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Cerebral Laterality for Famous Proper Nouns: Visual Recognition by Normal Subjects

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Lexical processing has long been associated with left-hemisphere function, especially for infrequently occurring words. Recently, however, persons with severe aphasia, including word-recognition deficits, were observed to recognize familiar proper nouns. Further, some patients suffering right-hemisphere damage were poorer at identifying famous names than left-hemisphere-damaged subjects. These observations point to the possibility that some property of the right hemisphere provides an advantage for the processing of familiar or personally relevant stimuli. To investigate this possibility, we conducted split-visual-field studies in which we manipulated stimulus sets, recognition task, and exposure duration. Greater accuracy in the right visual field was found for common nouns and unknown proper nouns, and famous proper nouns were overall more accurately recognized. Performance for famous nouns in the two visual fields was not significantly different when the task required categorization into famous or nonfamous and when stimuli most highly rated as familiar were used. These findings support our proposals that (1) both hemispheres can process famous proper nouns and (2) the right hemisphere is specialized for personal relevance.

Key Words: split visual fields; lexical processing; hemispheric specialization; proper nouns.

BACKGROUND

It is well known that processing of visually presented words is superior in the left hemisphere (LH) compared to the right hemisphere (RH) (Hellige, 1990; Marshall, 1970; Bradshaw & Nettleton, 1983; Leiber, 1976; Bradshaw, Hicks, & Rose, 1979). This is consistent with traditional lesion studies, whereby damage to the adult, left cerebral hemisphere is frequently associated with aphasia, while damage to the right hemisphere almost never results in lasting verbal deficits (Benson, 1979; Bogen, 1997). Although word finding is particularly vulnerable to intellectual decline from a variety of causes (Tweedy & Schulman, 1982), anomia and word-recognition defi-

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cits are generally associated with LH damage (Henderson, 1995; Goodglass & Butters, 1988; Goodglass, 1980). LH association with lexical processing has also been found in studies of split-brain patients (Sidtis, Volpe, Holtzman, Wilson, & Gazzaniga, 1981; Zaidel, 1977) and observations in Wada testing (Loring, Meador, Lee, & King, 1992; Loring, Meador, Lee, Murro, Smith, Flanigin, Gallagher, & King, 1990). However, some ability of the RH to process lexical items, especially those that are short, frequent, and concrete, is consistently reported in the split-brain studies mentioned above, in visual half-field studies (Day, 1977; Mannhaupt, 1983; Chiarello, 1988a, 1988b, 1988c; 1991; Burgess & Livesay, 1998), in brain damage (Van Lancker, 1988; Code, 1987; Kinsbourne, 1971; Czopf, 1981; Cummings, Benson, Walsh, & Levine, 1979; Landis, Graves, & Goodglass, 1982; Landis, Regard, Graves, & Goodglass, 1983), in Wada testing (Hart, Lesser, Fisher, Schwerdt, Bryan, & Gordon, 1991), and in adult left hemispherectomy (Burkland & Smith, 1977). Several studies report that the RH processes lexical items in different ways from the LH (Drews, 1987; Landis & Regard, 1988; Rodel, Cook, Regard, & Landis, 1992; Chiarello, 1988b; TenHouten, Hoppe, Bogen, & Walter, 1986).

Recently, a growing array of interests has revealed an important role of the RH in communicative function, particularly in pragmatics, the principles of language use (e.g., Perecman, 1983; Young, 1983; Brownell & Joanette, 1993; Brownell, Potter, Bihrle, & Gardner, 1986; Tompkins, 1996; Burns, Halper, & Mogil, 1996; Joanette & Brownell, 1990; Joanette, Goulet, & Hannequin, 1990; Van Lancker, 1997). Specifically, abilities involved in ''top-down'' aspects of language processing, such as inference, humor, idiom recognition, use of indirect requests, and topic tracking, have been convincingly shown to be impaired following RH damage in adults (Beeman & Chiarello, 1998; Gardner, Brownell, Wapner, & Michelow, 1983; Molloy, Brownell, & Gardner, 1990; Myers & Linebaugh, 1981; Myers, 1999; Van Lancker & Kempler, 1987). However, an ability to process low-frequency, phonologically complex compound (proper) nouns was not suspected prior to recent reports of preserved proper noun recognition (see below) in persons with extensive LH damage and severe aphasia.

Suggestive clinical reports of retained personal or geographical name recognition in LH patients had previously appeared (Warrington & McCarthy, 1983; Wapner & Gardner, 1979; Collins, 1991). In the first focused studies of this question, preservation of the spoken or written names of well-known persons was reported in global aphasia (Van Lancker & Klein, 1990; Van Lancker & Nicklay, 1992). This finding was supported by performance of larger groups of unilaterally brain-damaged patients; patients with RH damage were significantly more impaired on famous name recognition than matched patients with LH damage (Van Lancker, Lanto, Klein, Riege, Hanson, & Metter, 1991). Additional studies soon followed that supported the finding for preserved spoken and/or written geographical and/or famous personal names in left-hemisphere brain damage (Goodglass & Wingfield, 1993; Cipolotti, McNeil, & Warrington, 1993; Cipolotti & Warrington, 1995; Yasuda & Ono, 1998). In describing the globally aphasic patient MED, who retained the ability to comprehend proper nouns, the authors refer to the common noun deficit as a ''category specific access disorder'' (McNeil, Cipolotti, & Warrington, 1994). While various neuropsychological explanations have been proposed, the most parsimonious explanation is that, contrary to previous notions about the limitations of the RH for processing of complex lexical items, personally familiar proper nouns are successfully recognized by the RH.

One explanation for this unusual observation arises from more general knowledge about RH function, which has been consistently shown to differ in essential ways from LH function (Milner, 1971; Sperry, 1974; Bogen, 1969a, 1969b; Bradshaw & Nettleton, 1983; Bever, 1975; Springer & Deutsch, 1997). Some of these differences are compatible with the notion that the RH mediates processing of personally relevant phenomena. It is well known that familiarity agnosias, such as topographical agnosia, phonagnosia (familiar voice recognition deficits), prosopagnosia, and Capgras syndrome (the belief that a family member is an imposter), are associated with RH damage (Cummings, 1985, 1997; Cutting, 1990; Ellis, 1994; Landis & Regard, 1988; Van Lancker, Kreiman, & Cummings, 1989; Malone, Morris, Kay, & Levin, 1982; Van Lancker & Canter, 1982). Severely aphasic persons, whose right hemispheres are intact, have been observed to perform better on tasks involving personally familiar material (Wallace & Canter, 1985). Personally relevant stimuli were successfully recognized in the RHs of split-brain patients (Sperry, Zaidel, & Zaidel, 1979). Snowden, Griffiths, and Neary (1994) reported on five patients with structural and/or functional abnormalities restricted to the LH with a progressive semantic disorder. These patients (with intact RHs) performed better on personally relevant than nonpersonal names and places as compared to a group of amnesic Alzheimer patients, who presumably have relatively dysfunctional RHs. Conversely, a reduction of personally relevant (autobiographical) detail in stories produced by patients with RH damage, compared to normal control subjects, was reported (Cimino, Verfaellie, Bowers, & Heilman, 1991). Thus, an explanation for the RH ability to process proper nouns naming familiar-famous and familiar-intimate persons, as well as well-known geographical locations and cultural icons, might lie in RH specialization for establishing, maintaining, and processing personally relevant phenomena.

To further investigate the possibility that personally familiar proper nouns are processed successfully by the neurologically intact RH, we conducted a study of normal subjects comparing visual processing of matched (generic) common and (unique, personally familiar) proper nouns presented to the left visual field and right visual field. We justified the use of written proper nouns based on the finding of Van Lancker and Klein (1990) that preserved recognition of famous names in globally aphasic subjects was seen when written (read) as well as spoken (auditory) stimuli were used. Stimuli and task demands were varied to probe details about lateralized processing of generic common and familiar (famous) proper nouns.

GENERAL METHOD

Subjects, Tasks, and Design

Six split-visual-field experiments were conducted, each using 26–31 different undergraduate college students in Minnesota, for a total of 170 subjects, ranging in age from 18 to 22; 60% were female. A seventh study utilized another 24 subjects in a structural replication of Experiment Six for a grand total of 194 subjects. All subjects signed a written informed-consent form. All subjects tested were native speakers of English with normal or corrected vision. All but two were right-handed. One study [Experiment Four (b)] consisted of a reanalysis of data derived from Experiment Four (a), yielding a total of eight studies (see Table 1 for an overview of experiments).

Presentation of Lateralized Stimuli

Studies of hemispheric differences in lexical processing in persons with normal brains face a difficult issue. In order to present visual stimuli to one hemisphere or the other, it is necessary to displace them laterally relative to the percipient's point of fixation. This exploits the fact that each visual field projects exclusively to the contralateral hemisphere. The difficulty arises because printed language is in serial format and English words are read from left to right. How to equate the lateral displacement of visual stimuli presented to the two visual fields becomes a thorny issue. For very short stimuli (e.g., single letters or trigrams) that require little or no scanning, the problem is trivial, but if longer stimuli are used, the issue becomes more important. To illustrate, if degree of displacement for left visual field and right visual field presentation is indexed from the beginning of each word, the result is that stimuli presented to the LVF/RH are advantaged because the bulk of the stimulus falls closer to fixation than is the case

