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# Recognition of Self Among Persons with Dementia: Pictures Versus Names as Environmental Supports

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# RECOGNITION OF SELF AMONG PERSONS WITH DEMENTIA
## Pictures Versus Names as Environmental Supports

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ABSTRACT: The physical environment can promote the functional ability of persons with dementia. Many care facilities use environmental signage (e.g., names on doors)

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to facilitate adaptive behavior (e.g., room finding). However, the effects of such signage on residents' functioning are not well understood. In three experiments, we investigated if persons with moderate to severe dementia had the required skills necessary to benefit from signage. Compared to a control condition (recognition of fellow residents' photographs), a high percentage of participants could identify written names and photographs of themselves (Experiment 1). Moreover, name and photographic labels helped participants identify belongings (Experiment 2). Training improved some participants' recognition of their own photographs but not of their fellow residents' photographs (Experiment 3). These findings are consistent with research on self-reference and age-related changes in face recognition and reading, and they suggest that many persons with dementia may have the requisite abilities to benefit from prosthetic signage.

***Keywords:*** *Alzheimer's; dementia; environment; self-recognition; human-factors*

**Alzheimer's disease is a degenerative illness** that afflicts an increasing number of elderly individuals. Persons with dementia (PwD) suffer from progressively worsening sensoriperceptual and cognitive deficits. Characteristic symptoms include language deficits (Bayles, Tomoeda, & Trosset, 1992; Clem, 1991), inability to perform purposeful movements (Cohan, 1997), profound cognitive impairments (Mitchell, 1991), and acute visual, auditory, and olfactory sensory deficits (Doty, 1989; Esiri, Pearson, & Powell, 1986). These symptoms compromise PwD's ability to perform routine, daily activities, such as dressing and finding their way (Cohan, 1997). During the course of the disease, PwD require increasing levels of care and supervision. For example, wandering into the wrong room or into potentially dangerous areas is a common problem of PwD in residential care (Rosswurm, Zimmerman, Schwartz-Fulton, & Norman, 1986). The disease severely diminishes the quality of life of the affected persons, places a challenging burden on their caregivers, and exacts emotional and monetary costs from the supporting family members.

There is growing recognition that the physical environment is important in promoting the functional ability of PwD and in reducing the burden placed on their caregivers. Many design handbooks tout the therapeutic advantages of environmental design for PwD and offer architectural and interior design

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recommendations to promote the safety, autonomy, and well-being of dementia sufferers (e.g., Brawley, 1997, 2001; Calkins, 1988, 1997; Cohen & Weisman, 1990; Coons, 1990; Day & Calkins, 2002; Hiatt, 1987; Lawton, 1981). Research has also shown that some specific environmental modifications can affect specific behaviors of PwD in residential care. For example, visual barriers have effectively reduced the rates of exit from emergency doors (Namazi, Rosner, & Calkins, 1989); prominently displayed personal possessions have aided some residents in locating their rooms (Namazi, Rosner, & Rechlin, 1991); toilets that were directly in the line of sight increased use rates, as compared to visually concealed toilets (Namazi & Johnson, 1991a); and signs depicting concrete words (i.e., toilet) and directional arrows appended to the floor increased rates of entrance into the bathroom (Namazi & Johnson, 1991b).

Despite advances in the field, a pressing need remains for additional, empirical research on the role of the environment in the care of PwD. For example, special care units (SCUs) were founded as the physical manifestation of design guidelines and clinical knowledge, and they endeavor to offer care appropriately tailored to dementia sufferers (Gold, Sloane, Mathew, Bledsoe, & Konanc, 1991). Although there is some evidence for the effectiveness of SCUs (see Maslow, 1994), the facilities lack a standard definition (Grant, Kane, & Stark, 1995), and design features vary considerably across SCUs. Moreover, the use of special environmental features is not exclusive to SCUs (Maslow, 1994). For instance, environmental signage (e.g., residents' names on doors, labels on drawers, written instructions) appeared in 11% of SCUs as well as in 5% of non–SCUs in 437 Minnesota nursing facilities (Grant et al.,1995). Unfortunately, SCU models have not necessarily provided strong theoretical and conceptual bases for design practices and often have implemented global interventions rather than individual design features (Day, Carreon, & Stump, 2000; Grant, 1996). Thus, SCUs may offer a complex array of environmental interventions that may be associated with generic improvement in resident functioning. However, such findings do not indicate that a specific design intervention per se led to change in the intended behavior.

The present research was motivated by the observation that many long-term care facilities, including SCUs, commonly feature both residents' names and photos on doorways to help residents navigate their surroundings (e.g., Benson, Cameron, Humbach, Servino, & Gambert, 1987; Passini, Pigot, Rainville, & Tétreault, 2000; Passini, Rainville, Marchand, & Joanette, 1998). The effectiveness of this intervention presumes that residents can recognize their printed names and photographic images beyond chance accuracy. However, there appears to be no published research on the extent to which PwD in long-term care can recognize, and use, self-referent information to guide behavior.

PwD may not, in fact, recognize photographic images beyond chance accuracy. Clinical data reveal that PwD commonly display deficits in recognizing friends, family members, and images of themselves (Cohan, 1997; Mendez, Martin, Smyth, & Whitehouse, 1992). Mildly impaired PwD also demonstrated more frequent deficits on famous-face recognition tests than did controls (Della Sala, Muggia, Spinnler, & Zuffi, 1995; Giannakopoulos et al., 2000; Hassing & Baeckman, 1997; Hodges & Greene, 1998; Hodges, Salmon, & Butters, 1993). Consistent with these face-recognition deficits, PwD have deficient low-frequency contrast sensitivity (i.e., the minimum amount of visual contrast necessary to resolve light and dark boundaries), which impairs face recognition (Cronin-Golomb et al., 2000; Rizzo, Anderson, Dawson, & Nawrot, 2000). Thus, some research suggests that PwD may have difficulty recognizing faces in photographs at rates high enough for such images to be useful in environmental signage. Notably, on famous-face tests, PwD exhibit a disproportionately pronounced impairment for recognizing the faces of famous contemporaries (i.e., from the most recent decade) (Greene & Hodges, 1996; Hodges et al., 1993), suggesting that famous-face recognition declines as the disease progresses.

PwD's self-recognition also appears to become increasingly impaired as the disease progresses. Some PwD lose the ability to recognize their reflection in a mirror, as measured by self-directed responding (e.g., primping), responding to a mark placed on their forehead, and by answering the question, "Who is that?" For example, although moderately severe PwD (Stage 5 on the Global Deterioration Scale [GDS]) (Resiberg, Ferris, de Leon, & Crook, 1982) displayed mirror recognition, significantly fewer GDS Stage 6 participants did, and no GDS Stage 7 participants did (Biringer & Anderson, 1992; Biringer, Anderson, & Strubel, 1988). Self-recognition impairment was worse when images were static video clips, as compared to dynamic images (Biringer & Anderson, 1992). Mirror recognition tests, however, are not without criticisms, and failure to respond to mirrors (i.e., a null finding) does not necessarily mean failure to self-identify (Gallup, 1994). Mirror self-recognition has been elicited in some PwD after training (Bologna & Camp, 1997). In sum, PwD in residential care may not recognize themselves in photographs at rates high enough for these images to be useful in environmental signage.

