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The naming profile in Alzheimer patients parallels that of elderly controls

Tim M. Gale,[1,2,3] Karen Irvine,[1] Keith R. Laws,[1] and Sue Ferrissey[2]

[1]School of Psychology, University of Hertfordshire, Hatfield, UK
[2]Department of Psychiatry, QEII Hospital, Welwyn Garden City, UK
[3]School of Computer Science, University of Hertfordshire, Hatfield, UK

Controversy exists as to whether semantic disruption in Alzheimer's disease (AD) systematically impairs the naming of living things. Moreover, little is known about performance across more specific subcategories. We investigated picture naming in 28 AD patients and 24 controls. To deal with nonnormal distributions, we created 1,000 bootstrap hierarchical regressions and determined which variables (the "nuisance" variables familiarity, word frequency, age of acquisition and visual complexity; category; and control naming) best predicted AD patient naming. Nuisance variables combined, control naming, and category uniquely accounted for 39%, 36%, and 3% of patient naming variance, respectively. Finally, analysis of the AD naming profile across the 10 subcategories mirrored that of controls. Taken together, these findings indicate that while AD naming is, of course, quantitatively worse than that of controls, it does not qualitatively differ—that is, it is an exaggerated normal profile.

Keywords: Category specific; Alzheimer's disease; Bootstrap; Picture naming; Control; Superordinate.

INTRODUCTION

Object naming in patients with Alzheimer's disease (AD) is impaired relative to age-matched healthy elderly controls (e.g., Chertkow & Bub; 1992; Laws, Gale, Leeson, & Crawford, 2005); and the types of naming error made by AD patients (e.g., overextending the names of within-category associate items and producing the superordinate, rather than basic or subordinate level name for an item) are widely believed to reflect progressive deterioration in semantic memory function (Chertkow & Bub, 1992; Done & Gale, 1997). Semantic memory impairment is an early marker of AD, being detectable even in mild cognitive impairment cases—that is, in pre-AD neuropathology (Adlam, Bozeat, Arnold, Watson, & Hodges, 2006; Garrard et al., 2001; Vogel, Gade, Stokolm, & Waldemar, 2005).

There has been increasing interest in recent years as to whether AD systematically inflicts a *category-specific* impairment in semantic memory. In line with the broader literature on category-specific deficits, most studies in AD have focused on the relative impairment of living over nonliving categories. In a recent meta-analysis of 21 picture-naming studies involving 557 AD patients and 509 healthy controls, Laws, Adlington, Gale, Moreno-Martínez, and Sartori (2007) found AD patients to be impaired at naming items from both living and nonliving categories. Although more studies revealed deficits for living than nonliving things (13:8), no significant difference emerged between the effect sizes for living and nonliving things. Minimally, this casts a certain amount of doubt on the notion that AD patients suffer from a relative impairment in naming living things, although the question remains as to why some studies report category effects in AD, whereas others do not.

One problem with comparing previous picture-naming studies in AD is the considerable variability

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Address correspondence to Tim M. Gale, Department of Psychiatry, QEII Hospital, Howlands, Welwyn Garden City, Hertfordshire, AL7 4HQ, UK (E-mail: t.gale@herts.ac.uk).

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in the number and types of living and nonliving stimuli used by different researchers. For example, Laws et al. (2007) report that studies have used a wide range of 20–120 items. Although Laws et al. (2007) found that the number of stimulus items did not significantly predict effect sizes for either living or nonliving things, the emergence of category effects may still depend crucially on the specific choice of items used. In this context, the question of whether living or nonliving impairments reflect impoverished naming across the majority of subcategories within either domain (living or nonliving), or only a small subset, has not been systematically investigated in previous studies. The number of living and nonliving subcategories, as well as the specific choice of items representing each subcategory, may therefore influence the presence and direction of emergent category effects (Aronoff et al., 2006).