TABLE 1
Overview of Experiments, Conditions, and Results

Experiment	Ms	Font	Presentation	Subjects	Task	Results	Appendix
One: CA famous names and common nouns	80	caps	Randomized	28	Proper(famous)/ Common(generic)	Proper nouns: RH = LH Common nouns > LH	A
Two: CA famous names and common nouns	80	caps (PNs) title case (CNs)	Separate blocks	31	Female–male/ Animate-inanimate	Proper nouns and Common nouns > LH	A
Three: CA famous names and common nouns	66 (PNs) 93 (CNs)	caps (PNs) title case (CNs)	Separate blocks	28	Female-male/ Animate-inanimate	Proper nouns and Common nouns > LH	A
Four a: CA famous names and unknown proper names (MN phonebook)	80	caps	Randomized	28	Male/Female	Proper famous nouns and nonfamous nouns > LH Proper nouns > RH	B
Four b: (reanalysis of Experiment Four) Top 70 CA famous names and unknown proper names (MN phonebook)	80	caps	Randomized	28	Male/Female	Proper famous nouns and nonfamous nouns > LH Proper nouns > RH	B
Five: MN famous proper names and nonfamous proper nouns	80	caps	Randomized	26	Famous/Not famous	Famous proper nouns: RH = LH; nonfamous names < chance	D
Six: MN famous proper names and nonfamous proper nouns	93	caps	Randomized	29	Famous/Not famous	Famous proper nouns: RH = LH nonfamous names > LH	D
Six a: Replication of Experiment Six	106	caps	Chin rest; Randomized	24	Famous/Not famous	Famous proper nouns: RH = LH nonfamous names > LH	D

for RVF/LH stimuli. Prior investigations in this area have ameliorated the problem by presenting stimuli oriented vertically rather than horizontally (Luh & Wagner, 1997). However, initial- and last-letter differences associated with visual field have been found in that format also (Levy, Heller, Banich, & Burton, 1983). Further, that solution seemed inappropriate for the current studies, as our question involves familiarity, which depends to a considerable extent on encountering stimuli in as naturalistic a format as possible. Our solution was to present the stimuli so that their centers fell at 4° of visual angle to the left or right of fixation. This seems likely, if any advantage were to emerge, to result in an advantage for RVF/LH stimuli, but obviously would not spuriously enhance processing of LVF/RH stimuli. Thus, using this format, our hypothesis of a LVF/RH role in proper noun processing would not be favored.

Stimuli were presented to the LVF or RVF for a range of durations from 66.6, to 80, to 93, to 106 ms. The stimuli were presented horizontally such that the midpoint of each stimulus fell at 4° lateral displacement from the central fixation cross. The stimuli were designed and conducted using PsyScope, an experiment authoring program (Cohen, MacWhinney, Flatt, & Provost, 1993), running on Macintosh PowerPC computers. Stimuli were presented randomly one at a time in the LVF or RVF such that each subject saw an equal number of each stimulus category in each visual field. Subjects were encouraged to sit directly in front of the center of the monitor at a distance of about 18 inches and to maintain fixation on the middle of the screen. Subjects indicated their response using the computer keyboard. For example, in Experiment One, half of the subjects responded with the left hand for proper nouns and the right hand for common nouns and half with the reverse mapping. For all experiments, response hand (left or right) was varied across subjects. In Experiments Two and Three, in separate blocks, the task was to identify ''male'' or ''female'' in the proper noun block and ''inanimate'' or ''animate'' in the common noun block. For Experiments Four through Six, the task specified identification of ''famous'' or ''unknown.''

The procedure for each of the experiments was similar. Participants read instructions from the screen and then initiated a series of 20 practice trials prior to the block of 200 experimental trials. To ensure proper fixation and readiness, participants using the spacebar initiated each trial. Auditory feedback for both correct and incorrect answers was provided over headphones. Such feedback was expected to counteract the tendency to develop a bias toward one or the other response. Font case of stimuli was presented in the form most appropriate to the stimulus type, with upper- and lowercase (''title case'') for blocks containing all proper noun presentations and lowercase for blocks containing all common noun presentations. When both proper and common nouns were mixed within a block (e.g., Experiment One), stimuli were presented in all uppercase, to prevent cueing by the visual shape alone.

Stimuli. For the initial three experiments, two-word phrases constituting generic common or familiar (famous) proper nouns (names of culturally famous persons) were obtained from college student informants by instructing them to write down as many items as they could on sheets of paper provided. A separate sheet was handed out for each noun type (proper versus common). Informants were asked to list items in each of four categories: inanimate common nouns, animate common nouns, male well-known persons, and female well-known persons. There was no time limit, and other than the requirement that each item be made up of two words, no other restrictions were given in the instructions. Several examples were given in the written instructions to the subjects. The first sheet asked subjects to ''list common nouns that name objects in the world, nouns made up of two words.'' The instructions ended by asking informants to list animate and inanimate nouns separately. The second sheet asked subjects to list ''names of famous, well-known personalities''; it was explained that ''famous'' meant those persons in the public eye ''whose names, faces and/or voices you would recognize.'' The instructions ended by asking people to list famous males and females separately. Survey sheets requested information on age, sex, and years of education, but individual names of informants were not obtained. The 139 college students in two universities in the greater Los Angeles area providing responses ranged in age from 19 to 48, with a mean age of 26.8 years; 111 respondents were female, 23 were male, and 5 did not provide gender information. All respondents were students enrolled as majors in psychology, communication disorders, education, teaching English as a second language, or a related major and all were upperclassmen or masters candidates.

Common and proper nouns were entered and collated by the experimenters and ranked by frequency of occurrence. We obtained 565 inanimate and 291 animate common nouns and 366 famous female and 479 famous male proper nouns. Although some items were produced by several informants, the majority of words occurred only once. A length restriction (for later split visual field presentation) led to the elimination of several items, reducing the list to nouns of a maximum length. For common nouns, items were eliminated if they appeared as one word in the dictionary (for example, *blackboard*). For proper nouns, historical and mythical figures were eliminated (for example, *George Washington* or *King Kong*).

The selected items were subjected to a matching procedure to form units of four such that each unit was composed of a male and female proper noun and animate and inanimate common noun, with equal number of syllables and equal number of characters (plus or minus one) in each unit. Fifty groups of four items in this manner were arranged for the first three experiments described below (see Appendix

A). Using this method, 100 different common and 100 proper nouns formed the list of stimuli, drawn from a pool produced by a cohort of subjects to be tested. These stimuli were used without revision for Experiments One through Three.

In Experiment Four (a), the famous proper nouns were retained, and the common nouns were replaced by unknown proper names taken from the Minneapolis phonebook. This was done because proper names have been long held to have special linguistic qualities that distinguish them from common nouns (Miller, 1981; Miller & Johnson-Laird, 1976, pp. 310–311; Valentine, Brennen, & Bredart, 1996; Brown, 1988; Barresi, Obler, & Goodglass, 1998; Cohen & Burke, 1993). Therefore we wished to directly compare recognition of famous proper nouns with recognition of unknown proper names. Between two and six items were taken from each alphabetic set (A through Z) listed in the phonebook, selecting names that matched the phonological structure of the proper nouns obtained from the previous elicitation survey (see Appendix B). Syllable- and character-length matching were preserved in all stimulus lists. The data from Experiment Four (b) were reanalyzed utilizing only the top 70% most popular of famous names, as determined by the rating surveys (described below).

In Experiments Five and Six, the top 70% of previously obtained famous names were retained, with new famous names solicited from the Minnesota cohort (undergraduate students) obtained using written surveys similar to those described above. New unknown proper nouns were selected for the matching unfamiliar set. To derive the most ‘‘popular’’ famous names, 156 names solicited from approximately 30 students were rated on a scale of 1–7 by another group of 30 students on ‘‘familiarity’’ and ‘‘emotionality’’ scales (see Appendix C). The 100 most highly rated names on familiarity were selected for Experiments Five and Six (see Appendix D; for a listing of experiment stimuli and conditions, see Table 1).

Rating surveys. Rating sheets were prepared to obtain estimates of familiarity and of frequency of occurrence for items in the first three split-visual-field studies. In the first Experiment, subjects estimated how frequently they encountered each item, on a scale from 1–7, with 1 being least frequent and 7 being most frequent. The second sheet asked for ratings of ‘‘frequency or familiarity’’ using the same scale of 1–7. We were interested in whether the notions of ‘‘frequency’’ or ‘‘familiarity’’ would differ when used to judge common and proper nouns. Third, another group of subjects rated the items on a ‘‘familiarity’’ scale. Finally, for 157 new familiar stimuli elicited for Experiments Five and Six, the names were rated on both a ‘‘familiar’’ and an ‘‘emotional’’ scale (see Appendix C). We were interested in comparing subjects’ ratings on these two scales.

EXPERIMENT ONE: FAMOUS PROPER NOUNS AND GENERIC COMMON NOUNS

Methods

Experiment One directly compared lateralized recognition of generic common nouns, such as *TENNIS RACKET,* with famous proper nouns, such as *RONALD REAGAN.* In this task, all stimuli were presented in uppercase letters so that correct responses could not result from cueing by a simple visual difference. The stimuli were presented for 80 ms with stimulus type (proper or common) and visual field varying randomly. Subjects were instructed to press one key with a finger of one hand on seeing a common noun and another key with a finger of the other hand on seeing a proper noun. They were told that all the proper nouns were names of famous persons and all the common nouns were items in the world. Hand of response (left vs right) was alternated by subjects. Following 20 practice trials, subjects initiated the 200 trials of the actual experiment. As in all studies, auditory feedback was provided over headphones. After performing judgments on the 200 stimuli, each subject filled out the frequency-of-occurrence judgment sheet.

