finally, to determine whether or not the personal object advantage (if present) is linked to episodic memory functioning (Snowden et al., 1994), episodic memory was assessed for post hoc correlation analyses with variables reflecting the magnitude of the personal object advantage.

2. Methods

2.1. Participants

The study was performed with 16 individuals diagnosed with mild to moderate dementia according to DSM-IV-TR criteria (American Psychiatric Association, 2000). Fourteen participants were recruited from an outpatient memory clinic (UMDNJ-SOM); two were recruited from an assisted living facility for residents with dementia. To be included in the study, the participant's caregiver or residential staff person had to confirm that he/she regularly performed activities of daily living (with or without assistance) using his/her personal objects. Individuals were not recruited for the study if, following clinical neuropsychological assessment, it was determined that they did not have the attentional capacity and/or cognitive skills necessary to complete an hour-long testing session and comprehend task instructions. All participants signed informed consent forms that were approved by the UMDNJ-SOM Institutional Review Board.

Table 1
Demographic data for all participants

Subject number	MMSE	Age	Years of education	Sex	Diagnosis
1	25	80	12	W	AD
2	24	74	14	M	AD
3	26	72	12	W	AD
4	20	83	12	M	AD
5	19	79	12	W	Mixed
6	21	80	14	W	AD
7	14	71	9	M	Mixed
8	23	79	13	M	AD
9	22	79	12	W	VaD
10	23	82	12	W	AD
11	22	79	13	W	AD
12	27	74	12	W	VaD
13	28	78	8	M	AD
14	12	90	5	M	AD
15	23	62	12	W	AD
16	11	88	8	W	AD

W, woman; M, man; AD, Alzheimer's disease; mixed, mixed dementia; VaD, vascular dementia.

On average, the participants (10 women, 6 men) were 78 years old (S.D. = 6.7) and had 11 years of education (S.D. = 2.3). The mean Mini Mental-State Exam (MMSE; Folstein, Folstein, & McHugh, 1975) score was 21.3 (S.D. = 5.1). Fourteen participants met criteria for AD (McKhann et al., 1984); 2 of the 14 AD participants also showed mild white matter changes on MRI and were ultimately diagnosed with Mixed Dementia (Langa, Foster, & Larson, 2004). Two participants met criteria for vascular dementia (VaD; Chui et al., 1992). Table 1 shows all demographic data.

2.2. Procedures

Prior to the testing session, a telephone interview was conducted with each participant's caregiver to identify 12–15 portable household objects that the participant used on at least a weekly basis. The caregiver was asked to bring the personal objects to the testing session. The experimenter prepared a laboratory analog for each personal object.

Naming, Gesture, Personal Object Decision, and Semantic/Script Generation tasks (described below) were performed with all objects (personal & laboratory) during a single testing session that lasted approximately 1 h. The Naming and Gesture tasks were administered first, but their order was counterbalanced across participants. Object presentation was randomized within each task. Performance on all tasks was videorecorded for subsequent analysis by two coders blind to the classification (laboratory versus personal) of the objects. The two coders worked together on 6 participants and independently coded the remaining 10 participants to assess inter-rater reliability. Coding disagreements were reconciled through discussion and review of the videorecording following the reliability analyses.

2.3. Naming task

Participants were asked to name each object as quickly as possible. Each object was placed behind a screen that the experimenter raised when the participant indicated that he/she was ready for the trial. Three practice trials were performed with sample objects. Responses were coded as correct or incorrect from the video recording.

2.4. Gesture task

Object presentation followed procedures used in the Naming task. Participants were instructed to pantomime the use of each object ("Show me how to use this."). Three sample trials were performed. Gesture coding closely followed the procedures described by Bozeat et al. (2002). Prior to coding the videorecorded gestures, a gesture "dictionary" was developed that catalogued each object used in the study along with each object's gesture components or features, including the number of hands used to hold the object, the appropriate hand posture (e.g., clench, pinch), and each individual movement. Coders referred to the dictionary as a guide when scoring gesture production. One-point was assigned for each gesture component that was executed without error. Final scores reflect the percent of gesture components that were accurately performed.