Tippett, Grossman, and Farah (1996) showed that the emergence of a group category effect in AD patients was contingent on whether or not stimuli were matched across living and nonliving things on so-called "nuisance variables" (e.g., familiarity, visual complexity, word-frequency, and so on). Subsequently, recent studies of category specificity in AD have taken great care to match living and nonliving stimuli on as many relevant nuisance variables as possible (for a fuller exposition of the degree of variable matching, see Moreno-Martínez & Laws, 2007). Given the level of discord between living and nonliving things on nearly all such variables (Barbarotto, Capitani, & Laiacona, 2001; Gale & Laws, 2006), the choice of items available for inclusion in matched sets of pictures is reduced, especially when stimuli are drawn from a single source such as the Snodgrass and Vanderwart (1980) corpus. For example, living things in the Snodgrass and Vanderwart corpus are typically less familiar and have lower word frequency and higher visual complexity than nonliving things, and so there is an inherent bias, when matching between living and nonliving domains, to exclude living-thing items that might exaggerate this tendency (and to include less familiar nonliving things that counter the bias). Consequently, some items and subcategories are more widely represented in studies of AD naming than others. A useful approach when comparing living and nonliving things may therefore be to match within each domain for the number of different subcategories (fruits, vegetables, clothing, tools, etc.) and also the number of items representing each subcategory. A more detailed analysis of AD naming error profiles across a range of subcategories within living and nonliving domains is also required for a more specific test of some models of category specificity.

Additionally, the relative level of naming accuracy in healthy control groups, with respect to patients, can strongly affect the profile of patient impairment when the two groups are compared statistically. A series of experiments examining category specific naming in AD by Laws et al. (2005) showed that the emergence of a category effect and, perhaps more importantly, the direction of the effect, was modulated by the overall performance of the control group. Most healthy control subjects perform close to ceiling level in standard object-naming tasks, and this is especially so for studies that have presented stimuli from the Snodgrass and Vanderwart (1980) corpus (see Laws et al., 2007). Indeed, the vast majority of studies examining picture naming in AD, and other neuropathologies, have selected their stimuli from this corpus (see Laws, 2005, for a discussion). Ceiling level performance of control participants invalidates some important assumptions of statistical tests that compare control and patient group variances (Laws, 2005; Laws et al., 2005; Laws, Leeson, & Gale, 2003). Methods of data analysis that do not succumb to problems with nonnormal distributions are therefore essential, and bootstrap methods comprise one such alternative set of approaches for dealing with such data (e.g., Moreno-Martínez & Laws, 2007). These methods, which require far fewer assumptions than standard parametric tests, are suitable in circumstances where many zero data points exist in the dataset (e.g., controls who score very highly, or patients who perform at, or near, floor level). With bootstrap techniques, a relevant test statistic (t, F, r, etc.) is selected, and this statistic is then computed for n bootstrap samples—that is, n permutations of the original group data. When this occurs with replacement, each data point returns to the sampling pool and may be redrawn numerous times. After many permutations, this results in a distribution of test statistics (rather than data points), which can be analyzed. Hence bootstrap methods may be applied to data that have been collected using traditional, easy-to-name, stimuli, even when ceiling effects are present (Delucchi & Bostrom, 2004).

In this study, we compared the object naming profiles of 28 probable AD patients and 24 healthy elderly control participants. We used a set of 100 pictures drawn from the Snodgrass and Vanderwart (1980) corpus, which was specifically selected to control for the number of living and nonliving subcategories (i.e., animals, birds, clothing, furniture, etc.) and also the number of items representing each of those subcategories. The pictures are matched across domain (living vs. nonliving) for familiarity, word frequency, and visual complexity. We used bootstrap hierarchical regression analyses to establish the best predictors for the AD naming profile, and we also examined the naming profile of patients and controls across subcategories.