Results

Each subject’s percentage correct for the four conditions was submitted to a repeated-measures ANOVA with hemisphere (left and right) and noun type (proper and common) as factors. The main effect of hemisphere was significant [$F(1, 27) = 40.6$, $p < 0.5$]. As expected, subjects were better at identifying RVF/LH targets than LVF/RH targets: 68% vs 59%. The main effect of noun type was also significant [$F(1, 27) = 63.4$, $p < .05$]. Proper nouns were correctly categorized more often than were common nouns (74% vs 53%). The interaction of hemisphere and noun type, the comparison of greatest theoretical interest, was also significant [$F(1, 27) = 5.8$, $p < .05$]. We conducted two planned comparisons to evaluate differential processing

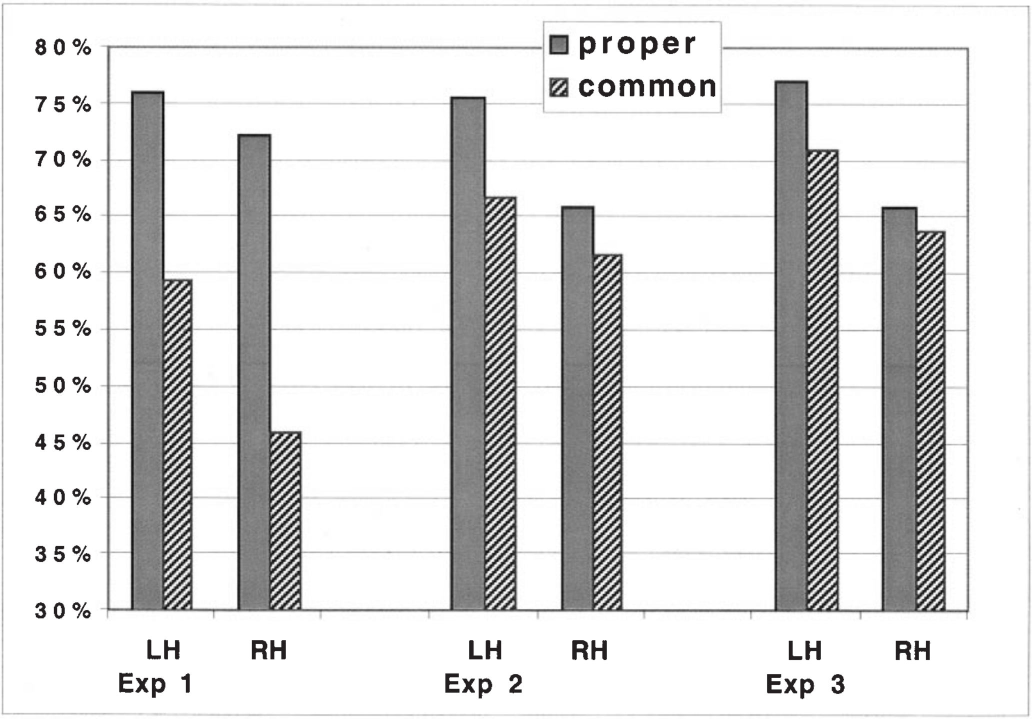

FIG. 1. Results from Experiment One: randomized famous proper and generic common nouns with common/proper judgments presented at 80 ms. Results from Experiment Two: famous proper and generic common nouns in separate blocks with animate/inanimate and male/female judgments presented at 80 ms. Results from Experiment Three: famous proper and generic common nouns in separate blocks with animate/inanimate and male/female judgments, different exposure times, 63.6 and 90 ms respectively.

of the proper and common nouns by hemisphere. In the first comparison, subjects' identification of proper nouns did not differ by hemisphere [$F(1, 27) = 2.1$, $p > .05$]; in contrast, subjects' identification of common nouns differed significantly in favor of the LH [$F(1, 27) = 23.7$, $p > .05$] (Fig. 1).

The hypothesis we are testing is that the difference between proper and common nouns will be larger for items presented to the right hemisphere than for those presented to the left hemisphere. This is simply a directional version of the standard analysis of variance (ANOVA) interaction contrast for hemisphere and noun type. Because ANOVA tests nondirectional hypotheses, and because the interaction contrast is lower in power than contrasts for main effects, we conducted a focused comparison which addressed the hypothesis directly. We computed difference scores for noun type (proper minus common) within each hemisphere (left and right) for each subject and conducted a dependent-samples, directional *t* test on these data. The result was significant [$t(27) = 2.4$, $p = .01$].

As this study was evaluating personally familiar terms, we wished to obtain an estimate of subjects' subjective ratings of the stimuli. We first asked subjects to rate each common and proper noun on a scale of 1–7 as occurring *least frequently* to *most frequently* in their everyday lives. Using this Likert scale, the common noun set was judged to be more frequent (average = 4.2) than were the proper nouns (average = 3.6). This difference was significant by a nondirectional, independent-samples *t* test [$t(198) = 3.7$, $p < .05$]. This contradicts the possibility that the effect was the result merely of greater frequency of proper nouns.

EXPERIMENT TWO: FAMOUS PROPER NOUNS AND GENERIC COMMON NOUNS (SEPARATE BLOCKS, EQUAL DURATIONS)

Methods

Our next question was whether the asymmetry for proper and common nouns observed in Experiment One would obtain when subjects were asked to make judgements about featural properties of those stimuli. It will be recalled that the stimuli were originally elicited based on the categories ''male'' and ''female'' (for proper nouns) and ''inanimate'' and ''animate'' for common nouns. These are linguistic-semantic features, originally called ''selectional features'' in early models of generative grammar (Chomsky, 1965). As mentioned above, half of the common nouns are animate (e.g., *flower petal* and *spinal cord*) and half are inanimate (e.g., *carpet cleaner* and *coffee mug*); similarly, the proper noun set is half-male and half-female. Common nouns and proper nouns were presented in two separate blocks in this part of the study, administered to 31 new subjects. Common nouns were all presented in lowercase, and proper nouns were presented in title case so as to more closely approximate the manner in which these items are usually encountered. For the common noun block, the subjects' task was to press one key with one hand on seeing an animate noun and to press the other key with the other hand on seeing an inanimate noun; for the proper nouns, subjects' task was to press respective left or right keys for male versus female. Hand response sides were alternated as described above. Exposure time was again 80 ms.

Following this study, 14 of the 31 subjects filled out rating survey sheets appropriate to this presented list, responding to the joint question of how ''frequent or familiar'' the items are.

Results

As in Experiment One, each subject's percentage correct for the four conditions was submitted to a repeated-measures ANOVA with hemisphere (left and right) and noun type (proper and common) as factors. The main effect of hemisphere was significant [$F(1, 30) = 16.38$, $p < .05$]. Again, as expected, subjects were overall better at identifying RVF/LH targets than LVF/RH targets: 71% vs 64%. The main effect of noun type was also significant [$F(1, 30) = 42.8$, $p < .05$]. Proper nouns were correctly categorized more often than were common nouns (also) (71% vs 64%). The interaction of hemisphere and noun type was again significant [$F(1, 30) = 4.8$], but differed from the result obtained in Experiment One. Here the difference between proper and common nouns was *larger* in the LH than in the RH. The planned comparisons of noun type by hemisphere revealed better identification in the LH of both proper nouns [$F(1, 30) = 42.1$] and common nouns [$F(1, 30) = 11.5$; both $p < .05$] (see Fig. 1).

Using the same Likert scale (1–7), the common noun set was again judged to be more frequent/familiar (average = 5.09) than were the proper nouns (average = 4.56). This difference was significant by a nondirectional, independent-samples *t* test [$t(198) = 3.3$, $p < .0002$].

EXPERIMENT 3: FAMOUS PROPER NOUNS AND GENERIC COMMON NOUNS (SEPARATE BLOCKS, DIFFERENT DURATIONS)

Methods

An unexpected finding of the first two studies was the consistent superior recognition of proper over common nouns. This was surprising because much has been said in the literature about proper nouns being more difficult than common nouns in mental processing (e.g., Semenza, 1995; Valentine, Brennen, & Bredart, 1996; Burgess & Conley, 1999). Proper nouns are unique and specific compared to the generic nature of common nouns. Further, while we could not guarantee familiarity with all the proper nouns, knowledge of all the common nouns in this population was expected. The explanation for greater accuracies on proper nouns could not reasonably involve higher familiarity or frequency of proper over common nouns, as the ratings in both studies gave significantly higher mean values for common nouns. Phonological complexity should not play a role: The stimulus sets were matched in length and syllable structure. Even though from these several facts we might have predicted poorer performance on proper nouns, for some reason, proper nouns were much more easily identifiable than common nouns. To gain a better estimate of hemispheric advantage and to accommode for the unexpected superior performance on proper nouns, we attempted to equalize performance by decreasing exposure time for the proper noun stimuli (to 66 ms) and increasing exposure time for the common nouns (to 93 ms). Separate block and task demands (animate–inanimate and male–female judgments) remained the same as in Experiment Two. Twenty-eight additional subjects were tested.

Results

Each subject's percentage correct for the four conditions was submitted to a repeated-measures ANOVA with hemisphere (left and right) and noun type (proper and common) as factors. The main effect of hemisphere was significant [$F(1, 27) = 18.7$, $p < .05$]. Subjects were better at identifying RVF/LH targets than LVF/RH targets (74% vs 65%). The main effect of noun type was also significant [$F(1, 27) = 8.9$, $p < .05$]. Despite the much shorter exposure time, proper nouns were still more often correctly categorized than were common nouns (72% vs 67%), although this difference was somewhat reduced from the previous experiment. The interaction of hemisphere and noun type was also significant [$F(1, 27) = 8.9$, $p < .05$]. In planned comparisons, subjects' identification of proper nouns differed by hemisphere [$F(1, 27) = 163.5$, $p < .05$], and subjects' identification of common nouns also differed significantly in favor of the LH [$F(1, 27) = 73.0$, $p < .05$] (Fig. 1).

The major result of our duration manipulation was to improve performance of common nouns for the RVF/LH presentations. We note that in Experiments Two and Three, detection of linguistic-semantic features was required of the subjects, in contrast to broader categorization into ''proper (famous) and common nouns'' required in Experiment One. In Experiments Two and Three, performance on both noun types was higher in the LH, and for the duration manipulations, performance was improved for common nouns, while remaining essentially unchanged for proper nouns. We suggest that classification of stimuli by linguistic features may be more challenging to the RH than the LH and may be more compatible with common than proper nouns.

Familiarity Ratings

Fifteen of the 22 subjects rated the stimuli on a scale from 1–7, indicating the relative familiarity of each item. Again, famous proper nouns were rated as less familiar (average = 4.65) than generic common nouns (average = 5.27) [$t(198) = 7.909$, $p < .0001$].

EXPERIMENT FOUR (A): FAMOUS AND NONFAMOUS PROPER NOUNS

Methods

As mentioned above, numerous writers have discussed the ways that common and proper nouns are different (Valentine, Brennen, & Bredart, 1996; Searle, 1958; Semenza, 1995). In this study, we compared performance on famous proper nouns with nonfamous proper nouns using names taken from the Minneapolis phonebook. As the stimuli did not differ on any other dimension, we considered the operative factor to be ''notoriety.'' The task was to identify whether each presented proper nouns (known or unknown) was ''male or female.''