Environmental signage in residential care typically includes the printed names of residents in addition to, or instead of, residents' pictures. The use of residents' names in signage presumes that PwD's ability to read and comprehend names remains intact and that this ability can guide appropriate behavior (e.g., discrimination of and entry into one's room). Consistent with this assumption, some studies have found that reading is more resistant to dementia than are other cognitive skills. For example, Noble, Glosser, and Grossman (2000) found that PwD could read aloud real words and pseudowords (pronounceable fake words), even though these participants were suffering from varying degrees of semantic impairment and were unable to match written words with corresponding pictures. Similarly, Patterson, Graham, and Hodges (1994) found that although PwD had difficulty reading irregular words (i.e., characterized by atypical letter-sound correspondences, such as those in *yacht*), they correctly read aloud regular words. PwD's ability to pronounce words and pseudowords, however, does not ensure that this ability can guide behavior. Yet Namazi and Johnson (1991b) found that signs featuring written words (e.g., toilet) to indicate the location of a bathroom increased rates of entrance into the bathroom (as previously discussed), suggesting that PwD can use written words to guide behavior.

Though some research findings suggest that reading is more robust than is face recognition among PwD, other evidence suggests that single-word reading suffers as the disease progresses. Performance on the National Adult Reading Test was influenced by severity of dementia (Cockburn, Keene, Hope, & Smith, 2000; O'Carroll et al., 1995; Taylor, 1999). Similarly, Passafiume, Di Giacomo, and Giubilei (2000) found that PwD had longer reading latencies, as compared to normal controls. Other indirect evidence also suggests that PwD may have impaired reading. PwD exhibited eye-movement disturbances (i.e., increased saccades, increased regressions, and longer fixation times) during reading, even at early stages of dementia, and these eye-movement changes correlated with impaired reading (Lueck, Mendez, & Perryman, 2000). Because severely impaired PwD are incapable of performing the required task (e.g., reading words aloud on command), their reading ability cannot be assessed using standardized measures. Thus, environmental signage that uses residents' names may be warranted if reading is more resistant to severity of dementia than are other cognitive skills. If reading becomes increasingly impaired among PwD, name labels may not be effective prosthetic devices.

In sum, although many residential care facilities use residents' written names and pictures as navigational aids, basic research findings on the effects of dementia on face recognition and reading raise doubts about the likely effectiveness of such interventions. In the series of studies presented here, rather than investigate the clinical effectiveness of environmental signage (i.e., the names and photos of residents) on doorways, we investigated the assumptions underlying such interventions. Environmental signage assumes that participants can recognize their own names and photographic images beyond chance accuracy. In Experiment 1, we investigated the extent to which persons suffering from moderate to severe cognitive decline could read their names and recognize their pictorial images. In Experiment 2, we extended our investigations to evaluate if written names and pictures can effectively label objects and thereby promote participants' ability to identify and locate personalized, generic objects when asked. In Experiment 3, we evaluated whether participants, who initially showed poor recognition for their own pictures, can be trained to identify these pictures more accurately.

## EXPERIMENT 1

In Experiment 1, the extent to which participants could identify their own written names and photographic images was investigated. We used repeated-measure designs (which are more powerful than between-subject designs) in this and the following experiments to analyze difficult-to-obtain, small samples of seriously impaired resident groups. In the game "Can you point to," participants were asked to point, in 10 separate trials, to a target named by the experimenter from an array of three stimuli. Targets included each participant's printed name and her recent photo. Distractor stimuli included the printed names and current photos of fellow residents because PwD in residential care must distinguish their own rooms and belongings (labeled with their names and photos) from fellow resident-labeled spaces and objects.

Because our game asks players to point to the same target (e.g., picture of self) in each of 10 consecutive trials in a single session, participants' repeated exposure to the same stimulus may produce artifactually high levels of performance. For example, a finding that PwD can point accurately to their own photos could reflect preexisting ability as well as the effects of repeated exposure to the same stimuli. Presumably, unimpaired individuals would detect, for example, the same face reappearing on every trial (even if the face had never been seen beforehand) and could use this observation to develop a strategy for good performance. Although cognitively impaired participants may explicitly fail to apply a deliberate strategy to enhance task performance (e.g., Winograd, Goldstein, Monarch, Peluso, & Goldman, 1999) (Experiment 1), there is evidence that PwD, particularly advanced-dementia sufferers (Bologna & Camp, 1995, 1997), may implicitly recognize (i.e., preferentially sort) the images of others (e.g., Winograd et al., 1999) (Experiment 2). Thus, to gauge performance due to preexisting ability (i.e., explicit recognition) from performance resulting from repeated exposure (i.e., implicit familiarization), we included two control conditions.

In the picture control condition, each participant was asked to point to the picture of one fellow female resident (because all participants were female) chosen randomly (to control for familiarity). We assumed that our cognitively impaired participants would not recognize the images of fellow residents at the onset of the experiment because of PwD's established face-recognition difficulties (e.g., Cohan, 1997; Cronin-Golomb et al., 2000; Mendez et al., 1992; Rizzo et al., 2000). Thus, accurate performance on this task would result primarily from repeated exposure to the identical stimulus. In contrast, correctly pointing to photos of themselves could reflect both preexposure ability (i.e., self-recognition) as well as any benefit arising from repeated exposure. Because amount of experimental exposure was held constant in own-photo and other-photo conditions, pointing significantly more accurately to own photo than to a photo of other would suggest that participants recognize their own photos beyond the effects of experimental exposure.

A control condition for the printed-name condition was also implemented, although we believed that this condition would be a less effective control than the photo-of-other condition. In the printed-name control condition, each participant was asked to point to the printed name of her randomly chosen fellow resident, prompted by her name spoken aloud, among an array of three fellow residents' printed names. The limitation of this control condition is that our participants may demonstrate good performance on the name-of-other task because reading simple words appears to be more resistant to dementia than are other cognitive skills (Noble et al., 2000; Patterson et al., 1994). That is, if participants' reading skills were intact, then this ability should generalize to reading the names of themselves (i.e., the experimental condition) and others (i.e., the control condition). Yet performance on the name-of-self task may be superior to performance on the name-of-other task because holding in memory a name spoken aloud should be easier when the name is one's own than when it is someone else's (particularly among dementia sufferers), according to research on self-reference effects in memory (Rogers, Kuiper, & Kirker, 1977). The mnemonic advantage of self-referent processing has generalized to various encoding tasks (e.g., to-be-remembered materials and autobiographical retrieval) and across different populations (e.g., children, adults, and depressed individuals) (see Symons & Johnson, 1997, for a review).

