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# Naming famous people: an examination of tip-of-the-tongue phenomena in aphasia and Alzheimer's disease

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## Abstract

Confrontation naming of famous faces was studied in 33 individuals with aphasia (anomic, Broca's, and conduction) and 27 individuals with mild or moderate Alzheimer's disease (AD). Naming failures were examined for evidence of tip-of-the-tongue (TOT) state by probing semantic and word-form knowledge (initial letter and word shape). Basic semantic information was provided for many of the recognized faces by all subject groups. Conduction and Broca's groups showed strongest evidence of TOT, performing above chance on initial letter identification. There was little evidence of word-form knowledge in anomic and AD groups.

## Introduction

Anomia is a common, pervasive complaint in both aphasia and Alzheimer's disease (AD). However, the nature of the underlying deficits may be quite distinct. Whereas individuals with aphasia often exhibit relatively preserved semantic information for an unretrieved word (Goodglass 1993), individuals with AD may show a degradation of semantic knowledge as well as failed lexical retrieval (Bayles *et al.* 1991, Nebes 1992). The precise nature of the naming impairments in aphasia and AD remains to be elucidated; in fact, the processes of lexical retrieval in neurologically intact individuals are still under consideration as well (Garrett 1992, Levelt 1989, 1992).

One approach to the study of lexical retrieval is the examination of knowledge during instances of anomia; in particular those instances that are accompanied by an awareness of 'closeness' to the target, or 'tip-of-the-tongue' (TOT) state (Brown and McNeill 1966). When in a TOT state, semantic information is available and there is a subjective sensation of knowing the word or name, but the phonological representation is not successfully accessed (Burton and Bruce 1992). Diary and laboratory studies have confirmed that TOT states may be accompanied by accurate but incomplete phonological or word-form information, such as initial letter, number of syllables, or stress location (Brown and McNeil 1966, Koriat and Lieblich 1974). Thus, TOT states appear to reflect a breakdown that occurs relatively late in the lexical retrieval process.

Models of lexical access, such as that of Levelt (1989) or Garrett (1995), suggest

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that TOT states occur when the desired lexical item (the 'lemma') is activated from the mental lexicon, but the phonological encoding of that item is not achieved. Lemma representations are thought to provide semantic and syntactic descriptions of a particular word and provide the linkage or 'address' to the phonological word form. Although the lemma does not contain the phonological representation, it is thought to have some sort of 'lexical pointer' that contains the initial letter and some sense of the word form, such as number of syllables and stress pattern (Levelt 1989). Thus, a TOT state may be conceptualized as a failure of the lexical pointer to address the correct phonological word form. This is the likely locus of TOT in healthy adults, in whom one can assume that the semantic and phonological representations are not disordered, and that articulatory implementation proceeds without impairment. When the neural substrates for language are damaged, however, as in aphasia and AD, retrieval failures may arise from impairments at various stages of speech production. Evidence of TOT states in such populations would confirm that the lemma representation is activated to the extent that the word-meaning and at least partial word-form information are available.

TOT states for common nouns have been reported in individuals with aphasia (Barton 1971, Beeson *et al.* 1995, Goodglass *et al.* 1976). Barton (1971) found that, during anomic instances for common objects, individuals with aphasia were able to retrieve the initial letter and indicate the syllable length for many of the words. Individuals with posterior lesions were slightly more likely than those with anterior lesions to have information about initial letter and number of syllables. Goodglass and colleagues (1976) examined TOT by aphasia type, and found that individuals with conduction or Broca's aphasia were the most likely to have partial word-form information during instances of anomia, a finding recently replicated by Beeson *et al.* (1995). Bruce and Howard (1988) also documented that some individuals with Broca's aphasia have initial letter information during instances of anomia. These findings suggest that anomia for common nouns in conduction and Broca's aphasia often results from a breakdown that occurs late in the lexical retrieval process, following semantic activation and at least some specification of the word form. Individuals with anomic or Wernicke's aphasia, on the other hand, have shown little evidence of word-form knowledge during anomia for common nouns (Goodglass *et al.* 1976).

One would not expect to observe TOT states in advanced dementia because of the deterioration of core semantic knowledge (Chenery *et al.* 1996, Nebes 1992). However, early stages of AD are characterized by anomia that is reminiscent of 'normal' word-retrieval difficulties, in which semantic information is still available, but recall of the word, or name, fails (Chenery *et al.* 1996, LaBarge *et al.* 1992). The exact nature of these lexical access failures is not clear; that is, do they reflect breakdowns that occur early or late in the lexical retrieval process? Probing for TOT states in mild and moderate AD may serve to clarify qualitative aspects of their anomia.