Results

Each subject's percentage correct for the four conditions was submitted to a repeated-measures ANOVA with hemisphere (left and right) and notoriety (famous

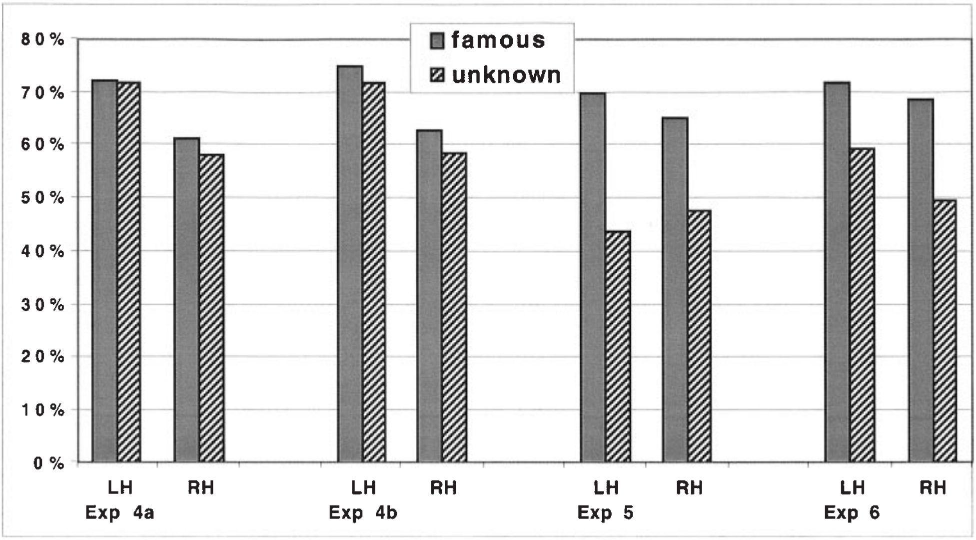

FIG. 2. Results from Experiment Four: randomized famous proper nouns and unknown proper nouns taken from the Minneapolis phonebook presented at an exposure duration of 80 ms. Reanalysis of performance data from Experiment Four (a) with famous proper nouns selected from highest ranking in Minnesota familiarity rating in survey and compared to matched unknown proper nouns. Results from Experiment Five: randomized famous proper nouns and nonfamous nouns with new famous proper noun stimuli elicited from Minnesota college informants presented at an exposure duration of 80 ms. Results from Experiment Six: randomized famous proper nouns and nonfamous nouns with new famous proper noun stimuli elicited from Minnesota college informants (same as Experiment Five above) presented at an exposure duration of 93 ms.

and nonfamous) as factors. The main effect of hemisphere was significant [$F(1, 27) = 34.3$, $p < .05$]. Subjects were better at identifying RVF/LH targets than LVF/RH targets (73% vs 61%). The main effect of notoriety was not significant [$F(1, 27) = 1.8$, $p > .05$]. Identification did not differ as a function of notoriety. The interaction of hemisphere and noun type was not significant [$F(1, 27) = 1.8$, $p > .05$]. Planned comparisons revealed no significant differences in the LH, while a marginally significant difference for known vs unknown proper nouns was seen in the RH. The absence of a main effect of the notoriety variable led us to question whether the famous names were all uniformly personally relevant (well known) to our Midwestern college students, even though they were reasonably within the same cohort with respect to age, occupation (student), and education. We examined the rating surveys of the stimuli and rank ordered the results for a reanalysis given as Experiment Four (b) below (Fig. 2).

EXPERIMENT FOUR (B): FAMOUS AND NONFAMOUS PROPER NOUNS: THE TOP 70

Methods

Famous proper nouns ranking highest in familiarity ratings by our subject population were selected and analyzed to the exclusion of the lower 30 in the familiarity ranking.

Results

Again, each subject's percentage correct for the four conditions was submitted to a repeated-measures ANOVA with hemisphere (left and right) and notoriety (famous and nonfamous) as factors. The main effect of hemisphere was significant [$F(1, 27) = 33.5$, $p < .05$]. Subjects were better at identifying RVF/LH targets than LVF/RH targets (73% vs 61%). The main effect of notoriety was also significant [$F(1, 27) = 7.1$, $p < .05$]. Famous names were more often correctly categorized than were unknown names (69% vs 65%). The interaction of hemisphere and noun type was not significant [$F(1, 27) = .41$, $p > .05$]. Post hoc studies revealed significant differences for LVF/RH recognition for known vs unknown proper nouns, with more accurate performance on known proper nouns. This finding suggested that personal familiarity with the stimuli led to an enhancement of RH processing for the proper noun stimuli (Fig. 2). To test this notion, a new set of personally familiar proper nouns was obtained from the cohort currently being tested.

EXPERIMENT FIVE: NONFAMOUS PROPER NOUNS AND NEW FAMOUS PROPER NOUNS

Methods

New stimuli were obtained from the larger pool of undergraduates to represent currently familiar items (see Appendix C). Stimuli were elicited in a manner similar to that described for stimuli obtained from the California cohort. One hundred fifty-seven items were obtained from previously and newly elicited famous proper names. These were then rated on two scales, familiarity and emotionality, each with choices from 1 to 7. The mean familiarity rating was 4.25, while the mean emotionality rating was 2.86. Although these ratings were highly correlated [Pearson's $r(156) = .842$, $p < .0001$], a paired two-tailed t test indicated a significant difference between the two ratings [$t(156) = 29.02$, $p < .0001$]. This relationship can be seen graphically on Fig. 3.

The first one hundred items from the rank-ordered familiarity ratings were selected for use as stimuli (see Appendix C and Fig. 3). This new set included, in addition to famous persons, cartoon characters, landmarks, brand names, and geographical locations. Unfamiliar items were selected from the previous

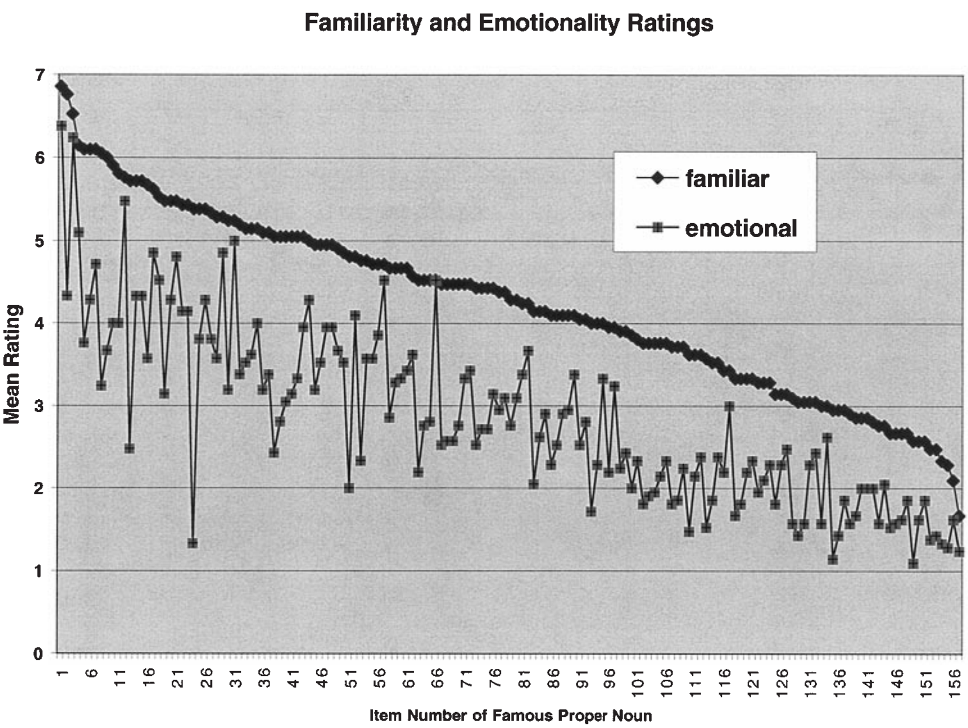

FIG. 3. Rank-ordered familiarity ratings of 157 stimuli shown with matched emotionality ratings.

pool of unknown proper nouns and matched to the new famous items. Instructions to subjects asked them to classify the stimuli as famous or nonfamous. All stimuli were presented horizontally in uppercase letters for 80 ms. Twenty-six new subjects were tested.

Results

Each subject's percentage correct for the four conditions was submitted to a repeated-measures ANOVA with hemisphere (left and right) and notoriety (famous and nonfamous) as factors. The main effect of hemisphere was not significant [$F(1, 25) = .02$, $p > .05$]. The main effect of notoriety, however, was significant [$F(1, 25) = 33.3$, $p < .05$]. Famous nouns were more often correctly categorized than were unknown nouns (68% vs 46%). The interaction of hemisphere and noun type was not significant [$F(1, 27) = 3.05$, $p > .05$]. The planned comparison of hemisphere for famous nouns was not significant [$F(1, 25) = 1.75$, $p > .05$].

A problem with the result from this fifth study is that subjects performed at or below chance on nonfamous stimuli, whether presented to the RVF or LVF. This probably led to the lack of the expected LH advantage. Although the finding of no hemispheric advantage for famous nouns lends partial support to our hypothesis, subjects' inability to identify nonfamous proper nouns at levels greater than chance left us unable to evaluate the asymmetry hypothesis. Therefore, for the final experiment, to enhance performance values, we increased duration exposure for all stimuli.

EXPERIMENT SIX: NONFAMOUS PROPER NOUNS AND NEW FAMOUS PROPER NOUNS (LONGER DURATION)

Methods

We tested 29 new subjects at an exposure duration of 93 ms using the revised set of famous names derived from the Minnesota cohort and the unknown proper names taken from previous studies (see Appendix C).