In summary, extrapolating from research on self-reference (e.g., Rogers et al., 1977), we hypothesized that participants' performance in the printed name-of-self condition would be better than performance in the printed name-of-other condition and that performance in the photo-of-self condition would be better than performance in the photo-of-other condition. Because the ability to read words aloud is generally retained until the onset of severe dementia (Noble et al., 2000; Patterson et al., 1994), and because PwD have face-recognition difficulties (Cohan, 1997; Cronin-Golomb et al., 2000; Mendez et al., 1992; Rizzo et al., 2000), we hypothesized that PwD would identify their printed names more accurately than their own photos and identify the names of others more accurately than the photos of others.

## METHOD

*Participants*. Participants were 10 females (*M* age = 85.3, *SD* = 7.9) suffering from probable Alzheimer's disease, who were full-time residents in a specialized Alzheimer's dementia unit in a full-time care facility in Grand Rapids, Michigan. Participants were included in the study if (a) consent for their participation was granted from their legal guardians and (b) they usually could point on request.

Participants' levels of dementia are reported using two indexes: (a) scores on the Cognitive Performance Scale (CPS) (based on the minimum data set [Morris et al., 1994]) and (b) functional capacity as determined by full-time-caregivers' ratings. The CPS furnishes a functional view of cognitive performance in five domains: coma status, short-term memory, capacity to make daily decisions, ability to communicate and comprehend speech, and eating independence. On the CPS, three, two, and five participants belonged, respectively, to Level 3 (moderate impairment), Level 4 (moderately severe impairment), and Level 5 (severe impairment).

In some cases, several months or longer had elapsed since the CPS evaluations were performed. Therefore, full-time resident caregivers rated the functional capacity of our participants, an approach recommended (Camp, Koss, & Judge, 1999; Salamon, 1999) for participants who demonstrate profound language deficits (as did many of our participants). No information was available on the number of or interrater reliability of caregiver raters. On the functional capacity ratings, residents were grouped into three categories reflecting distinctions in residents' abilities to perform daily living activities; these functional groupings provided the basis for determining appropriate recreational and therapeutic activities. Three participants were viewed by caregivers as suffering from moderate cognitive decline and were described as likely to remember their own names and distinguish familiar from unfamiliar people in environment; generally aware of recent events, experiences, and surroundings; having some vague knowledge of past; requiring little assistance with daily activities; continent; exhibiting reasonably good social and verbal skills and moderate attention spans (30 to 60 minutes); showing familiarity with daily routine; needing minimal cueing during activity participation; able to follow simple one- or two-step directions; easily redirected; acting appropriately with minimal assistance; and exhibiting moderate delusional and obsessive symptoms as well as moderate amounts of anxiety and agitation.

Two participants were viewed as suffering from severe cognitive decline and were described as likely to forget the names of family and friends; generally unaware of recent events, experiences, and surroundings; having some vague knowledge of past; requiring assistance with daily activities, including needing travel assistance to familiar places (e.g., their bedroom); usually incontinent; likely to recall own names and distinguish familiar from unfamiliar people in environment; having limited attention spans (i.e., 15 to 30 minutes); distractible; and exhibiting moderate to severe delusional and obsessive symptoms, anxiety, and agitation.

Five participants were viewed as suffering from very severe cognitive decline and were distinguished by their minimal social skills; frequent engagement in repetitive, rhythmic motions or sound making; frequent need to walk (often invading others' personal space); high distractibility; fleeting attention spans; high safety concerns (e.g., placing small objects in mouth); difficulties in identifying familiar others; need for hands-on assistance and maximal verbal cueing for travel to familiar places (e.g., their bedroom); and noticeable language difficulties (i.e., limited to a few words or nonexistent). Furthermore, these participants were incontinent and required assistance when toileting. Pronounced loss of basic psychomotor skills was also present (e.g., conspicuous difficulty with preplanned movements). These participants exhibited severe delusional and obsessive symptoms, as well as high levels of anxiety and agitation. In sum, most of the participants in the present study were severely cognitively impaired. Information regarding participants' other sources of decline (e.g., Huntington's disease, stroke, or other comorbid conditions) was not available in participants' files.

*Stimuli*. The main focus of the current experiment was to determine the extent to which PwD could identify written names and photographic images of themselves and controls (i.e., fellow residents) at above-chance levels of accuracy. One challenge in conducting research with PwD was to construct the experimental stimuli in such a way that any failure to identify the stimuli likely reflected participants' impaired cognitive ability rather than their sensory impairment. Low-level sensory degradation (e.g., participants' inability to see the letters) could lead to the appearance of high-level cognitive impairments (e.g., participants' inability to recognize the words) but merely reflect degraded sensory signals entering higher order systems. Thus, stimulus materials were carefully constructed in an effort to design an interface that met the needs of its users by controlling for extraneous factors that may affect the perception of photo cards and the legibility of printed name cards. Additionally, we strove to feature a homogeneous set of target and distractor stimuli because their overall degree of similarity strongly influences recognition performance (Faw, 1992). This careful attention to the construction of stimulus materials presumably made it more likely to detect actual competencies, allowing us to be more confident about our findings.

To construct the picture cards, photos of all 23 residents were taken just prior to beginning the study. The photos featured shoulder-and-above images to minimize peripheral information such as clothing and body position. We used matte-finished photos to minimize glare because glare causes eye fatigue, eye discomfort, and reduced visibility (Isensee & Bennett, 1983). The photos were in color and depicted residents appearing against a blue background. Blue was chosen for the background because foveal vision is less sensitive to blue (Pokorny, Graham, & Lanson, 1968); thus, blue should be less distracting during the recognition task that relies on foveal vision. Blue is also recommended as a background for tasks performed on displays at a close distance (U.S. Department of Defense, 1989)—a viewing condition present in our experiment. Head size and facial expression were held relatively constant in the photos to minimize the likelihood that these cues would be used in recognition. Two residents' photos were excluded from the role of distractors because they differed from the others in expression and face size. The remaining 21 photos were mounted individually onto 4-in. × 6-in. cards for stability.

To construct the name cards, the first and last names of the 21 residents who appeared in the photo cards were printed in black ink, in all caps, in a nonserif font. Black lettering on a white background insured high contrast and excellent legibility under normal lighting conditions (Berger, 1944a, 1944b; Shneiderman, 1992). High contrast was especially important because the participant population had impaired vision (Woodson & Conover, 1964). A nonserif font enhanced legibility of the characters by eliminating curlicues and flourishes (Eastman Kodak Company, 1983). Capital letters were used to minimize visual distinctiveness because logographic prereaders and early readers use visual distinctiveness as a heuristic to identify words in a nonanalytic manner, focusing on idiosyncratic visual attributes of each word (Gough & Juel, 1991; Gough, Juel, & Griffith, 1992). By using all capital letters in the stimuli, we could be more certain that participants were making name-card selections on the basis of content rather than visual appearance. Display design guidelines also recommend the use of capital letters for headings and brief messages (U.S. Department of Defense, 1989). The 16-point font was chosen so that the height, but not the width, of the printed letters from a viewing distance of approximately 16 inches was within participants' foveal vision. Previous research suggests that character sizes should not be smaller than 14, or larger than 22, minutes of arc in height for reading, which corresponds to 8- to 12-point type when viewed at typical reading distances (Shneiderman, 1992). Our choice for 16-point type corrected for the slightly longer distance between our participants and the printed material. Printed names were affixed to 4-in. × 7-in. cards for stability. The slightly longer length (4 in. × 7 in.) of name cards than of photo cards (4 in. × 6 in.) permitted first and last names to each appear on one line, centered in the middle of the card.