METHOD

Materials

A total of 100 pictures depicting items from 10 different subcategories were selected from the Snodgrass and Vanderwart (1980) corpus. We used the grayscale versions of these stimuli that have been created by Rossion and Pourtois (2004), and which contain greater amounts of surface texture than the original line drawings. Items were selected from 5 living-thing subcategories (animals, birds, body parts, fruit, and vegetables) and 5 nonliving subcategories (clothing, furniture, musical items, tools, and vehicles), with 10 different items representing each subcategory. The pictures were presented on laminated cards of approximately 10 cm^2. Living and nonliving things were matched for: concept familiarity (3.24 ± 1.01 vs. 3.53 ± 0.87), $F(1, 98) = 2.41$, $p > .1$; visual complexity (3.01 ± 0.93 vs. 3.03 ± 0.85), $F(1, 98) < 1$, $p > .9$; and log word frequency (1.11 ± 0.64 vs. 1.13 ± 0.75), $F(1, 98) < 1$, $p = .88$; from Kuçera & Francis, 1967), but not for age of acquisition (3.6 ± 1.04 vs. 3.41 ± 1.18), $F(1, 98) = 4.29$, $p = .04$. This set of stimuli is also reported in Gale and Laws (2006), and Gale, Laws, and Foley (2006), and a list of all items appears in the Appendix.

Participants

Patients

A total of 28 patients with probable AD were recruited from a consecutive series of attendees at an outpatients' memory clinic in the United Kingdom. All participants had been assessed for probable AD using National Institute of Clinical Effectiveness (NICE) criteria for diagnosis of AD (NICE, 2007) which includes elimination of other possible pathologies by means of detailed assessment of history/onset, detailed neuropsychological assessment, and, in some cases, neuroimaging. Any patients who were judged by their treating consultant not to have capacity to give informed consent were excluded. All included patients had normal, or corrected-to-normal, vision, and all spoke English as their first language. The AD group comprised 9 males and 19 females, and mean age was 83.3 years (*SD* = 6.9; range = 71–98 years). The average Mini Mental State Examination (MMSE: Folstein, Folstein, & McHugh, 1975) score was 22.1 (*SD* = 4.5; range = 14–30). One individual with probable AD scored 30 on the MMSE at the time of testing (all others scored less than 28). However, this person presented with marked anomia and had been given a probable diagnosis of AD by her treating clinician, so we included her in the study on this basis. Mean predicted premorbid IQ score for the group (derived from National Adult Reading Test, NART, scores: Nelson, 1982) was 109.4 (±7.6; range 95–119).

Controls

A total of 24 elderly control participants (13 male, 11 female) of mean age 78 (*SD* = 6) years were recruited. Although controls and AD patients were not matched exactly on age, this factor was accounted for in later analyses. The controls were recruited through their general practitioner, who had screened them for good health. All were healthy, had no history of cognitive impairment, psychiatric illness, any form of brain injury, or alcohol or drug abuse. All had normal, or corrected-to-normal, eyesight, and all spoke English as their first language.

Procedure

The study was ethically approved by the National Health Service (NHS) Hertfordshire Research Ethics Committee. The majority of participants (patients and controls) completed the naming task in their own homes, seated comfortably at a table. The picture cards were presented, one at a time, in a pseudorandomly determined order, and the participant was asked to name each item in turn. The exact response was recorded verbatim on a response sheet for later scoring. The pictures were presented in two blocks, each of 50 cards, with a short break between blocks.

Where a picture could legitimately be referred to by more than one name (e.g., sailboat/yacht, chicken/hen, sofa/couch, lorry/truck, etc.), the alternative names were accepted as correct. Similarly, when presented in such a stylized format, some items were difficult to distinguish from visually similar associates, (e.g., violin/viola, cabbage/lettuce). In such cases, either name was accepted as correct. Finally, items that were named at a more specific level (e.g., "overcoat" for coat; "trilby" for hat) were accepted as correct provided that the subordinate level name given was appropriate to the specific depiction of the item. Responses were scored by two raters (T.G. and K.I.), and a consensus was reached by discussion for any items where the raters had disagreed.

RESULTS

Living versus nonliving

AD patients named significantly more nonliving (mean = 81.3%, SD = 19.3%) than living items (mean = 71.6%, SD = 25.6%), $F(1, 98) = 4.59$, p = .035. Controls named slightly more nonliving (mean = 96%, SD = 9.4%) than living items (mean = 95%, SD = 10%) but the difference did not reach significance, $F(1, 98) < 1$.