Results

Submitting each subject's percentage correct for the four conditions to a repeated-measures ANOVA with hemisphere (left and right) and notoriety (famous and nonfamous) as factors resulted in a significant main effect of hemisphere [$F(1, 28) = 10.3$, $p < .05$]. Subjects were better at identifying RVF/LH targets than LVF/RH targets: 66% vs 59%. The main effect of notoriety was again significant [$F(1, 28) = 75.4$, $p < .05$]. The interaction of hemisphere and noun type reached significance in the nondirectional test [$F(1, 28) = 4.04$, $p = .05$]. [Significance level is more obvious given the unidirectional measure ($p < .05$).] Famous nouns were more often correctly categorized than were nonfamous nouns (70% vs 54%). The planned comparison of hemisphere for famous nouns was again not significant [$F(1, 28) = 1.51$, $p > .05$]; however, the nonfamous proper nouns differed significantly by hemisphere [$F(1, 28) = 16.6$, $p < .05$]. The major effect of increasing exposure duration was to improve performance for the nonfamous nouns in the RVF/LH by about 15% (see Fig. 2).

As in Experiment One, the hypothesis we are testing calls for a directional interaction contrast. Here our difference scores reflected the difference between famous and nonfamous proper nouns for each hemisphere. The result was again significant [$t(26) = 2.4$, $p = .03$].

Replication. In order to obtain convergent evidence for the generality of this effect, we conducted a systematic replication of Experiment Six, using a chinrest to insure proper positioning and a stimulus duration of 106 ms. Experiment Six was replicated with 24 students from a neighboring college in Minnesota (Gustavus Adolphus). Percentages correct follow the same pattern:

	LH	RH
Famous	69.6	68.1
Unknown	57.3	48.2

Again, there was a significant main effect of hemisphere [$F(1, 23) = 6.546$, $p < .02$]; a significant main effect of notoriety [$F(1, 23) = 44.387$, $p < .0001$]; and the critical measure, the interaction, was again significant [$F(1, 23) = 4.63$, $p = .042$], supporting the hypothesis of equal processing in both cerebral hemispheres of famous proper nouns.

DISCUSSION

Subjects performed better across all task conditions on famous proper than common nouns. This finding appears at odds with the frequent commentary that access to proper nouns is considered ''more difficult'' than access to common nouns (Valentine, Brennen, & Bredart, 1996, p. 101). It may be that these remarks are directed to the task of productive naming, not recognition; several authors (Burton & Bruce, 1993; Geva, Moscovitch, & Leach, 1997) speak of evidence for a dissociation between explicit and implicit memory for proper names. The higher accuracies on famous proper noun recognition in these studies is not attributable to any perceived greater frequency or familiarity, as proper nouns received consistently lower ratings with respect to either familiarity or frequency.

In all six studies (plus the replication), greater RVF/LH than LVF/RH accuracies were found. In three of the studies, hemispheric differences were greater for common/nonfamous nouns than proper nouns. Experiments One, Five, and Six resulted in significantly better recognition of proper than common or nonfamous nouns in the LVF/RH. In these experiments, subjects were asked to discriminate between matched famous proper nouns and generic common or nonfamous nouns. In contrast, less difference in performance was seen in Experiments Two, Three, and Four, in which subjects discriminated linguistic-semantic features (animate/inanimate and male/female). It is possible that the increase in performance for common but not proper nouns is attributable to the greater compatibility of linguistic-semantic featural analysis in association with common nouns.

We tested this hypothesis with a post hoc comparison of performance in Experiments One and Two. Recall that these experiments presented exactly the same stimuli, but they differed precisely in task demands relating to category versus featural classification. In Experiment One, common and proper nouns were randomly presented and subjects identified ''proper (famous) or common noun.'' In Experiment Two, common nouns and proper nouns were presented in separate blocks, and subjects identified ''animate or inanimate'' and then ''male–female.'' We found a significant interaction of noun type $\times$ experiment [$F(1, 57) = 29.4$, $p < .05$]. There was, as always, a significant main effect of hemisphere in favor of the LH, while the hemisphere $\times$ experiment and the noun type by hemisphere interactions were not significant. The interaction of noun $\times$ hemisphere $\times$ experiment was significant [$F(1, 57) = 10.54$, $p < .01$], indicating that altering task demands (from recognizing featural clues to recognizing categories) significantly affected the results. The performance means are further suggestive of the effect of using linguistic-semantic features in the task demand: The change in task demands increased performance on common nouns, while reducing performance on proper nouns.

	Exp. 1	Exp. 2	% change
Proper nouns (%)	74.1	70.8	−3.3
Common nouns (%)	52.5	64.3	+11.8

This change is also seen when performance in visual field/hemispheres is examined; performance on proper nouns decreases, while performance on common nouns increases in both visual fields.

	Exp. 1	Exp. 2	% change
Proper nouns (%)			
LH	76.1	75.6	−0.5
RH	72.1	65.9	−6.2
Common nouns (%)			
LH	59.2	66.8	+7.4
RH	45.1	61.7	+16.6

We interpret these results to suggest that asking subjects to categorize stimuli into familiar proper nouns versus generic common nouns (Experiment One) was more conducive to performance accuracy on these items than interpolating linguistic-semantic featural properties (Experiment Two).

In Experiment Four (a), which used the first set of famous names combined with unknown names from the telephone book, a significantly greater performance difference between famous and unknown was seen in the reanalysis [Experiment Four (b)]. In the reanalysis, the familiarity ratings were used to isolate the 70 rated as most familiar of the 100 stimuli in the independent survey. Confining the analysis to the famous names rated as most familiar by the subject cohort resulted in a significant difference in LVF/RH performance between generic common and famous proper nouns. Finally, in Experiments Five and Six, addition of famous names most well known to the subject cohort resulted in the highest recognition rates of proper nouns for the RH. Inexplicably, the 80-ms exposure duration in Experiment Five was insufficient for the subjects to perform above chance on recognition of unknown proper nouns, although accuracies for famous proper nouns were high in both visual fields. However, using the same stimuli and increasing the exposure time to 93 ms (Experiment Six), we found results similar to Experiment One. The same results were found in a replication of Experiment Six. In both those experiments, the LH excelled at recognizing common nouns or unknown (nonfamous) proper names, while differences between hemispheric recognition of proper nouns were not significant. In both of these experiments, the instructions focused on categorization into famous versus nonfamous, and the final experiment presented the items the most highly rated for familiarity. It is in these two experiments that maximum separation with respect to the ‘‘personal relevance’’ parameter was represented in the stimulus sets.

Brain Sites for Proper Noun Processing

For *comprehension*, studies of patients with focal LH lesions at various sites (Wapner & Gardner, 1979; Collins, 1991; Goodglass & Wingfield, 1993; Collins, 1991; Van Lancker & Klein, 1990; Van Lancker & Nicklay, 1992; McNeil, Cipolotti, Warrington, 1994; Cipolotti, McNeil, & Warrington, 1993; Yasuda & Ono, 1998) and one study comparing patients with RH or LH damage (Van Lancker, Lanto, Klein, Riege, Hanson, & Metter, 1991) point to an intact RH as source of the preserved comprehension ability. In study of ‘‘lesion overlap’’ in 116 patients with focal lesions, defective visual recognition of persons was associated with maximal overlap in the right temporal region (Tranel, Damasio, & Damasio, 1997). Proper names were not presented in this study, but this finding supports our model of famous name recognition, which proposes that the name forms part of constellation of factors about the famous entity, which may include appearance, voice pattern, biographical facts, gait, affective tone, and so on.

A functional brain imaging (PET) study also tested proper name discrimination (Gorno Tempini, Price, Josephs, Vandenberghe, Cappa, Kapur, & Frackowiak, 1998). Unfortunately, the complex-compound cognitive subtraction methodology is problematic for interpretability of the findings (Sidtis, Strother, Anderson, & Rottenberg, 1999; Sidtis, 1998, 2000; Jennings, McIntosh, Kapur, Tulving, & Houle, 1997; Friston, Price, Fletcher, Moore, Frackowiak, & Dolan, 1996). For example, a contrast of interest (item 8b) involves subtracting brain image patterns for performance on single (one word) proper names from those on object names, and then, from that remainder, subtracting the result of the difference between double object names from object names. From these and several similar computations, the authors conclude that the left temporoparietal junctions, bilateral temporal poles, and posterior cingulate cortex were significantly activated for proper and common names, but that ''activation in the left anterior middle temporal region extended more laterally for famous proper names than for common names'' (p. 2115). This discrimination study has poor concordance with lesion studies, as famous proper name recognition has been preserved in extensive left-hemisphere damage which included the left temporal lobe.

Indirectly related to our comprehension studies are several reports detailing deficient proper noun *production* (personal or proper noun anomia; prosopanomia) associated with cerebral dysfunction. Most prosopanomic patients can produce biographical information about target famous persons (Hanley, Young, & Pearson, 1989, but see exception in Semenza, Zettin, & Borgo, 1998). In many configurations, proper noun anomia is considered another type of category naming disorder, such as the selective inability to name tools, parts of speech, or animals (Goodglass & Wingfield, 1997). Familiar proper noun anomia has been reported in left parieto-occipital (Semenza & Zettin, 1988), left fronto-temporal (Semenza & Zettin, 1989), temporal damage (Reinkemeier, Markowitsch, Rauch, & Kessler, 1977); due to head trauma (Miceli, Daniele, Esposito, & Magarelli, 1998), and left thalamic damage (Lucchelli & De Renzi, 1992; Luccelli, Muggia, & Spinnler, 1997); traumatic brain injury (Milders, 2000; Milders, Deelman, & Berg, 1999), and multiple lesion damage (Carney & Temple, 1993); following surgery for an aneurysm of the internal carotid (Fery, Vincent, & Brédart, 1995) and the posterior cerebral artery (Hanley, 1995); and from a LH degenerative process (Fadda, Turriziani, Carlesimo, Nocentini, & Caltagirone, 1998), a large LH tumor (Hittmair-Delazer, Denes, Semenza, & Mantovani, 1994), and a left temporal lobe tumor (Shallice & Kartsounis, 1993).

In a group study of unilaterally brained-damaged patients, 11% performed poorly in naming famous persons subjects (Damasio, Grabowski, Tranel, Hichwa, & Damasio, 1996). Lesion location using PET imaging focused on the left temporal pole with some involvement of the interotemporal region. ''Maximal overlap'' was seen in the lateral, inferior, and medial aspects of the temporal pole, involving subcortical and cortical extent (p. 501).