Training stimuli consisted of six pictures chosen from the Peabody Picture Vocabulary Test, third edition (Dunn & Dunn, 1997). The pictures featured two sets of common objects (i.e., Group 1: banana, grapes, apple; Group 2: table, couch, bed) drawn from the same category (i.e., fruit and furniture, respectively). The targets *banana* and *table* were chosen because speech perception research reveals a comprehension advantage for perceptually distinctive (i.e., polysyllabic words generally sound less alike than do monosyllabic words), high-frequency words (i.e., the frequency of words spoken in language) (Luce, Pisoni, & Goldinger, 1990). The pictures were individually affixed to 4-in. × 7-in. cards for stability.

*Procedure*. Prior to beginning, the experimenter spent extended time in the residential facility to become familiar to the participants. In the experiment, participants were tested individually, seated in front of a table, with their eyes approximately 16 in. from the center of the table. Once seated, the experimenter cleaned the glasses for participants with corrected vision.

In the training trials, three training stimuli (banana, grapes, and apple picture cards) were shuffled and placed centered on the table, facing the participant in a pyramidal configuration, with one card on top and two just below. The participant was instructed as follows: "Look in front of you. Can you point to the picture of the banana?" A correct selection was congratulated. Failure to point, or pointing to the wrong object, received corrective feedback (i.e., by stating that the choice was incorrect and by modeling how to point to the correct target); then, participants were again asked to point to the correct target. This training procedure was repeated using the three pictures of furniture with *table* designated as the target. Participants were advanced to the experimental trials after completion of the training trials.

In the experimental trials, three stimuli (one target and two distractor stimuli) were laid onto the table according to predetermined, random orders. Stimuli were arranged in a pyramidal configuration, with one card on top and two immediately below, with the center point of the array approximately 16 in. away from participants' eyes. After placement, the experimenter spoke the instructions, "Let's play another game. The name of the game is 'Can you point to___'." Depending on the session, spoken (in the blank) was "your picture___ [first and last name of participant]," "your name [first and last name of fellow resident]," "her picture [first and last name of fellow resident]," and "her name [first and last name of fellow resident]." These short instructions, which rely on an audible cue, were necessitated because of the cognitive impairment of participants (e.g., their inability to follow detailed verbal instructions). The instructions were designed so that the last thing participants heard was the target, presumably allowing this cue to remain held in working memory (Baddeley, 1990). The final prompt of the instructions was repeated as necessary until a response was made.

Participants' selections were recorded and were followed by noncorrective, positive feedback (e.g., "this game is fun"). On completion of each session, participants were thanked. To encourage participation in subsequent sessions, we provided appropriate incentives (e.g., favorite nutritional snacks and small objects, such as stickers) before commencing and at the completion of each experimental session.

There were two experimental targets (participants' printed names and photos) and two control targets (fellow residents' printed names and photos), with only one designated target in a session. Target type was counterbalanced across sessions. We removed each participant's self-referent information from the array of distractors for the control conditions to eliminate the possibility that participants might be unduly distracted by their own pictures and names when trying to point to a fellow resident's picture and name. The name and photo of another randomly selected resident were used instead.

Each participant received two training trials and 10 experimental trials per session. Ten experimental trials were chosen to balance the need for a reliable index of performance and the amount of time required per session. With two distractors per trial and 10 trials per session, the odds of randomly choosing the correct answer on each trial was 33.3%, and 7 or more correct trials out of 10 represented a performance significantly greater than chance alone ($p < .05$). At least 2 days, and no more than 7 days, elapsed between experimental sessions.

#### RESULTS AND DISCUSSION

The sample sizes of severe dementia sufferers typically are small. To compensate for the low power of small, clinical samples, directional alphas ($p \leq .05$) were adopted (in accordance with our a priori hypotheses) for this and

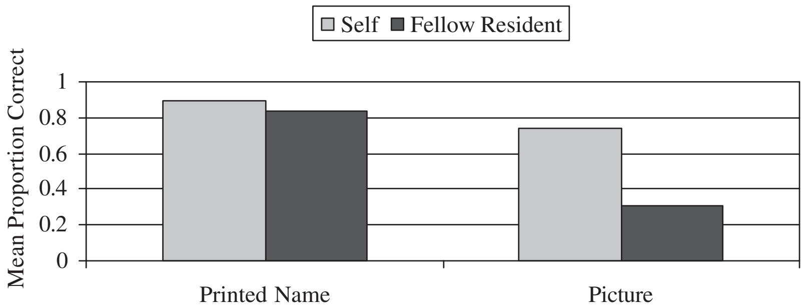


**Figure 1: Mean Proportion Correct as a Function of Target Type (Picture vs. Printed Name) and Self-Reference (Self vs. Fellow Resident)**

subsequent experiments. An ANOVA, with the mean proportion of correct pointing responses as the dependent variable and with the factors of target type (picture vs. printed name) and self-reference (self-referent vs. control) (repeatedly measured by participants), revealed significant main effects for target type, $F(1, 9) = 20.5$, $MS_e = .06$, and for self-reference, $F(1, 9) = 29.1$, $MS_e = .02$. As displayed in Figure 1, participants correctly identified themselves more often than controls (i.e., fellow residents) and identified names more often than photographs. However, these main effects were qualified by a significant interaction, $F(1, 9) = 7.2$, $MS_e = .05$.

Pairwise comparisons (i.e., repeated measure *t* tests) were conducted to elucidate the nature of the interaction. No correction for alpha was made in this and the following experiments because of the limited number of participants and corresponding lack of power. Thus, the probability of Type I errors may have been increased. Consistent with the hypothesis that performance would be better in the photo-of-self condition than in the photo-of-other condition, participants were significantly more likely to identify their own photos (*M* proportion correct = .74, *SD* = .30), $F(1, 10) = 15.7$, $MS_e = .01$, than the photos of fellow residents (*M* proportion correct = .31, *SD* = .20). In fact, each participant was markedly unable to identify the picture of one current fellow resident in the control condition, performing no better than by chance despite the picture's reappearance on 10 consecutive trials. This poor performance indicated that implicit familiarization due to repeated exposure to an identical stimulus (i.e., the picture of fellow resident) cannot account for participants' good performance in the other conditions (i.e., the self-referent conditions).