We computed skewness and kurtosis statistics (g_1 and g_2) for both the patient and the healthy control data. For patients, skewness was –1.17, and kurtosis was 0.73. D'Agostino, Belanger, and D'Agostino's (1990) test for skewness failed to reject the null hypothesis that the distribution was symmetrical: $zg_1 = -4.2$. Further, the D'Agostino–
Q2 Pearson omnibus test for normality, which uses both g_1 and g_2 as input, revealed that the distribution did differ significantly from normality: K^2 = 19.8, $p < .0001$. For the controls, skewness was –3.10, and kurtosis was 10.81. D'Agostino et al.'s test for skewness failed to reject the null hypothesis that the distribution was symmetrical: $zg_1 = -7.6$. Further, the D'Agostino–Pearson omnibus test for normality revealed that the distribution differed significantly from normality: $K^2 = 88.1$, $p < .0001$.

Given that all the variables we examined correlated with patient naming (Table 1), we used a bootstrap multiple regression to estimate the degree of variance in the AD patient naming data that was explained by each predictor (familiarity, word frequency, age of acquisition, visual complexity, category—living vs. nonliving—and control naming performance). We created 1,000 bootstrap samples, each equal in size to the original sample and each using random, with-replacement, sampling. One single bootstrap sample might therefore contain multiple instances of a single data point and no instances of a different data point. Multiple hierarchical regressions were run for each of the 1,000 bootstrap samples to determine the contribution of each predictor in explaining the outcome variance within each model. Table 2 shows the contribution of each predictor variable in accounting for naming in the AD patients.

Each hierarchical regression analysis included three blocks of predictors. In Model 1, we entered the so-called "nuisance variables" (familiarity, word frequency, age of acquisition, and visual complexity) together in Block 1, followed by "category" in Block 2, and finally "control performance" in Block 3 (Table 2, Model 1). This revealed that the nuisance variables accounted for 39% of the variance in patient naming. Category (living vs. nonliving) was also significant, accounting for 10% of variance after controlling for the nuisance variables. Finally, control performance was highly significant and accounted for almost 30% of the remaining variance after controlling both for the effects of nuisance variables and for the effects of category. Finally, the 1,000 bootstrapped hierarchical regression analyses were rerun, but this time changing the order of steps to: "nuisance variables," "control performance," and finally "category" to determine the amount of variance attributable to category after controlling for nuisance variables and the naming difficulty index, as measured by control naming performance (Table 2, Model 2). Here category accounted for only a small (3%), though significant, amount of patient naming variance after controlling for all of the nuisance variables and the difficulty index for controls (R^2 change = .36, $p < .0001$). In combination, these hierarchical regression analyses revealed that category and control difficulty accounted, respectively, for 3–10% and 29–36% of the variance in AD naming.

TABLE 1
Correlations between AD naming and nuisance variables

	VC	*AA*	*WF*	*Control naming*	*Category*	*AD naming*
Familiarity	–.40***	–.69***	.40***	.30**	.16	.51***
Visual comp	—	.39***	–.16	–.11	.01	–.22*
AA		—	–.52***	–.43***	.22*	–.59***
WF (log)			—	.17	.01	.38***
Cont. Naming				—	.10	.79***
Category					—	.21*

Q3

Note. AD = Alzheimer's disease. VC = visual complexity. AA = age of acquisition. WF = word frequency.
Probability two-tails : *p < .05. **p < .01. ***p < .001.

TABLE 2

Results of 1,000 bootstrap regression analyses using two different hierarchical models

Model	*Step*	*Variable*	R^2	ΔR^2	*p*
1	1	Familiarity, visual complexity, word frequency, and AoA	.39	.39	
	2	Category	.49	.10	.0052
	3	Control naming	.78	.29	<.0001
		Overall model adjusted R^2	.78		
2	1	Familiarity, visual complexity, word frequency, and AoA	.39	.39	
	2	Control naming	.75	.36	<.0001
	3	Category	.78	.03	.02

Note. AoA = age of acquisition.