In nonsupport of some of these reports, selective *preservation* of proper noun production in left-hemisphere damage, despite anomia for other words, has been reported (Warrington & Clegg, 1993) in one case with left-temporal-lobe damage (McKenna & Warrington, 1978) and another with parieto-occipital damage (Semenza & Sgaramella, 1993). Cipolotti, McNeil, and Warrington (1993) described spared written (but not spoken) naming in association with left fronto-parietal and thalamic damage.

In the survey of residual utterances in severe, chronic aphasia, proper names formed a significant category (Code, 1982, 1989; Blanken & Marini, 1997). Of 75 residual utterances recorded, Code (1989) reported that five were proper nouns and ‘‘all the proper names were relatives of the patient in question’’ (p. 161), i.e., personally relevant names. In a less direct result, a greater proper noun word knowledge was seen in aphasic than in Alzheimer's patients on confrontation naming of famous faces (Beeson, Holland, & Murray, 1997). In the PET studies mentioned above, using naming tasks in nine normal adults, right as well as left temporal poles were activated (Damasio, Grabowski, Tranel, Hichwa, & Damasio, 1996).

The data have not converged unequivocally on an obvious neuroanatomical site in either production or recognition (Semenza, Mondini, & Zettin, 1995). The least consistency is seen for production in that both deficient and preserved proper noun production have been associated with left-temporal-lobe damage and proper noun anomia has resulted from damage in several brain regions. In instances where prosopanomia is associated with LH lesions, proper noun recognition is usually spared, again implying an involvement of the RH in this ability. A role of the RH is consistent from lesion and functional scanning evidence.

Previous information on the properties of RH function is also pertinent to our discussion of the study results. First, studies from many sources, including those using the split-visual-field paradigm, suggest that the RH is ‘‘predisposed for the processing of global aspects of the visual world’’ while the LH is well suited for local aspects (Hellige, 1993, p. 74; see also Hellige, 1983; Bradshaw & Nettleton, 1983; Bogen, 1969a, 1969b; Luh & Wagner, 1997; Delis, Robertson, & Efron, 1986; Martin, 1979). Proper nouns are more likely to be perceived globally—as a whole, unanalyzed unit—in contrast to common nouns, which have a greater possibility of compositionality. Second, RH damage has been associated with neuropsychological agnosias, which often include some defect in the subjective feeling of familiarity. In some cases, patients with RH damage can identify the stimulus in terms of its category (face, voice, handwriting, pet, and topographical point) but they cannot experience its previous familiarity in the sense of personal relevance (see Van Lancker, 1991). Ellis (1994) reviewed neuropsychological literature on instances of Capgras syndrome, the delusion that a familiar person is an imposter; right-hemisphere dysfunction was frequently associated with these disturbances. In their review of 10 patients, Hanley and Kay (1998) found that proper noun anomia correlated with anomia for geographical locations, supporting our notion that personal relevance (involving a range of personally familiar stimuli) accounts for the observations. These clinical conditions suggest that the familiarity sense is a dissociable neuropsychological function.

CONCLUSION

In our results, performance on proper nouns in the RH was associated with task demands and familiarity with the stimuli. When the task was to categorize ‘‘proper (famous) nouns’’ or ‘‘famous names,’’ and when stimuli were analyzed or selected based on familiarity ratings, an increase in RH performance on famous names was observed; when the task was to identify gender or animacy, the effect disappeared (see Table 1). The findings (in these conditions) of no visual field superiority for familiar proper nouns, contrasted with the expected significant RVF/LH superiority for common nouns, suggest that (1) famous proper nouns are represented cerebrally differently from common nouns and unknown proper nouns, (2) the LH is specialized for common nouns and unknown (nonfamous) proper nouns, and (3) both hemispheres process recognition of famous proper nouns. It is further likely that the RH and LH process proper nouns in different ways, with the RH drawing more strongly on the familiarity, affective, and contextual cues that constitute personal relevance.

If personal relevance is operative in proper noun processing, then one's own name must be the most salient of all, and indeed, studies suggest its special status in various kinds of processing: auditory evoked response (Mueller & Kutas, 1996), during sleep (Oswald, Taylor, & Treisman, 1960), dichotic listening (Moray, 1959), when embedded in masking noise (Howarth & Ellis, 1961) or in a stream of distracting nouns (Shapiro, Caldwell, & Sorenson, 1997), and in letter preference studies in adults (Nuttin, 1985, 1987) and children (Treiman & Broderick, 1998). Further, persons in one's own ethnic group, with which there is a strong identification, might elicit higher recognition scores than other-race stimuli. This was found in a study of flashbulb memories (Brown & Kulik, 1977) and in preliminary results on same- and other-race face recognition (Van Lancker, Drake, Pachana, & Sudia, 1997).

The feeling of familiarity accesses affective features which are idiosyncratic and personal. An association of emotions, emotional features, and emotional words with RH hemisphere function has appeared in many research reports (e.g., Mills, 1912; Wechsler, 1973; Bryden & Ley, 1983; Borod, 1993; Semenza, Pasini, Zettin, Tonin, & Portolan, 1986; Cicone, Wapner & Gardner, 1980; Bowers, Bauer, & Heilman, 1993; TenHouten, Hoppe, Bogen, & Walter, 1986; Van Lancker & Breitenstein, 2000). We propose that familiarity and affect are related but separate qualities that inhere in personally relevant phenomena. It can be noted on Fig. 3 that ratings of the famous proper noun stimuli for familiarity and emotionality were significantly correlated, but that many individual items differed considerably in the two ratings. This visual impression is supported by the statistical results. It is likely that these qualities join with cognitive associations to form a rich context for each personally relevant item. The role of contextual features in proper noun processing has been investigated from many points of view (e.g., Seamon & Travis, 1993; for review see Valentine, Brennen, & Brédart, 1996). Our notion is similar to that expressed by Valentine, Moore, and Bredart (1995): In an information processing model, the personally relevant meanings might be said to add weight onto the linkage from person identity to the output lexicon. Our view is also compatible with the ideas of Burgess and Conley (1999) about semantic neighborhoods, which consist of other words related in meaning to the target word; they state that ''neighborhoods for famous PNs (proper nouns) [e.g., Reagan] are quite different'' from lexical neighborhoods for unfamiliar PNs (e.g., John). We concur with their conclusion that ''famous PNs would be easier to remember due to their richer semantic neighborhood'' (p. 70).

One controversy in the philosophical wing of the proper noun literature involves whether the proper name is a meaningless label (Cohen, 1990; Lucchelli & De Renzi, 1992), a unique referring expression (Burton & Bruce, 1992), or a member of the constellation of informational features (Van Lancker, 1991). Given the mention of ''rich semantic neighborhoods'' for famous proper nouns above, we do not consider the proper name to be only a meaningless label. Instead, the RH hypothesis advanced here suggests that the proper name is a member of the set of features which include historical, physical, factual, auditory (voice and typical verbal expression), and any other facts that can be stored, as well as affective valence. That these verbal labels may have a special status in this constellation is suggested by the apparent vulnerability of proper name retrieval in normally functioning adults (e.g., Burton & Bruce, 1992). Although a single report of ability to name famous persons without comprehension of other personal information has appeared (Brennen, Davide, Fluchaire, & Pellat, in press), most studies of proper noun anomia (see Semenza, 1995 for review) report preserved ability to give biographical information about the target person (e.g., Hanley, 1995; Harris & Kay, 1995; Semenza & Zettin, 1989), suggesting that the name may have a special status. Seamon and Travis (1993) demonstrated a decline in name retrieval of known persons with time, replicating original observations by Bahrick, Bahrick, and Ettlinger (1975). The relationship of the name to the biographical information is likely to differ more when the task is naming (name retrieval) than when the task is recognition.

Our study does not contribute to information about proper noun production. The preponderance of literature suggests that areas in the LH mediate explicit familiar proper name retrieval and production, although the precise site is controversial. Generally, very little RH speech production has ever been convincingly documented. However, is it possible that familiar proper names may fall in the category of ''automatic speech'' with counting, expletives, and overlearned expressions, which are believed to be mediated in large part by the RH (Critchley, 1962, 1970; Van Lancker, 1973, 1988, 1990; Code, 1996, 1997; Kinsbourne, 1971; Czopf, 1981; Jackson, 1874, 1876, 1915; Smith, 1966; Graves & Landis, 1985), perhaps in association with the basal ganglia (Van Lancker & Cummings, 1999; Speedie, Brake, Folstein, Bowers, & Heilman, 1990).

Rather than pursuing a unified information processing model to explain storage, retrieval, and recognition of proper names, we propose that a more useful course of study is to consider hemispheric differences in these processes. Production and comprehension processes are likely represented asymmetrically in the hemispheres; further, comprehension of familiar proper nouns may have characteristics that themselves are lateralized in accordance with preferential hemispheric modes. Analogously to respective categorical versus coordinate (Kosslyn, 1987) or linguistic versus contextual organization (Drews, 1987) for lexical items, the proper noun may be a ''meaningless'' label in LH function associated to a referential meaning, while forming a strongly connotative (familiar) member within a cluster of cognitive and affective details in RH processing.