Consistent with the hypothesis that reading remains more intact than does picture recognition in severe dementia, participants were significantly more capable of recognizing the printed names of fellow residents (*M* proportion correct = .84, *SD* = .24) than the photographs of fellow residents (*M* proportion correct = .31, *SD* = .20), $F(1, 10) = 22.6$, $MS_e = .013$. Similarly, participants recognized their own printed names (*M* proportion correct = .90, *SD* = .14) marginally more accurately than their own pictures (*M* proportion correct = .74, *SD* = .30), $F(1, 10) = 2.8$, $MS_e = .009$, $p = .06$. Finally, there was a nonsignificant trend for participants reading and identifying their own printed names (*M* proportion correct = .90, *SD* = .14) slightly more accurately than the names in the control condition (i.e., printed names of fellow residents) (*M* proportion correct = .84, *SD* = .24), $F(1, 10) = 1.8$, $MS_e = .002$, $p = .11$. As expected, performances in both name conditions (i.e., self and control) were high (near ceiling), suggesting that some reading skills are intact among severely impaired PwD.

An alternative way of analyzing these data is to calculate the number of participants who performed at above-chance levels of accuracy for each of the four target conditions and to submit these data to nonparametric tests of significance. We used Cochran's *Q* because this nonparametric test is appropriate in experiments involving repeated observations or matched groups (Hays, 1988). The nonparametric analyses revealed the same pattern of results as the parametric analyses. As before, participants were incapable of identifying pictures of the controls, despite repeated exposure to the identical pictorial image, as none of the participants could perform this task beyond chance levels. In contrast, 6 of 10 participants recognized their own pictures, a difference greater than chance (Cochran's $Q[1] = 6.0$). For name reading, 9 of 10 participants correctly recognized their own names, and 8 of 10 participants correctly recognized controls' names, a difference not greater than chance ($p = .16$). When recognizing control stimuli, 8 of 10 participants correctly identified fellow residents' names, but none identified controls' pictures, a difference greater than chance (Cochran's $Q[1] = 8.0$, $p < .05$). When recognizing themselves, 9 of 10 participants identified their own printed names, but only 6 of 10 identified their own pictures, a difference greater than chance (Cochran's $Q[1] = 3.0$, $p < .05$).

Combined, these findings suggest that many (six of nine) participants recognized their current images and that this recognition ability was not likely attributable to merely detecting the repeating image across 10 trials, as none of our participants could use this repetition cue to identify images of fellow residents. This inability to learn to recognize the target stimulus despite its reappearance appears to reveal the severity of participants' cognitive impairment. Our findings also revealed that most participants read and recognized their own and the controls' written names when prompted by the corresponding spoken names at greater than chance levels of accuracy, suggesting that reading is more intact than is face recognition among PwD. Thus, written names of themselves and others, as well as photographs of themselves, might be useful in prompting appropriate behavior among PwD.

## EXPERIMENT 2

Experiment 1 revealed that names were more effective cues than photos and that participants were better at recognizing self-referent information than other-referent information. The photos of fellow residents were especially poor cues for recognition. Nonetheless, these recognition differences do not insure that pictures and names can effectively guide participants' adaptive behaviors. For example, a resident may read and recognize her name in the task used in Experiment 1, but this finding does not guarantee that, if name labels were placed on her possessions, she could discriminate her belongings from others' possessions. Therefore, Experiment 2 investigated the extent to which picture labels and name labels can be used to effectively personalize common objects found in residential care facilities and thereby promote residents' ability to locate their possessions.

In Experiment 2, common objects (i.e., mugs, cups, and plates) were labeled by attaching the appropriate self-referent and control labels. For example, a trial consisted of laying three differently labeled plates in front of participants. One plate was labeled with a self-referent cue (picture or name of self), and two plates were labeled with non-self-referent cues (pictures or names of fellow residents). Participants were instructed to locate their dinner plates from the array of plates in front of them. To specifically evaluate participants' ability to identify their objects without the assistance of their names spoken aloud, we replaced the audible cue with *you* and *your* for self-referent conditions only. In the control conditions, fellow residents' names were spoken aloud. Even though the lack of the audible cue should make the self-referent conditions more difficult, we hypothesized that self-referent cues would more successfully help participants locate their possessions than would other-referent cues, a prediction consistent with the results of Experiment 1 and with the self-referent effect (Rogers et al., 1977; Symons & Johnson, 1997). We also hypothesized, as found in Experiment 1, that objects labeled with printed names would more easily be identified than photo-labeled objects because of PwD's established face-recognition difficulties (e.g., Cohan, 1997; Cronin-Golomb et al., 2000; Mendez et al., 1992; Rizzo et al., 2000).

**METHOD**

*Participants*. Nine PwD (six from Experiment 1 and three drawn from the same population) (*M* age = 84.4; *SD* = 7.3) participated in Experiment 2. Participants' levels of dementia on the CPS (Morris et al., 1994) included three participants at Level 3, three participants at Level 4, and three participants at Level 5. Using the functional groupings established by caregivers (as described previously in Experiment 1), three participants suffered from moderate cognitive decline, two from severe cognitive decline, and four from very severe cognitive decline.

*Stimuli*. Although the training stimuli (discussed here) and training procedure (discussed in the next section) differed from those used in Experiment 1, they more closely foreshadowed the task required of participants in Experiment 2. Training stimuli consisted of the names and photos of famous people whose period of fame occurred for an extended period during the 1930s through the 1980s, as judged (informally) by nondemented senior citizens. One set each of name cards and photo cards were prepared for Humphrey Bogart, Marilyn Monroe, and John Kennedy (Training Trials 1 and 2) and for Audrey Hepburn, Elvis Presley, and Lucille Ball (Training Trials 3 and 4). The training stimuli were constructed following the general procedures used when preparing experimental stimuli in the previous experiment, except that famous people's photos (obtained from the Internet) appeared in black and white. The experimental stimuli were identical to those used in Experiment 1.

*Procedure*. Participants were tested individually while seated in front of a table with their eyes approximately 16 in. from the center of the table. Once seated, the experimenter cleaned the glasses for participants with corrected vision.

In the training trials, the names of three famous people (Training Trial 1) were individually affixed with Velcro to mugs borrowed from the residential dining hall. The labels laid flat and angled toward participants. Labeled mugs were randomly placed in a row. Participants were instructed, "Can you show me John Kennedy's mug?" Correct selections were congratulated. Incorrect selections, or failures to point, received corrective feedback. For Training Trial 2, bowls (from the dining hall) replaced mugs, and photos of the famous people used in Training Trial 1 replaced their printed names. Participants were instructed, “Can you show me John Kennedy’s bowl?” Again, corrective and congratulatory feedback were provided as warranted. The above procedure was repeated for Training Trials 3 and 4.

In the experimental trials, name cards and photo cards were attached with Velcro to another common object (i.e., dinner plates). These name and photo labels laid flat and oriented toward participants. For every trial, one plate was the designated target and two plates were distractors. The labeled plates were laid in a linear arrangement according to predetermined, random orders for target and distractor locations. After placement, participants heard one of the following instructions. For non-self-referent trials, the instructions were as follows: “Look at these plates. One of these plates belongs to [first and last name of fellow resident]. Can you show me [first and last name of fellow resident]’s plate?” For self-referent trials, we said, “Look at these plates. One of these plates belongs to you. Can you show me your plate?” Participants were instructed without their names to specifically investigate participants’ ability to read and identify their own names without the benefit of the audible cue. This particular departure from Experiment 1 also was made to more closely approximate the task required of PwD living in residential care. For example, a group of residents may be directed to find their seat.