Words that are most vulnerable not only to anomia, but to TOT, are proper names. They tend to be harder to retrieve than common nouns, especially in older adults (Burke *et al.* 1991, Cohen and Faulkner 1986, Maylor 1990). The literature suggests that the representation of proper names is distinct from common nouns (Cohen and Burke 1993, Semenza and Zettin 1989), and that the devoted neural substrates may differ (Damasio *et al.* 1996). Impairment of proper-name retrieval has been documented as part of a more general anomia (Flude *et al.* 1989), and, in

some cases, in the presence of relatively intact common noun retrieval (McKenna and Warrington 1980, Lucchelli and DeRenzi 1992, Semenza and Zettin 1989).

For this study, proper-name retrieval was examined in the context of naming famous faces as a means of eliciting potential TOT states in individuals with aphasia and AD. We probed for the availability of semantic and word-form information during instances of naming failure in order to characterize the nature of the observed naming impairments. Comparisons were made among aphasia types and AD severity, and the examination of individual data was also of interest.

## Method

### *Subjects*

Thirty-three individuals with aphasia and 27 with dementia participated in this study (see Table 1). The individuals with aphasia all had experienced a single, left hemisphere stroke and had no premorbid history of language or memory impairment. All but one subject with aphasia was premorbidly right-handed. They were selected from a larger pool of subjects so that three classic aphasia syndromes were represented: anomic, Broca's and conduction aphasia[1] as determined by the Western Aphasia Battery (WAB; Kertesz 1982). Aphasia severity, measured by the WAB aphasia quotient (WAB AQ), differed among aphasia groups in that the anomic group was less impaired than the Broca's and conduction groups, $F(2, 32) = 17{\cdot}39$, $p < 0{\cdot}001$, Tukey-HSD, $p < 0{\cdot}05$. There were no significant group differences in time post-onset of aphasia, $F(2, 32) = 2{\cdot}82$, $p = 0{\cdot}075$, with subjects ranging from 3 months to 19·7 years post-onset.

The individuals with dementia were diagnosed with probable Alzheimer's disease on the basis of the criteria established by the NINCDS-ADRDA Task Force on Alzheimer's disease (McKhann *et al.* 1984). They had no other significant neurological history that would negatively affect their speech, language, or cognition. They were classified as either mildly or moderately demented on the basis of the Mini Mental Status Examination scores (MMSE; Folstein *et al.* 1975). MMSE scores ranged from 18 to 23 for those with mild dementia and from 8 to 17 for those with moderate dementia.

All subjects were native speakers of English who passed the speech discrimination subtest of the Arizona Battery for Communication Disorders in Dementia (Bayles and Tomoeda 1991) with 80% or better accuracy. They also passed a vision screening test, indicating that they could correctly identify gender and facial features of photographs of faces, and were able to read 18-point font. All subjects had a negative history regarding drug or alcohol abuse, psychiatric illness, and recent clinical depression.

Because our subject groups were fairly representative of their respective populations, it was not surprising that the mean age of the mild and moderate AD groups was significantly older than that of the Broca's and conduction groups, $F(4, 59) = 8{\cdot}60$, $p < 0{\cdot}001$, Tukey-HSD, $p < 0{\cdot}05$. There were no significant group differences with regard to years of education, $F(4, 59) = 2{\cdot}45$, $p = 0{\cdot}057$. All subjects had an estimated premorbid intelligence within normal limits as determined by a regression equation based upon demographic variables (Barona *et*

[1] We were also interested in the performance of individuals with Wernicke's aphasia but did not have enough subjects to constitute a group.

**Table 1. Group characteristics**

| | Aphasia | | | Alzheimer's disease | |
|---|---|---|---|---|---|
| | Anomic ($n = 12$) | Broca's ($n = 11$) | Conduction ($n = 10$) | Mild AD ($n = 15$) | Moderate AD ($n = 12$) |
| *Male : Female* | 8:3 | 8:3 | 7:4 | 5:10 | 8:4 |
| AGE | | | | | |
| *M* | 64·0 | 61·4 | 72·5 | 78·8 | 76·8 |
| SD | 10·5 | 15·3 | 5·5 | 6·0 | 5·7 |
| Range | 40–74 | 36–79 | 64–80 | 67–87 | 67–88 |
| *Education* | | | | | |
| *M* | 14·1 | 14·3 | 14·4 | 13·8 | 11·1 |
| SD | 3·8 | 2·4 | 2·8 | 3·1 | 2·8 |
| Range | 8–20 | 11–18 | 8–18 | 8–19 | 7–16 |
| *Estimated IQ* | | | | | |
| *M* | 114·4 | 116·8 | 119·4 | 113·1 | 106·0 |
| SD | 9·0 | 6·3 | 6·6 | 8·5 | 8·2 |
| Range | 100–124 | 102–125 | 103–125 | 100–125 | 93–123 |
| *WAB Aphasia Quotient* | | | | | |
| *M* | 86·9 | 58·9 | 63·4 | — | — |
| SD | 5·6 | 11·1 | 18·0 | — | — |
| Range | 79·0–92·0 | 40·3–76·6 | 38·4–85·0 | — | — |
| *Time post-onset (years)* | | | | | |
| *M* | 3·0 | 6·3 | 1·9 | — | — |
| SD | 5·5 | 4·8 | 1·6 | — | — |
| Range | 0·17–19·7 | 1·5–15·4 | ·08–5·1 | — | — |
| *MMSE* | | | | | |
| *M* | — | — | — | 19·7 | 13·0 |
| SD | — | — | — | 1·9 | 2·9 |
| Range | — | — | — | 18–23 | 8–17 |