APPENDIX A

Stimuli from Experiments One–Three: Famous Proper and Generic Common Nouns Derived from California Survey Sheets

No.	Item	Category	No.	Item	Category
1	nasal passage	animate	6	carpet cleaner	inanimate
1	Oprah Winfrey	female	6	Jerry Seinfeld	male
1	tennis racket	inanimate	7	elbow joint	animate
1	Ronald Reagan	male	7	Connie Chung	female
2	middle finger	animate	7	compact disk	inanimate
2	Nancy Reagan	female	7	Howard Stern	male
2	baby bottle	inanimate	8	spinal cord	animate
2	Elvis Presley	male	8	Helen Hunt	female
3	upper palate	animate	8	coffee mug	inanimate
3	Leeza Gibbons	female	8	Rodney King	male
3	banjo player	inanimate	9	heart muscle	animate
3	Magic Johnson	male	9	Bette Midler	female
4	cocker spaniel	animate	9	door stopper	inanimate
4	Janet Jackson	female	9	Bill Cosby	male
4	coffee table	inanimate	10	gall bladder	animate
4	Dennis Rodman	male	10	Joan Collins	female
5	bengal tiger	animate	10	oil filter	inanimate
5	Barbara Walters	female	10	Walt Disney	male
5	science fiction	inanimate	11	double chin	animate
5	Michael Jordan	male	11	Sharon Stone	female
6	flower petal	animate	11	steering wheel	inanimate
6	Whoopi Goldberg	female	11	Tiger Woods	male

APPENDIX A—*Continued*

No.	Item	Category	No.	Item	Category
12	killer shark	animate	26	pipe cleaner	inanimate
12	Sally Fields	female	26	Paul Newman	male
12	ballet shoes	inanimate	27	pine needle	animate
12	Jerry Brown	male	27	Jane Austin	female
13	singing bird	animate	27	nail polish	inanimate
13	Shirley Booth	female	27	Kirk Douglas	male
13	butter knife	inanimate	28	vocal cord	animate
13	Jackson Browne	male	28	Sally Ride	female
14	garden snake	animate	28	salad fork	inanimate
14	Marcia Clark	female	28	Larry Bird	male
14	picture frame	inanimate	29	hair follicle	animate
14	Howard Hughes	male	29	Rose Kennedy	female
15	flying fish	animate	29	tape recorder	inanimate
15	Jenny Jones	female	29	Frank Sinatra	male
15	paddle boat	inanimate	30	funny bone	animate
15	Marvin Gaye	male	30	Sharon Tate	female
16	thyroid gland	animate	30	tennis shoe	inanimate
16	Goldie Hawn	female	30	Gerald Ford	male
16	dental floss	inanimate	31	frontal lobe	animate
16	Steven Stills	male	31	Bonnie Raitt	female
17	belly button	animate	31	paddle float	inanimate
17	Sandra Bullock	female	31	Milton Berle	male
17	water bottle	inanimate	32	bottom lip	animate
17	Jimmy Carter	male	32	Sandra Dee	female
18	water lily	animate	32	dollar bill	inanimate
18	Geena Davis	female	32	Richard Gere	male
18	lazy susan	inanimate	33	grizzly bear	animate
18	Sonny Bono	male	33	Tipper Gore	female
19	pine tree	animate	33	baseball card	inanimate
19	Kate Moss	female	33	Stephen King	male
19	desk lamp	inanimate	34	poison oak	animate
19	Brad Pitt	male	34	Doris Day	female
20	blood clot	animate	34	duffel bag	inanimate
20	Glenn Close	female	34	Henry Ford	male
20	front door	inanimate	35	jugular vein	animate
20	George Bush	male	35	Virginia Woolf	female
21	ear lobe	animate	35	digital phone	inanimate
21	Mae West	female	35	Harrison Ford	male
21	gym shoe	inanimate	36	cinnamon roll	animate
21	Bob Hope	male	36	Natalie Wood	female
22	box turtle	animate	36	aerosol spray	inanimate
22	Meg Ryan	female	36	Nicholas Cage	male
22	air filter	inanimate	37	alley cat	animate
22	Jim Carrey	male	37	Rikki Lake	female
23	homo sapiens	animate	37	music box	inanimate
23	Paula Barbieri	female	37	Jerry Rice	male
23	muscle relaxer	inanimate	38	horny toad	animate
23	Pablo Picasso	male	38	Betty Boop	female
24	bald eagle	animate	38	credit card	inanimate
24	Joan Rivers	female	38	Calvin Klein	male
24	book cover	inanimate	39	coral reef	animate
24	Mick Jagger	male	39	Patsy Cline	female
25	blood vessel	animate	39	garden hose	inanimate
25	Grace Kelly	female	39	Ringo Starr	male
25	glass cleaner	inanimate	40	mitral valve	animate
25	Clark Gable	male	40	Vanna White	female
26	belt buckle	animate	40	nasal spray	inanimate
26	Jane Pauley	female	40	Chevy Chase	male

APPENDIX A—*Continued*

No.	Item	Category	No.	Item	Category
41	polar bear	animate	46	vagus nerve	animate
41	Martha Raye	female	46	Rosa Parks	female
41	dining room	inanimate	46	denim pants	inanimate
41	Orson Wells	male	46	Roger Moore	male
42	orange juice	animate	47	canine teeth	animate
42	Minnie Pearl	female	47	Patty Hearst	female
42	alarm clock	inanimate	47	cutting board	inanimate
42	Jessie Helms	male	47	Wesley Snipes	male
43	gastric acid	animate	48	middle ear	animate
43	Kirstie Alley	female	48	Lucille Ball	female
43	toilet paper	inanimate	48	bottle cap	inanimate
43	Spencer Tracy	male	48	Johnny Cash	male
44	left ventricle	animate	49	hearing loss	animate
44	Kim Bassinger	female	49	Roseanne Barr	female
44	air freshener	inanimate	49	fountain pen	inanimate
44	Jack Nicholson	male	49	Sigmund Freud	male
45	ear canal	animate	50	human heart	animate
45	Ann Taylor	female	50	Stevie Nicks	female
45	fax modem	inanimate	50	photo shoot	inanimate
45	Jay Leno	male	50	Donald Trump	male

APPENDIX B
Stimuli from Experiment Four Including Minneapolis Phonebook Unfamiliar Proper Nouns

CA proper names	MN phone book	CA proper names	MN phone book
Jane Austin	Barb Ashby	Elvis Presley	Aaron Garvey
Virginia Woolf	Natalie Singh	Stephen King	Bernard Ross
Ann Taylor	Sue Johnson	Jay Leno	Bill Koho
Minnie Pearl	Kitty Black	Mick Jagger	Bob Daeger
Kate Moss	Joyce Yuen	George Bush	Brent Murr
Rosa Parks	Mary Munz	Larry Bird	Brian Hagg
Doris Day	Susan Lea	Roger Moore	Daniel Naarr
Nancy Reagan	Connie Hagen	Tiger Woods	David White
Paula Barbieri	Carol Zaccardi	Howard Stern	Dennis Royce
Bette Midler	Beth Bartner	Magic Johnson	Dixon Ashton
Patty Hearst	Betty Rourk	Michael Jordan	Donald Dwinnel
Barbara Walters	Kathryn Carlson	Pablo Picasso	Dougie Voegele
Jenny Jones	Linda Falls	Clark Gable	Duane Hadley
Sally Fields	Tammy Garnes	Wesley Snipes	Edward Falck
Janet Jackson	Penny Hackett	Jerry Rice	Elmer Gark
Goldie Hawn	Cathy Leaks	Rodney King	Gilbert Neff
Bonnie Raitt	Stacie Thorp	Jack Nicholson	Glenn Mulligan
Grace Kelly	Marge Wilson	Kirk Douglas	James Bradford
Sharon Tate	Velma Wade	Sigmund Freud	Jeffrey Scheel
Betty Boop	Paula Code	Harrison Ford	Jeremy Ornes
Jane Pauley	Jenn Barney	Jimmy Carter	Jerry Carney
Helen Hunt	Karen Haar	Jim Carrey	Jim Hooker
Lucille Ball	Dianne Zak	Jerry Brown	Jimmy Fearn
Connie Chung	Cindy Nietz	Walt Disney	John Austin
Joan Collins	Jane Kroening	Steven Stills	Joseph Parks
Patsy Cline	Nancy Feest	Richard Gere	Kenneth Haag
Sharon Stone	Sandra Stein	Orson Wells	Kevin Poole
Vanna White	Jenny Nobbe	Sonny Bono	Larry Illes
Mae West	Pam Farl	Henry Ford	Leroy Fahl
Oprah Winfrey	Sarah Stein	Jessie Helms	Lester Jones

APPENDIX B—*Continued*

CA proper names	MN phone book	CA proper names	MN phone book
Sandra Bullock	Myrtle Imsdahl	Milton Berle	Martin Dirks
Kirstie Alley	Betsy Bonar	Dennis Rodman	Michael Engberg
Shirley Booth	Marcia Faires	Paul Newman	Mike Emmons
Glenn Close	Grace Bonde	Jackson Browne	Milton Krough
Roseanne Barr	Irene Opp	Marvin Gaye	Norman Laxe
Martha Raye	Tonya Mohr	Johnny Cash	Norton Zeck
Leeza Gibbons	Sally Engels	Chevy Chase	Peter Orff
Whoopi Goldberg	Rosie Dahlberg	Calvin Klein	Richie Ploog
Rose Kennedy	Joan Robinow	Brad Pitt	Rick Hall
Joan Rivers	Ruth Atkins	Ringo Starr	Robby Paske
Rikki Lake	Heidi Kist	Howard Hughes	Robert Kirsch
Geena Davis	Bonnie Kolar	Jerry Seinfeld	Roger Colberg
Sally Ride	Julie Paar	Bob Hope	Sam Holt
Sandra Dee	Maxine Tan	Frank Sinatra	Steve Narocka
Meg Ryan	Ann Haley	Ronald Reagan	Steven Barrow
Tipper Gore	Peggy Ore	Nicholas Cage	Timothy Rice
Stevie Nicks	Cheryl Platt	Bill Cosby	Tom Larson
Kim Bassinger	Meg Dinneson	Gerald Ford	Walter Kohn
Natalie Wood	Virginia Ward	Donald Trump	Wilfred Young
Marcia Clark	Shirley Patch	Spencer Tracy	William Walker

APPENDIX C

One Hundred Fifty-Seven Newly Solicited Famous Proper Nouns with Familiarity and Emotionality Ratings (Familiarity Ratings Are Rank-Ordered)

Item	Familiar	Emotional
St. Olaf	6.8571	6.3810
Bill Clinton	6.7619	4.3333
Adolf Hitler	6.5238	6.2381
Santa Claus	6.1429	5.0952
Easter Bunny	6.0952	3.7619
Abraham Lincoln	6.0952	4.2857
Bill Cosby	6.0952	4.7143
Holland Hall	6.0476	3.2381
Dairy Queen	6.0000	3.6667
Big Bird	5.9048	4.0000
Carleton College	5.8095	4.0000
Mother Theresa	5.7619	5.4762
Burger King	5.7143	2.4762
Cookie Monster	5.7143	4.3333
Monica Lewinsky	5.7143	4.3333
Charlie Brown	5.6667	3.5714
Twin Cities	5.6190	4.8571
Great Britain	5.5238	4.5238
Elvis Presley	5.4762	3.1429
St. Paul	5.4762	4.2857
Pontius Pilate	5.4762	4.8095
Pacific Ocean	5.4286	4.1429
Walt Disney	5.4286	4.1429
El Paso	5.3810	1.3333
Lake Superior	5.3810	3.8095
Disney Land	5.3810	4.2857
Ole Store	5.3333	3.8095
Donald Duck	5.2857	3.5714
Jesse Ventura	5.2857	4.8571