Positive, noncorrective feedback was provided after every trial. There were 10 experimental trials for each of the four target conditions: participants’ printed names, participants’ photos, fellow residents’ printed names, and fellow residents’ photos. Order of target condition was counterbalanced, with each session separated by at least 2, and no more than 7, days.

#### RESULTS AND DISCUSSION

An ANOVA, with the mean proportion of correct pointing responses as the dependent variable and with the factors of label type (picture vs. printed name) and self-reference (own vs. control) (repeatedly measured by participants), revealed main effects for label type, $F(1, 8) = 12.8$, $MS_e = .05$, and for self-reference (self-referent target vs. non-self-referent target, $F(1, 8) = 18.8$, $MS_e = .04$. As in Experiment 1, participants identified plates more often with self-referent labels than with fellow-resident labels (i.e., control labels) and when the labels consisted of names rather than photos. However, these findings were qualified by a significant interaction between label type and self-reference, $F(1, 8) = 11.1$, $MS_e = .04$ (see Figure 2).

Pairwise comparisons were conducted to elucidate the nature of the interaction. Consistent with the hypothesis that PwD can use pictures of themselves to promote adaptive functioning, participants were significantly more successful at locating their own possessions ($M$ proportion correct = .81,

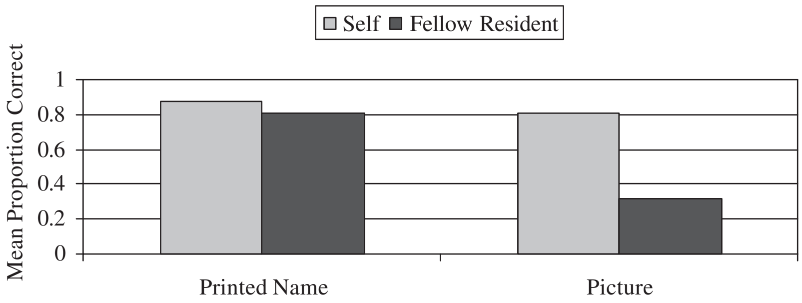


**Figure 2: Mean Proportion Correct as a Function of Label Type (Picture vs. Printed Name) and Self-Reference (Self vs. Fellow Resident)**

*SD* = .26) than at locating fellow residents' possessions (*M* proportion correct = .32, *SD* = .20), $F(1, 9) = 18.9$, $MS_e = .01$, when objects were labeled with photographs. As in Experiment 1, participants were notably impaired when identifying objects labeled with pictures of fellow residents, as compared to all other conditions, having performed no better than chance, as hypothesized. Again, participants' poor performance in the photo-of-other condition indicated that participants did not learn to recognize the control photos despite repeated exposure.

Consistent with the hypothesis that reading is more resistant to dementia than is face recognition, a printed name was a more effective label (*M* proportion correct = .81, *SD* = .26) than was a picture (*M* proportion correct = .32, *SD* = .20), $F(1, 9) = 27.4$, $MS_e = .009$, when locating a plate belonging to a fellow resident. However, identifying that an object belonged to oneself was equally facilitated both by picture labels (*M* proportion correct = .81, *SD* = .26) and printed name labels (*M* proportion correct = .88, *SD* = .20, $p > .05$).

Finally, objects labeled with printed names were identified as belonging to oneself (*M* proportion correct = .88, *SD* = .22) only slightly and nonsignificantly more accurately than those belonging to fellow residents (*M* proportion correct = .81, *SD* = .26, $p = .15$). The functional requirements of asking participants to "point to your plate" are not the same as asking them to point to another's plate (e.g., "point to Sally Smith's plate"). PwD had to generate their own names from memory in the self-referent condition only. The other-referent condition appears functionally easier because the names of the fellow residents were furnished audibly. Although these tasks differ in their functional requirements, the bias appears to be in the direction opposite to that predicted and found. Participants successfully located their name-labeled possessions without hearing their names spoken aloud. In sum, the reading of printed names appears to be a robust skill among PwD, as evidenced here and in Experiment 1.

As in Experiment 1, we performed nonparametric tests of significance to determine the number of participants who performed at above-chance levels of accuracy for each of the four conditions. In the picture-label condition, none of the nine participants identified the objects labeled with fellow residents' pictures, confirming that recurring exposure to an identical, pictorial stimulus cannot account for the good performance in the other conditions. In contrast, seven of nine participants correctly selected objects labeled with their own pictures, a difference greater than chance (Cochran's $Q[1] = 7.0$).

When objects were labeled with printed names, seven of nine participants correctly selected their own objects, and six of nine participants correctly selected objects belonging to the designated fellow resident, at greater than chance levels; these observed frequencies were not significantly different ($p = .16$), suggesting that name reading is a robust skill among PwD. When asked to identify the objects that belonged to fellow residents, six of nine participants could do so when objects were labeled with fellow residents' printed names, but none of nine could do so when objects were labeled with fellow residents' pictures (Cochran's $Q[1] = 6.0$), suggesting that only printed name labels can aid participants in locating others' possessions. However, consistent with the parametric analyses, participants' printed names and photographs were equally effective in guiding object selection. Specifically, seven of nine participants correctly selected objects labeled with their names, and seven of nine participants correctly selected objects labeled with their pictures ($p = .50$).

Thus, Experiment 2 replicated the main findings of Experiment 1 with a task that more closely approximated how environmental signage is used to guide behavior in long-term care. More than two thirds of the participants could identify, at greater than chance rates, objects labeled with their own written names and their own photographs. Thus, both Experiments 1 and 2 found evidence consistent with the practice of using residents' own names and photographs as environmental labels to help guide adaptive behavior.

## EXPERIMENT 3

Experiments 1 and 2 found that most participants could identify their printed names, their current pictures, and the printed names of controls (i.e., fellow residents) at greater than chance levels. In Experiment 2, we additionally found that participants could use their own printed names and the photos and names of others to locate personalized objects. In contrast, none of these participants identified objects labeled with fellow residents' pictures beyond chance levels.

Because many participants in Experiments 1 and 2 were unable to identify photos of themselves and others, the goal of Experiment 3 was to examine the extent to which recognition of photographic images could be improved with training. We hypothesized that participants would learn to recognize pictures of themselves to a greater degree than pictures of others, a finding consistent with the self-referent effect (e.g., Rogers et al., 1977). We included printed names as a condition and again hypothesized that printed-name recognition would remain superior to photo recognition because reading may be retained until the onset of severe dementia (Noble et al., 2000; Patterson et al., 1994) and because of PwD's established difficulty recognizing friends, family, and their own mirror images (e.g., Cohan, 1997; Mendez et al., 1992).

**METHOD**

*Participants*. Six female PwD ($M$ age = 86.5, $SD$ = 8.0) were selected to participate because in either Experiment 1 or Experiment 2 they failed to show above-chance rates of recognition for both themselves and fellow residents depicted in photos. According to the functional groupings discussed previously in Experiment 1, two participants suffered from moderate cognitive decline, one from severe cognitive decline, and three from very severe cognitive decline. Participants' levels of dementia on the CPS (Morris et al., 1994) included one participant at Level 3, two participants at Level 4, and three participants at Level 5.