Q4

TABLE 3

Results of 1,000 bootstrap regression analyses on a subset of closely matched patient and control samples using two different hierarchical models

Model	*Step*	*Variable*	R^2	ΔR^2	*p*
1	1	Familiarity, visual complexity, word frequency, and AoA	.33	.33	
	2	Category	.45	.11	.004
	3	Control naming	.74	.30	<.0001
		Overall model adjusted R^2	.78		
2	1	Familiarity, visual complexity, word frequency, and AoA	.33	.33	
	2	Control naming	.70	.37	<.0001
	3	Category	.74	.04	.02

Note. AoA = age of acquisition.

More closely matched samples

Recent work shows that the sex of participants may interact with semantic category, both for patients and for healthy participants. In particular, men show better performance with some nonliving subcategories, while women show an advantage with some living subcategories (for reviews, see Gainotti, 2005; Laiacona, Barbarotto, & Capitani, 2006). Because our groups were not closely matched for sex ratio, we reran the analyses on a subset of patients and controls who were closely matched:[1] 18 AD patients (9 male, 9 female) with a mean age 79.6 years and 22 elderly controls (11 male, 11 female) with a mean age 79 years. We also removed the one AD patient with a MMSE score of 30. The bootstrap analyses did not differ from those described above for the full sample (see Table 3).

Subcategories

The profiles of subcategory naming for AD patients and controls are displayed in Figure 1. Body parts were named most accurately by patients and controls, a pattern that is not typical of the overall living-thing naming profile. Similarly, the naming of musical instruments was more consistent with the naming accuracy levels observed in several of the living-thing subcategories.

The range of item accuracies for AD patients was 10.7% to 100%. The least accurately named (all below 40%) were: artichoke, pepper, pumpkin, French horn, cherry, eagle, peach, guitar, ostrich, and asparagus (notably, all living things or musical items). The most accurately named (all at 100%) were: banana, bike, bird, bed, car, hammer, foot, hat, trousers, lips, dog, chair, shoe, scissors, and ear.

After Z-transforming the within-group naming performance for AD patients and for elderly controls, a remarkably similar profile of naming emerged in the two groups (Figure 2). This suggests that the levels of difficulty shown by controls are exaggerated in AD patients and that this pattern emerges consistently across all subcategories. For example, both groups clearly found vegetables and musical instruments the most difficult to name subcategories; and both found body parts and clothing the easiest to name.

DISCUSSION

This study examined two issues that may underpin inconsistent findings in the study of category specific semantic impairments in AD. First, we examined the influence of the so called “nuisance variables,” which are known to differ across living and nonliving domains. Second, and more importantly, we examined the treatment of control data and the associated problem of ceiling effects. We proposed the use of bootstrap analyses as a solution: As noted, bootstrap techniques are one way to circumvent the problems associated with non-normal distributions, which often emerge when contrasting neurologically impaired and unimpaired groups (Delucchi & Bostrom, 2004).

[1]Unfortunately information about length of education was not available for patients or controls.