2.5. Personal Object Decision

This task was administered to determine whether participants could reliably distinguish their personal objects from the laboratory objects. Participants were shown each object one at a time and asked, "Is this yours?" The dependent variable was the percent correct.

2.6. Semantic/Script Generation

Participants were asked (1) where, (2) when, and (3) how each object would be used. Objects were presented one at a time and participants were given as much time as needed to respond to each query. Responses were transcribed from the video recording by two coders blind to object classification. A second set of blind coders tallied the total number of words and total "content" words produced for each object. "Content" words were coded to quantify the amount of accurate and meaningful information generated for each object. Content words were defined as all nouns, verbs, adjectives, and adverbs that correctly referred to the target object. For instance, when shown a remote control, the following 14-word response would have been coded as containing only 2 "content" words: "Well, I <u>find</u> my bills and <u>use</u> this to add and subtract the amount." However, if this response were provided in reference to a calculator, six content words would have been coded: find, bills, use, add, subtract, and amount. For each object, the total words, total content words, and percent of content words (content words/total words) were calculated.

2.7. Memory assessment

Memory testing was of interest to evaluate the role of episodic memory in the personal object advantage (Snowden et al., 1996). Participants were administered the Philadelphia (repeatable) Verbal Learning Test (PVLT; Garrett et al., 2004; Libon et al., 2005; Price et al., 2004), a 9-word list learning task that is administered in the same manner as the 16-word California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 1983). The variables of interest for this study included the total number of words recalled across the first five learning trials [P(r)VLT 1–5] and the recognition discriminability score [P(r)VLT-discrim]. Recognition discriminability was included, as it minimizes retrieval demands and is typically considered a more pure measure of episodic memory encoding (Libon et al., 1996).

2.7.1. Data analysis

Naming, Gesture, and Script Generation scores were calculated separately for personal objects and laboratory objects. Within subject *t*-tests were performed to assess differences between personal and laboratory objects.

The total percent correct obtained on the Personal Object Decision Test was compared to chance (50%) for each participant using the Fisher's Exact Test. Significant findings indicated that the participant was better than chance at discriminating between personal objects and laboratory objects, whereas non-significant analyses suggested that the participant was not better than chance and could not reliably distinguish his/her objects from the laboratory objects.

Difference scores were calculated for each subject for variables that showed a statistically significant personal-object advantage. Difference scores reflected the proportional increase in the task score with personal versus laboratory objects ([personal object score–laboratory object score]/personal object score). Difference scores were used in correlation analyses with the following variables: P(r)VLT 1–5, P(r)VLT-discrim, and Personal Object Decision score.

3. Results

3.1. Naming

Table 2 shows the mean percent correct across object type. As shown, the difference between personal and laboratory objects was not significant. Overall, participants responded correctly to slightly over 80% of all objects. The average

Table 2
Results from the Semantic/Script Generation, Naming, and Gesture tasks

	Laboratory object		Personal object		Analyses		Effect size, *d*
	M	S.D.	*M*	S.D.	*t*	*p*-value	
Semantic/Script Generation task							
Total words	39.3	18.1	38.3	17.3	.58	.57	.15
Content words	8.80	3.8	9.60	4	2.22	.04	−.56
Percent content words	26.1	6.2	27.8	5.3	2.34	.03	−.58
Naming task							
Percent correct	81.3	14.8	82.2	10.8	.34	.74	−.09
Gesture task							
Percent correct	70.5	11.3	74.5	12.8	2.43	.03	−.61

percent agreement between coders was 94 (range 85–100% agreement) for classifying a naming response as correct versus incorrect.

3.2. Gesture task

Table 2 shows participants produced a significantly higher percent of correct gesture components for personal objects versus laboratory objects. While the mean difference between these conditions was relatively small (4%), the effect size was medium to large. The average percent agreement between coders was 89 (range 81–94% agreement) for coding each component as correct versus incorrect.