*Stimuli*. The stimuli were the same as used in Experiment 1.

*Procedure*. The procedure was identical to that used in Experiment 1, with two exceptions. Experiment 3 used corrective feedback and rewards. For incorrect trials, the experimenter stated that the choice was incorrect and pointed to the correct target while stating, "This is [first and last name of target]. I am pointing to [first and last name of target]. Now you point to [first and last name of target]." Participants were required to point to the target before advancing to the next trial. A correct, or corrected, point was congratulated and rewarded with nutritional snacks (e.g., yogurt covered raisins) and small objects (e.g., stickers). These incentives were placed on the side of the experimental table in full view during the session, and participants were allowed to select their desired rewards. The order of targets (self-referent vs. other-referent; pictures vs. printed names) was counterbalanced. At least 2 days, and no more than 5 days, elapsed between experimental sessions.

#### RESULTS AND DISCUSSION

One participant, who suffered from very severe cognitive decline, sustained unrecoverable damage to her reading glasses and was unable to complete all experimental sessions. Her data were omitted from the analyses.

An ANOVA, with mean proportion of correct responses as the dependent variable and with the factors of training (pretest vs. posttest), target type (picture vs. printed name), and self-reference (self-referent vs. other-referent) (repeatedly measured by participants), revealed a marginally significant effect for training, $F(1, 4) = 3.4$, $MS_e = .03$, $p = .07$, a marginally significant effect for self-reference, $F(1, 4) = 4.5$, $MS_e = .04$, $p = .05$, and a significant main effect for target type, $F(1, 4) = 16.7$, $MS_e = 0.8$. Consistent with our hypothesis that participants would learn more effectively pictures of themselves than of fellow residents, there was a significant interaction between training and self-reference, $F(1, 4) = 6.4$, $MS_e = 0.07$.

Pairwise comparisons, performed separately for name recognition and picture recognition, revealed that recognition of one's own picture was marginally better after training (*M* proportion correct = .72, *SD* = .28) than beforehand (*M* proportion correct = .42, *SD* = .16), $F(1, 4) = 3.2$, $MS_e = .03$, $p = .07$, consistent with predictions. In contrast, recognition of fellow residents' pictures (i.e., the control condition) did not show significant improvement from baseline (*M* proportion correct = .36, *SD* = .21) to posttraining (*M* proportion correct = .42, *SD* = .13, $p = .21$. Thus, even with explicit feedback, in addition to any benefit derived from repeated exposure, all participants were unable to learn to recognize the images of others. In comparison, some (three), but not all (five), participants learned to recognize their own pictorial images. The two participants who failed to learn were suffering from severe and very severe cognitive decline.

For printed-name recognition, we expected that there would be no significant improvement as a result of training because rates of name recognition were already high in two previous experiments. Nonetheless, recognition of one's own printed name after training (*M* proportion correct = .92, *SD* = .18) was marginally greater than beforehand (*M* proportion correct = .88, *SD* = .16), $F(1, 4) = 2.7$, $MS_e = .03$, $p = .09$. Recognition of fellow residents' (i.e., the controls') printed name before training (*M* proportion correct = .80, *SD* = .25) and afterward (*M* proportion correct = .82, *SD* = .30) did not differ significantly ($p = .31$). As in Experiments 1 and 2, reading one's own name was marginally easier than reading the printed name of another. Importantly, participants' recognition of their own and others' names in print remained consistently high both before and after training, suggesting that some reading skills are robust among PwD. Ceiling effects likely constrained the amount of change that could be influenced by training.

As in the prior experiments, we also calculated the number of participants who performed at above-chance levels of accuracy when identifying pictures and printed names both before and after training and submitted these data to nonparametric tests of significance. There was evidence for some improvement in identifying participants' own pictures during the course of training. Before training, none of the five participants could identify their own picture at above-chance accuracy. However, after training, three of the five could do so (Cochran's $Q[1] = 3.0$, $p < .05$). In contrast, both before and after training, none of the five participants could identify fellow residents' pictures at levels above chance, even though each participant was furnished with explicit feedback about the correct answer as well as repeated exposure to the identical pictorial image. When recognizing names, four of five participants recognized their own and fellow residents' names before training and four of five performed at above-chance levels after training, supporting the claim that reading names in print is a robust skill, consistently exemplified in three experiments.

In summary, some participants learned to recognize their current pictorial images as a function of training, even though they could not do so beyond chance accuracy before training. In contrast, none of the participants learned to identify fellow residents' photos after training, despite receiving explicit feedback and repeated exposure to the same images. Finally, participants robustly identified their own and fellow residents' names in print.

## GENERAL DISCUSSION

Many long-term care facilities use residents' names and photos on doorways to aid residents' navigation of their surroundings (e.g., Benson et al., 1987; Passini et al., 2000; Passini et al., 1998). We investigated some of the core assumptions underlying this intervention (i.e., that PwD in residential care can recognize their printed names and photographic images at above-chance levels of accuracy). Certainly, if PwD could not identify these stimuli under the optimal conditions studied here, it would seem unlikely that such stimuli would be able to substantially influence their behavior in residential settings. Experiments 1 and 3 asked participants to identify their written names and photos. Experiment 2 asked participants to identify personally labeled generic objects, a task that more closely approximated the adaptive behavior required of residents in long-term care. Across three experiments, our findings revealed that although suffering from profound sensoriperceptual and cognitive deficits, participants read and identified their own names in print at above-chance levels. Participants recognized their own pictures, although significantly less than their printed names, in Experiment 1 (but not in Experiment 2). Participants also identified the printed names of fellow residents and could use these cues to select the correct objects. Although the names of fellow residents were included as a control condition, participants' above-chance performance on this task indicates the robustness of reading ability in our sample of PwD.

We are confident that participants' above-chance performance in identifying their own names and pictures reflected preexisting skill and not the effects of repeated exposure to these stimuli during the course of the experiment. All three experiments found that recognition of fellow residents' pictures remained at chance levels, despite recurring exposure (in Experiments 1 through 3) and explicit feedback (in Experiment 3). Thus, if repeated exposure to stimuli was sufficient to produce above-chance performance, participants should have performed at above-chance levels when identifying pictures of fellow residents as well. Thus, mere familiarity as a function of the repeated exposure does not appear to be a viable alternative explanation for the performances observed in the other three conditions.

Moreover, the results of Experiment 2 provided compelling evidence that when a participant identified her own name in print, she understood that the name referred to her personally. In all three experiments, participants displayed excellent performance at identifying their own names. However, in Experiments 1 and 3, the experimenter asked a given participant to identify her own written name immediately after the experimenter spoke the participant's name. Perhaps participants merely identified the printed name that matched the name just spoken without any recognition that that the name referred to her. To rule out this alternative explanation, we replaced participants' spoken names with *you* and *your* in Experiment 2 and again found that participants successfully recognized their personalized plates. Our findings offer promise for the use of printed name labels in residential care as a tool to aid even severely impaired participants in locating their personal belongings and spaces. Extrapolating from our findings, caregivers should be able to successfully direct residents to find their seat when chairs have been labeled with residents' names.