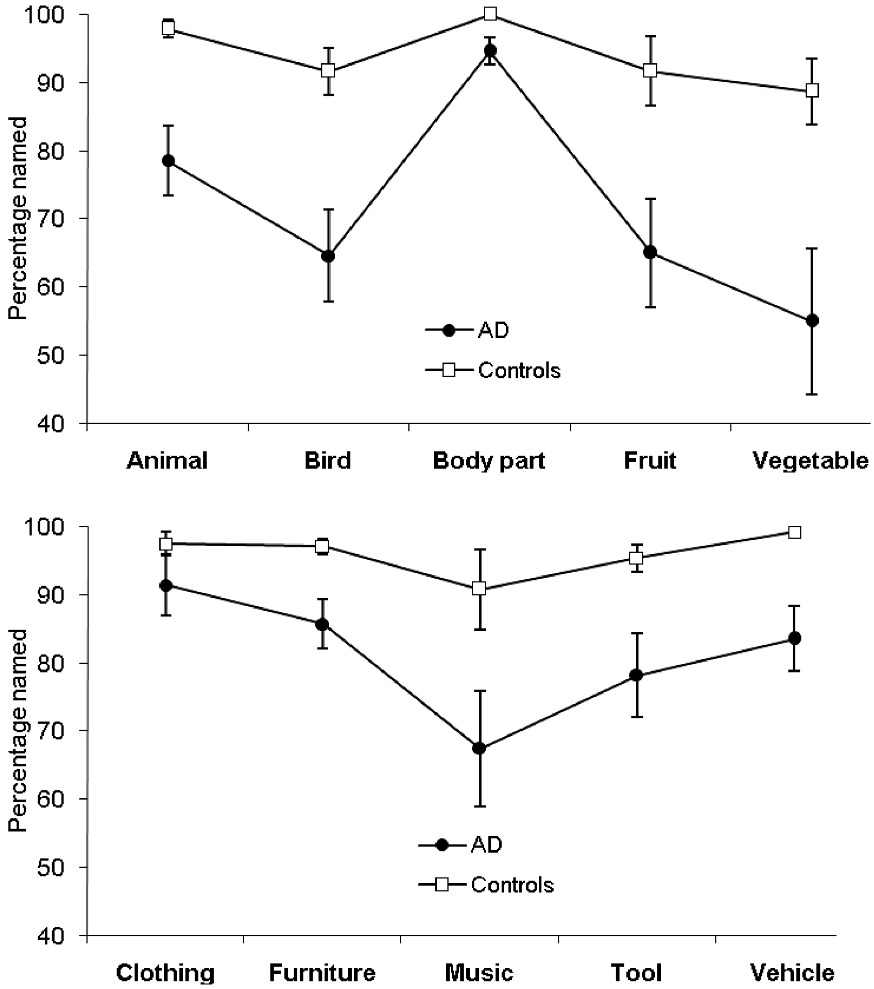

Figure 1. Mean naming (percentage) for Alzheimer's disease (AD) patients and elderly healthy controls in five living and five nonliving subcategories. Bars = standard errors.

Many studies have now investigated category-specific naming performance in AD using rigorously controlled stimuli; however, their findings are not wholly consistent (for a review, see Laws et al., 2007). Although most reports of category-specific impairments in AD patients record living-thing impairments (e.g., Grossman, Robinson, Biassou, White-Devine, & D'Esposito, 1998; Mauri, Daum, Sartori, Riesch, & Birbaumer, 1994; Silveri, Daniele, Giustolisi, & Gainotti, 1991), others describe both living and nonliving deficits within the same group of patients (Gonnerman, Andersen, Devlin, Kempler, & Seidenberg, 1997; Laws et al., 2005; Laws et al., 2003; Moreno-Martínez, Tallón-Barranco, & Frank-García, 2007; Tippett et al., 1996; Zannino, Perri, Carlesimo, Pasqualetti, & Caltagirone, 2002). Furthermore, Laws et al's (2007) meta-analysis of category-specific picture naming in AD patients highlighted the fact that while more studies have reported significant category effects for living things, the effect sizes for living and nonliving things did not significantly differ. The greater number of previous studies reporting living-thing impairments has, perhaps, encouraged the impression that AD patients show a differential living-thing category disadvantage. In concurrence with most previous studies, we found that AD patients named significantly fewer living than nonliving things and, furthermore, that this could not be readily attributed to any differences in nuisance variables (at least those that were matched statistically across living and nonliving domains).