3.3. Semantic/Script Generation

There was no difference between laboratory and personal objects in the total number of words generated on the script task (Table 2). However, the number of content words and the percent of content words were significantly higher for familiar versus laboratory objects, and the effect sizes for these analyses were medium. (Sample responses are shown in Table 3.) The average percent agreement between coders for the classification of words as content versus non-content was 97 (range 96–99% agreement).

3.4. Personal Object Decision

On average, participants responded accurately to 79% of objects (S.D. = 17; range 100–53%). Twelve participants were more accurate than chance (>76% correct). The remaining four participants were unable to reliably distinguish their objects from the laboratory objects (<59% correct).

3.5. Memory testing

Two participants were not administered the P(r)VLT because of scheduling conflicts. Of the 14 participants who were tested, the average number of words recalled across trials 1–5 was 17.4 (S.D. = 5.8; control $M = 32.5$, S.D. = 5.2; Libon et al., 2005). The average P(r)VLT-discrim score was 69.2 (S.D. = 13.3; control $M = 96.6$; S.D. = 4). All P(r)VLT-discrim scores fell below two standard deviations from the control mean, suggesting all participants experienced significant impairment in encoding episodic memories.

3.5.1. Correlation analyses

Difference scores were calculated for the Gesture (Gesture difference $M = 4.8$; S.D. = 8.5) and Semantic/Script Generation tasks (percent content words; Semantic difference $M = 3.5$; S.D. = 15.3) for correlation analyses. There were no significant correlations between the Gesture difference score and episodic memory scores [P(r)VLT 1–5:

Table 3
Selected Semantic/Script Generation task responses

P	Object	Object type	Query			Total words	Content words	Percent content words
			Where?	What for?	How?			
5	Ice-cream scoop	Laboratory	I would use it in the kitchen	To eat it	Scoop it out of the ice-cream box and eat some ice-cream	22	5	23
		Personal	If I wanted some ice-cream out of the refrigerator	For dipping the ice cream out of the container	Opening up the ice-cream box, I'd scoop ice-cream out into a small bowl and put the lid on	35	12	34
8	Remote control	Laboratory	In my office	Keeping check account straight	Well, I pick it up put the power on and then perform the task that's ahead of me	25	5	20
		Personal	If I was sick, viewing television	Turning television on off, changing stations	First off, hit the button and hit the channel if watching television, if it's channel 12, I'd hit 12	29	11	38

P = participant number. Content words are underlined.

$r = -.10$, $p = .73$; P(r)VLT-discrim: $r = .07$, $p = .81$]. There were also no significant correlations between the Semantic difference score and memory scores [P(r)VLT 1–5: $r = -.25$, $p = .38$; PVLT-discrim: $r = -.18$, $p = .54$].

The relation between the Object Decision score and the difference scores was also assessed to determine whether or not the personal object advantage was influenced by the ability to discriminate personal from laboratory objects. The correlations were non-significant for both the Gesture ($r = .21$, $p = .44$) and Semantic/Script ($r = .10$, $p = .71$) tasks, suggesting the personal object advantage is not linked to the ability to overtly identify personal objects.

4. Discussion

The primary aim of this study was to explore the personal object advantage in a heterogeneous group of dementia participants. Results revealed a significant personal object advantage for gesture production and script generation. While the advantage was subtle in comparison to reports of individuals with SD (Bozeat et al., 2002; Snowden et al., 1994), differences were statistically significant and effect sizes were medium to large.

The pattern of performance across tasks provides some insight into the potential mechanism(s) responsible for the personal object advantage in this sample. For instance, the significant advantage for personal objects on the Gesture task accords with the notion that learned movement sequences may be more strongly associated with routinely used personal objects than unfamiliar exemplars of the same object. Additionally, results on the Script/Semantic Generation task revealed that the personal object advantage occurred at the level of conceptual knowledge of tasks and objects. This supports Funnell's (2001) position that personal objects are tightly linked to script/event knowledge of frequently performed actions.