Our findings are consistent with the large literature on self-referent effects in memory (see Symons & Johnson, 1997, for a review). Previous research has shown that information encoded under self-relevant conditions is better remembered, as compared to performance under various control conditions. In the present experiments, participants showed better recognition for their own pictures than for the pictures of fellow residents in both Experiments 1 and 2. Further support for the mnemonic advantage of self-referent cues was found in the Experiment 3, in which some participants learned to identify self-referent pictures, whereas none of the participants learned to identify other-referent pictures.

Because one's printed name is more stable across the life span than is one's pictorial image, printed names may be more effective labels for residents' rooms and possessions, particularly as the cognitive impairment associated with Alzheimer's disease progresses. The three experiments found consistently that written names were identified at higher rates than pictures, particularly when comparing the excellent recognition of fellow residents' printed names to the poor recognition of fellow residents' pictures. This finding is consistent with a body of research that indicates that PwD show impairment in face recognition (Cohan, 1997; Della Sala et al., 1995; Giannakopoulos et al., 2000; Hassing & Baeckman, 1997; Hodges & Greene, 1998; Hodges et al., 1993; Mendez et al., 1992,) but that their reading ability appears to be more resistant to the effects of dementia (Noble et al., 2000; Patterson et al., 1994) and has successfully guided appropriate behavior (Namazi & Johnson, 1991b). Even though printed names had an advantage over pictures in the current studies, the combination of both names and pictures may be more effective than either cue alone. Future research should investigate this possibility.

The use of residents' pictures as environmental labels may have promise if residents could be trained to identify pictures more accurately. Our primary goal in Experiment 3 was to evaluate if participants who failed to identify their own and fellow residents' images in photos could be trained to do so. We found that recognition for one's own pictorial image can be improved with training for some PwD but not others. However, consistent with the self-referent effect, learning to identify fellow residents' pictures appeared to be especially resistant to training. Thus, the results of Experiment 3 suggest that some PwD who do not currently identify their own pictures can acquire greater skill in this capacity with training. Compatibly, previous research has found that mirror self-recognition has been elicited in some PwD after training (Bologna & Camp, 1997).

Perhaps training failed for some PwD because we used simple corrective feedback rather than more sophisticated training techniques. Baddeley and Wilson (1994) contend that because memory-impaired individuals (i.e., persons with amnesia) suffer explicit, but not implicit, memory deficits, these individuals are unable to use corrective feedback that relies on explicit memory. Consistent with this view, previous research conducted with mildly and moderately impaired participants found that spaced retrieval (i.e., retrieval practices at set intervals that gradually increase in length [e.g., expanding rehearsal]) (Landauer & Bjork, 1978) and errorless learning techniques (i.e., preventing the learner from making mistakes during the initial acquisition period) have effectively aided memory-impaired individuals' ability to identify common objects as well as the names of pictures of staff and of new acquaintances (e.g., Carruth, 1997; Cherry, Simmons, & Camp, 1999; Clare, Wilson, Breen, & Hodges, 1999; Clare et al., 2000; Davis, Massman, & Doody, 2001; Heun, Burkart, & Benkert, 1997; Kesslak, Nackoul, & Sandman, 1997; McKitrick & Camp, 1993).

Although we contemplated using errorless learning and spaced-retrieval techniques, we chose not to because most of our participants were suffering from profound impairment. Completing 10 experimental trials (required for each participant for each of the four target sessions) sometimes took several hours spread across several days. On some occasions, we were unable to collect any data because participants were unable (e.g., conspicuous difficulty with pointing on request) or unwilling to participate. We returned on another day to complete the session when necessary. Thus, we were reluctant to increase the complexity of the training intervention for fear that we would be unable to collect useable data. In fact, the severity of our participants' impairments, which placed constraints on the training techniques, also possibly accounted for the finding that not everyone learned with training. One of the strengths of our experiments was that we used a much more severely impaired sample of participants than is common in research on PwD. Future research should evaluate the effectiveness of more elaborate training interventions with profoundly impaired dementia sufferers.

Indeed, the severity of our participants' impairments placed constraints on the kinds of techniques we could use in these investigations. For example, across three experiments, we used simple "point to" instructions because most of our participants suffered pronounced language deficits (conspicuous difficulty speaking and comprehending). Our participants' severity of dementia may limit the generality of our findings. The small size of our samples also limits the generality of our findings. Additionally, in our investigations, we opted for a high level of experimental control by carefully designing the stimuli (e.g., blue background in photos, lack of flourishes in printed font) to enhance the ease of the task and to eliminate extraneous reasons for poor performance. However, the use of such contrived stimuli may be at the expense of external validity and generalizability.

Ideally, future research should investigate the role of self-referent and other-referent cues as environmental labels in the actual environment and evaluate the direct effects on residents' target behaviors. Field studies potentially could evaluate whether these prosthetic supports become increasingly useful to residents as they receive guidance on how to use the environmental cues. Future studies also could evaluate the effectiveness of providing redundant cues—both names and pictures—as labels for personalizing objects and spaces (e.g., residents' rooms).

In sum, our findings suggest that printed names, and to a lesser extent photos, may have great utility as environmental supports for PwD in residential care, in so far as these prosthetic supports are carefully designed. We took great care in the design of the experimental stimuli to ensure that these environmental cues were congruent with participants' levels of sensoriperceptual and cognitive competence to thereby ensure participants' optimal performance in our task (Calkins, 1988, 1997; Calkins & Chaftez, 1996). Such care in the design of environmental cues would be necessary in their final application. Unfortunately, the signage outside residents' doorways in some residential care facilities feature minimally effective recognition aids (e.g., small photos that feature full-body shots, such that depicted faces are smaller than an inch in size or small, hand-written names).

In addition to their careful design, placement of environmental supports likely can be aided by a careful review of pertinent research and by careful planning. In an application, visual prosthetics can vary in a number of features, including location (vertical, horizontal, and depth coordinates), color, motion (dynamic vs. static), intensity, and information type (analog vs. digital; pictorial vs. textual) (Wickens, 1992). For example, to increase information strength, color can make a location more distinctive. However, the limitations of elderly vision (reduced sensitivity to blues), the amount of lighting (e.g., night vision is achromatic), and the role of color associations (e.g., red signals stop, urgent, and danger) place potential constraints on the role of color as a prosthetic device. These design considerations are just a few of the concerns when placing environmental supports into an application. Our research focus was on visual prosthetics because previous research (see Deatherage, 1972) has shown that visual information, as compared to auditory information, is preferred when the information might be referred to continually (e.g., navigation cues), indicates a location in space (e.g., room location), or is presented in a distracting, ambient-noise environment such as those common to residential care facilities. In sum, the environment may be a prosthetic tool in the care of PwD, but great care has to be taken to ensure that environmental cues are meaningful to its users and presented in a useful way.

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