As with many similar studies of picture naming in AD that have used the Snodgrass and Vanderwart (1980) images, the data from our healthy controls were at ceiling and may have therefore masked any "normal" category effect—especially since the patient data were also nonnormally distributed. What is almost certain is that any conventional statistical comparison of the AD and control groups may well have led to an unreliable conclusion

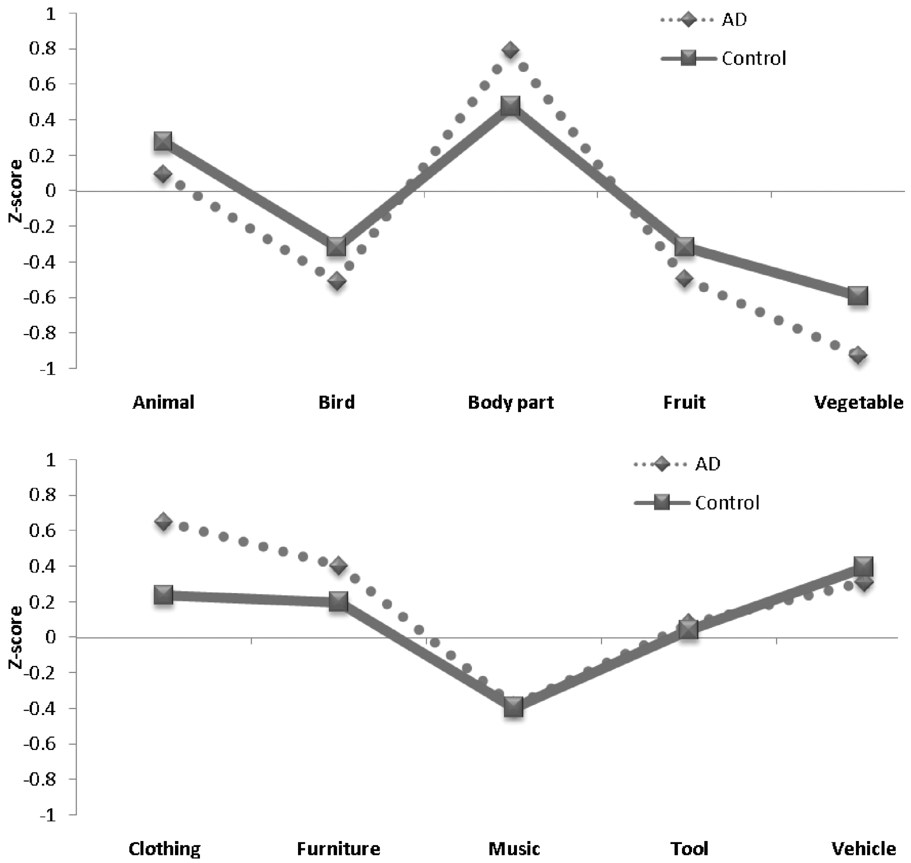

Figure 2. Standardized *Z*-profiles for Alzheimer's disease (AD) patients and elderly healthy controls across five living and five nonliving subcategories.

regarding the size and direction of category effects in these patients (see Laws, 2005; Laws et al., 2005). As we have argued, bootstrap analyses address some of the problems associated with heavily skewed distributions, and, in the current study, we used bootstrap hierarchical regression analyses to determine the specific roles played by three types of variable (nuisance variables per se, a control group difficulty index, and category). As already noted, the use of unmatched stimuli has been highlighted as one possible reason why patients may show poorer performance with living than nonliving things in some previous studies (Tippett et al., 1996). Although we matched items across category (living vs. nonliving) on some nuisance variables (familiarity, visual complexity, log word frequency), these variables, combined with age of acquisition, still accounted for a large proportion of the variance in patient naming (39%).

The persistence of a significant, albeit small, category effect, even after controlling for nuisance variables, does not alone confirm that the category effect is a consequence of the neurological damage. Rather, it is also vital to establish whether the category effect is larger than that which might be expected in healthy controls. A large amount of variance in patient naming was uniquely explained by the difficulty index derived from elderly healthy controls (approximately 29%). By contrast, although category did significantly predict patient naming, it uniquely accounted for just 3% of the variance after controlling for the other variables (i.e., 10 times less than the control difficulty index). While we would not argue that the direction and size of this difference in controls would invariably occur across different stimulus sets, the level and direction of difficulty that exists for healthy controls must be established on any specific stimulus set being used.