There are two findings that are somewhat inconsistent with Snowden et al.'s (1994) position that the personal object advantage is mediated by the episodic memory system. First, episodic memory was markedly impaired in our sample, yet the personal object advantage was observed. Second, correlation analyses showed no significant relation between scores on memory tests and the personal object advantage on gesture and script tasks. Thus, while episodic memory may contribute to the dramatic personal object advantage for object identification in SD, it does not seem to explain the subtle, but significant, effects observed on gesture and script generation in this heterogeneous sample.

It is important to mention that 25% of participants in this study could not reliably discriminate personal from laboratory objects. Furthermore, correlation analyses showed neither a strong nor statistically significant relationship between the personal object advantage and performance on the Personal Object Decision task. Thus, the personal object advantage may occur through implicit learning. A closer look at individual subject data illustrates this conclusion.

Subject 5 performed at chance level when asked to identify task objects as personal versus laboratory (53% correct); nevertheless, her performance on the Semantic/Script Generation Task was 18% higher for personal objects. Similarly, Subject 11 correctly identified only 50% of objects as personal versus laboratory; yet, her gesture scores were 7.4% higher for personal objects. Thus, explicit recognition of an object as one's own was not a prerequisite for the personal object advantage. This suggests that the personal object advantage may be mediated by an implicit process(es), such as repetition priming (Cave, 1997) or procedural learning (Squire, 1992).

The personal object advantage for gesture production is easily conceptualized as a consequence of implicit processes. Routine motor responses are often acquired and produced by procedural memory systems. The link between semantic knowledge and implicit memory systems, however, has received relatively little attention, particularly in the study of degenerative dementia. Our results suggest that the repeated exposure and use of specific objects may foster a rich, but rigid, semantic network that does not generalize to alternate exemplars of the same object. This implies a link between semantic knowledge for objects/actions and implicit memory systems. Further studies are needed to explore the potential interaction between implicit and semantic systems and the possibilities that this interaction may hold for facilitating everyday functioning in dementia patients.

We found no evidence for the personal object advantage on a test of lexical representations/retrieval. Past studies of healthy individuals, have shown reduced naming *latencies* following repeated exposure to objects (repetition priming), even after long interstimulus intervals (e.g., 6 weeks; Cave, 1997). Neuroimaging studies have demonstrated activation changes following repeated exposure to objects. Healthy participants showed decreased activity in occipitotemporal and left inferior frontal cortex and increased activity in the left insula and basal ganglia when naming more familiar versus less familiar objects (van Turnnout, Bielamowicz, & Martin, 2003). We acknowledge the possibility that our naming score may have been too coarse to detect the personal object advantage and that naming latencies may have yielded significant results.

We also acknowledge that the sample size, though larger than previous case reports, was somewhat small. A larger sample would have increased the power to detect relations between variables that may have been missed in the present correlation analyses. However, it is worth noting that all correlations fell far short of statistical significance and r values were small; thus, it is unlikely that a larger sample size would have yielded significant findings. Effect sizes for within-group analyses were medium to large, suggesting these results are reliable. Nevertheless, future work should expand upon our findings with respect to sample size as well as the possible influence of dementia diagnosis (e.g., AD versus VaD) on the presence, magnitude, and mechanism of the personal object advantage. We also acknowledge that without a control group, we cannot be sure whether the personal object advantage is a normally occurring phenomenon. We assume, however, that healthy participants would have performed at or close to ceiling on our experimental tasks with both personal and laboratory objects. Furthermore, a control group was not essential to meet the primary aim of this study, which was to explore the personal object advantage in a group of heterogeneous patients for the purpose of suggesting a strategy to facilitate everyday functioning.

In conclusion, our results demonstrate statistically significant differences between personal versus unfamiliar/laboratory objects, with familiar objects eliciting more accurate gestures and more detailed information. As previously stated, further research is necessary to examine the clinical implications of our results for everyday functioning in dementia. However, on the surface, our results suggest that preserving personal objects, particularly following relocation to a new residence, may facilitate object use and everyday action in dementia patients. Moreover, when dementia patients must use new objects, they may benefit from repeated exposure to the novel objects prior to their use in everyday tasks. Finally, we wish to raise awareness to the possibility that overt personal object recognition may not be an accurate gauge of the potential benefit of personal objects on actions and activities.

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