APPENDIX C—*Continued*

Item	Familiar	Emotional
Bugs Bunny	5.2381	3.1905
Rosa Parks	5.2381	5.0000
Oprah Winfrey	5.1905	3.3810
Drew Barrymore	5.1429	3.5238
Peter Pan	5.1429	3.6190
Chris Farley	5.1429	4.0000
Billy Crystal	5.0952	3.1905
Roseanne Barr	5.0952	3.3810
Best Buy	5.0476	2.4286
George Bush	5.0476	2.8095
Frank Sinatra	5.0476	3.0476
Pizza Hut	5.0476	3.1429
Harrison Ford	5.0476	3.3333
Eiffel Tower	5.0476	3.9524
Steven Spielberg	5.0000	4.2857
Michael Jordan	4.9524	3.1905
Magic Johnson	4.9524	3.5238
Jerry Seinfeld	4.9524	3.9524
Jim Carey	4.9524	3.9524
Sigmund Freud	4.9048	3.6667
Mount Rushmore	4.8571	3.5238
Brad Pitt	4.8095	2.0000
Jerry Springer	4.8095	4.0952
Barbara Walters	4.7619	2.3333
Ronald Reagan	4.7619	3.5714
Jack Nicholson	4.7143	3.5714
Grand Canyon	4.7143	3.8571
New York	4.7143	4.5238
Chevy Chase	4.6667	2.8571
Bill Murray	4.6667	3.2857
Dennis Rodman	4.6667	3.3333
Helen Hunt	4.6667	3.4286
Los Angeles	4.5714	3.6190
Big Ben	4.5238	2.1905
Marilyn Monroe	4.5238	2.7619
David Spade	4.5238	2.8095
Jack Kevorkian	4.5238	4.5238
Clint Eastwood	4.4762	2.5238
Calvin Klein	4.4762	2.5714
Taco Bell	4.4762	2.5714
Cyndi Lauper	4.4762	2.7619
Bob Dylan	4.4762	3.3333
Gwyneth Paltrow	4.4762	3.4286
Sandra Bullock	4.4286	2.5238
Whoopi Goldberg	4.4286	2.7143
Wonder Woman	4.4286	2.7143
Steve Martin	4.4286	3.1429
Jay Leno	4.3810	2.9524
Steven King	4.3810	3.0952
Eddie Murphy	4.2857	2.7619
New England	4.2857	3.0952
Taj Mahal	4.2381	3.3810
Ken Starr	4.2381	3.6667
Costa Rica	4.1429	2.0476
Roger Rabbit	4.1429	2.6190
Black Hill	4.1429	2.9048
Sheryl Crow	4.0952	2.2857
Ellen Degeneris	4.0952	2.5238

APPENDIX C—*Continued*

Item	Familiar	Emotional
Martha Stewart	4.0952	2.9048
Hong Kong	4.0952	2.9524
Marilyn Manson	4.0952	3.3810
Las Vegas	4.0476	2.5238
Woody Allen	4.0476	2.8095
Richard Gere	4.0000	1.7143
Bruce Springsteen	4.0000	2.2857
Yellowstone Park	4.0000	3.3333
North Dakota	3.9524	2.1905
San Francisco	3.9524	3.2381
Wayne Gretzky	3.9048	2.2381
Mad Hatter	3.9048	2.4286
Sharon Stone	3.8571	2.0000
Target Center	3.8095	2.3333
Geena Davis	3.7619	1.8095
King Kong	3.7619	1.9048
Goldie Hawn	3.7619	1.9524
Janet Jackson	3.7619	2.1429
Eau Claire	3.7619	2.3333
Vanna White	3.7143	1.8095
Bob Hope	3.7143	1.8571
Happy Chef	3.7143	2.2381
Ed McMahon	3.6190	1.4762
Willie Nelson	3.6190	2.1429
Sleepy Hollow	3.6190	2.3810
Dick Clark	3.5714	1.5238
Tiger Woods	3.5238	1.8571
King Tut	3.5238	2.3810
Kansas City	3.4286	2.1905
New Zealand	3.4286	3.0000
Wesley Snipes	3.3333	1.6667
St. Cloud	3.3333	1.8095
New Mexico	3.3333	2.1905
Mexico City	3.3333	2.3333
Liza Minelli	3.2857	1.9524
Old Faithful	3.2857	2.0952
John Belushi	3.2857	2.2857
Archie Bunker	3.1429	1.8095
Busch Gardens	3.1429	2.2857
Mount McKinley	3.1429	2.4762
Mickey Rooney	3.0952	1.5714
Buenos Aires	3.0476	1.4286
Panama Canal	3.0476	1.5714
Cape Cod	3.0476	2.2857
Lake Tahoe	3.0476	2.4286
Home Depot	3.0000	1.5714
Tel Aviv	3.0000	2.6190
Rio Grande	2.9524	1.1429
Brooklyn Bridge	2.9524	1.4286
St. Croix	2.9524	1.8571
New Hampshire	2.9048	1.5714
Palm Beach	2.8571	1.6667
San Antonio	2.8571	2.0000
Seven Flags	2.8571	2.0000
Larry King	2.8095	2.0000
Don Johnson	2.7619	1.5714
Iron Range	2.7619	2.0476
Hubert Humphrey	2.6667	1.5238

APPENDIX C—*Continued*

Item	Familiar	Emotional
Golden Valley	2.6667	1.5714
Johnny Cash	2.6667	1.6190
Lake Calhoun	2.6667	1.8571
White Sox	2.5714	1.0952
Tampa Bay	2.5714	1.6190
Grand Rapids	2.5714	1.8571
New Guinea	2.4762	1.3810
Palm Springs	2.4762	1.4286
Grand Forks	2.3333	1.3333
Red Sox	2.2857	1.2857
Red River	2.0952	1.6190
Dodge City	1.6667	1.2381

APPENDIX D
Stimuli from Experiments Five and Six Including Minnesota Phonebook-Generated Famous Names and New Nonfamous Names

Famous Terms	Matches	Famous Terms	Matches
Costa Rica	Rich Area	Martha Stewart	gastric acid
El Paso	La bomba	Michael Jordan	middle finger
Great Britain	great island	Monica Lewinsky	oxygen molecule
Hong Kong	ping pong	Mother Theresa	father donaldo
Lake Superior	high candelabra	Oprah Winfrey	tennis racket
Las Vegas	the clouds	Pontius Pilate	soccer marking
Los Angeles	the cornices	Richard Gere	dollar bill
New England	old crocket	Ronald Reagan	nasal passage
New York	big arch	Rosa Parks	denim pants
North Dakota	south pedestal	Roseanne Barr	hearing loss
Pacific Ocean	wandering stream	Sandra Bullock	water bottle
San Francisco	sand volleyball	Sharon Stone	double chin
St. Paul	in hand	Sigmund Freud	fountain pen
Twin Cities	both speakers	Steve Martin	heart muscle
Big Ben	leg pad	Steven King	baseball card
Black Hills	white rocks	Steven Spielberg	banjo strummer
Carleton College	Higher School	Walt Disney	play button
Disney Land	Jeffrey Rand	Wayne Gretzky	sound module
Eiffel Tower	gothic piller	Whoopi Goldberg	carpet cleaner
Grand Canyon	large chasm	Woody Allen	axle lever
Holland Hall	Denmark Park	Best Buy	last bug
Mount Rushmore	mount bradford	Burger King	Eating Queen
Ole Store	dome bridge	Calvin Klein	credit card
St. Olaf	on time	Dairy Queen	Farmer Maid
Taj Mahal	high control	Pizza Hut	tension rod
Yellowstone Park	hydrolic hose	Taco Bell	local guy
Big Bird	top wire	Santa Claus	triple jump
Bugs Bunny	Fats Runner	Wonder Woman	racing number
Charlie Brown	Robbie Green	Abraham Lincoln	lateral aspect
Cookie Monster	Dinner Wagon	Adolf Hitler	Aaron Garvey
Donald Duck	Seymour Rat	Barbara Walters	science fiction
Easter Bunny	Sunday Critter	Bill Clinton	door stopper
Mad Hatter	sick roofer	Bill Cosby	Bob Ashby
Peter Pan	Richie Day	Bill Murray	Barb Haley
Roger Rabbit	Jamie Badger	Billy Crystal	Elmer Hooker
Magic Johnson	banjo player	Bob Dylan	Jim Kolar
Marilyn Manson	digital cable	Brad Pitt	desk lamp
Marilyn Monroe	jugular lining	Bruce Springsteen	Steve Dahlberg

APPENDIX D—*Continued*

Famous Terms	Matches	Famous Terms	Matches
Cheryl Crow	Tammy Rose	George Bush	front door
Chevy Chase	Lincoln Jones	Gwyneth Paltrow	Kathryn Emman
Chris Farley	Duane Hadley	Harrison Ford	cinnamon roll
Clint Eastwood	Glenn Westman	Helen Hunt	spinal cord
Cyndi Lauper	Bonnie Barney	Jack Kevorkian	Jeff Mulligan
David Spade	Gilbert Neff	Jack Nicholson	air freshener
Dennis Rodman	coffee table	Jay Leno	oil filter
Drew Barrymore	Doug Voegelbar	Jerry Seinfeld	carpet cleaner
Eddie Murphy	Robby Paske	Jerry Springer	middle finger
Ellen Degeneris	Carol Zaccardi	Jesse Ventura	closet freshener
Elvis Presley	baby bottle	Jim Carey	air filter
Frank Sinatra	tape recorder	Ken Starr	ear lobe

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