Both the regression analyses and, furthermore, the profile across subcategories indicate that despite the obvious quantitative difference between patient and control performance, they do not differ qualitatively. As far as we are aware, no previous study has examined such a broad range of categories in AD patients, at least with respect to picture naming. Critically, the AD patients and healthy controls showed similar difficulty profiles across the five living and the five nonliving categories. For example, although AD patients show greater difficulty with naming vegetables, this was also the most difficult category for controls to name. Notably both groups show substantial naming variability across subcategories, and this again underscores the importance of stimulus choice when examining category effects. As with previous studies (Barbarotto et al., 2001; Gale & Laws 2006; Gale et al., 2006; Laws, Gale, Frank, & Davey, 2002a), body parts and musical instruments appear to be atypically good and poor when referenced to living and nonliving categories, respectively, both for AD patients and for controls. In other words, naming in AD patients reflects a similar pattern of task difficulty expressed by healthy elderly controls.

Our findings are consistent with the patient performance being an exaggeration of normal healthy control performance (see Moreno-Martínez & Q5 Laws, 2007, in press; Perri et al., 2003). The presence of a considerable category effect in neurologically normal participants may well have been "hidden" by ceiling effects in the control data of previous studies. Indeed, the presence of a *normal* category advantage (whether living or nonliving) accords with recent findings in healthy participants (Brousseau & Buchanan, 2004; Coppens & Q6 Frisinger, 2005; Filliter, McMullen, & Westwood, 2004; Låg, 2005; Låg, Hveem, Ruud, & Laeng, 2006; Laws, 1999, 2000; Laws & Hunter, 2006; Laws & Neve, 1999; Laws, Leeson, & Gale, 2002b; Lloyd-Jones & Luckhurst, 2002; McKenna & Parry, 1994). With the recent accumulation of studies documenting category effects in healthy participants, it is pertinent to ask whether, and indeed how, extant models of category specificity incorporate the notion of category effects in the healthy brain.

Current models of category specificity have been designed to specifically account for patient deficits rather than to make predictions about normal category effects, and so may not make obvious predictions about category effects in normal cognition. The closest to a *normal* model is, indeed, the artifactual (nuisance variable) account, and this would typically predict a nonliving advantage, though not of course for matched stimuli. Although the "domain-specific" account (Caramazza & Shelton, 1998) does not make specific predictions about normal category biases, we might expect the preferential processing of those categories that have dedicated domains (e.g., foodstuffs, animals, tools) in neurologically unimpaired individuals (see Laws, 2000). Our data provide no evidence of differential impairment in any subcategory of living or nonliving domains. This suggests that the naming of AD patients reflects the same pattern of task difficulty as that seen in healthy elderly controls—that is, there are no qualitative differences attributable to the disease process itself. Rather, at least within the context of AD, the disease process affects categories in an additive manner, rather than selectively affecting specific neural subsystems of knowledge. Whatever predictions may or may not be derived from extant models of category specificity, this study underlines the importance of examining the performance of neurologically healthy participants when documenting category-specific naming deficits in neurological patients, and the need for models of category specificity to address the finding of normal category effects.

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APPENDIX

LIST OF STIMULI USED

Animals: bear, cow, dog, elephant, giraffe, goat, horse, lion, sheep, squirrel

Birds: bird, chicken, duck, eagle, ostrich, owl, peacock, penguin, rooster, swan

Body parts: arm, ear, eye, finger, foot, hand, leg, lips, nose, toes

Clothing: coat, dress, hat, jacket, pants, shirt, shoe, skirt, sock, sweater

Fruit: apple, banana, cherry, grapes, lemon, orange, peach, pear, pineapple, strawberry

Furniture: bed, chair, couch, desk, dresser, fridge, rocking-chair, stool, table, TV

Musical instruments: accordion, bell, drum, flute, French horn, guitar, harp, piano, trumpet, violin

Tools: axe, chisel, hammer, paintbrush, pliers, ruler, saw, scissors, screwdriver, wrench

Vegetables: artichoke, asparagus, carrot, celery, lettuce, mushroom, onion, pepper, potato, pumpkin

Vehicles: airplane, bicycle, bus, car, helicopter, motorbike, sailboat, train, truck, wagon