WAB = Western Aphasia Battery; MMSE = Mini Mental Status Exam.

*al.* 1984); however, the moderate AD group had a lower mean IQ than Broca's and conduction groups, $F(4, 59) = 4{\cdot}54$, $p = 0{\cdot}003$, Tukey-HSD, $p < 0{\cdot}05$.

### *Procedure*

Twenty-five black-and-white pictures of famous people were presented for naming. The pictures included 19 men and six women who are relatively well known due to their participation in politics or entertainment. The faces had been named correctly by at least 65% of a group of 23 older adults during pilot testing.

Subjects were asked to name the pictured individual. If they were unable to name correctly the person, the following sequence ensued:

(*a*) 'Do you know this person?' (To establish familiarity)
(*b*) 'Tell me something about him/her.' (Seeking semantic information)
(*c*) 'What letter do you think his/her name starts with?' (Pointing task)
(*d*) 'What shape do you think the name is?' (Pointing task)
(*e*) 'Which is the correct name?' (Pointing task)
(*f*) 'Was that the name you were thinking of?' (Confirmation of TOT)

Famous people who were unfamiliar to the subject were eliminated from further testing because they were not candidates for TOT for that subject (question *a*). Basic identifying information was accepted as correct semantic information (question *b*). For example, 'singer' was accepted for Bing Crosby, but 'dead' was not accepted because it was too general. Items were not eliminated if the semantic information was incorrect or inadequate, because such errors could reflect the language impairment rather than lack of semantic knowledge. To probe for initial letter (question *c*), a card with the alphabet printed in capital letters was presented for a pointing response. First- or last-name initial letter, or both, were accepted. For the name shape recognition (question *d*), three shapes were presented that were created by tracing the first and last names of the target name and two foils (see Appendix for example). This task was designed to probe word-form knowledge without placing heavy demands upon metalinguistic knowledge such as number of syllables, or syllable stress patterns; the shapes simply provided visual information about word length and configuration. The final recognition task (question *e*) was the selection of one of three printed names (the target and two foils, one related by profession and one unrelated). In order to maximize the likelihood of TOT, we considered only those responses for pictured famous people wherein correct recognition was ultimately achieved on a forced choice task (question *e*), and the name was acknowledged as 'the name they were thinking of' (question *f*). This final question was to confirm that the subject was potentially in TOT for the name of the target famous person.

### *Scoring and data analyses*

In order to examine comparative naming ability we first analysed immediate, correct naming of the person. Group performances were also compared for delayed correct naming, including names that were retrieved following circumlocution (e.g. 'Oh, I know that guy, he always had that thing in his mouth and his wife was Gracie, oh yea, George Burns') and correct names that were retrieved during follow-up questions *b* through *d* (i.e. responses that could be considered resolved TOTs).

Additional analyses were limited to those items that were acknowledged as being familiar (question *a*), were correctly recognized (question *e*), and were acknowledged as having been the name of whom the subject was thinking (question *f*). For these items correct semantic information about the person, correct letter selection for first or last name, and correct selection of shape of the name were examined. One-way ANOVAs were performed for each dependent variable, followed by Tukey-HSD *post-hoc* tests when necessary ($\alpha = 0{\cdot}05$).

Pearson correlation coefficients were calculated to examine inter-rater reliability for scoring the naming responses and semantic information, the two measures that required examiner judgement. Responses from 12 subjects selected randomly from the five subject groups were scored by two of the authors, and point-to-point reliability was found to be 96%.

## Results

Figure 1 displays group performances for correct immediate and delayed naming of famous faces. Significant group effects were found for both correct immediate naming, $F(4, 59) = 11{\cdot}70$, $p < 0{\cdot}001$, and correct delayed naming, $F(4, 59) = 3{\cdot}48$,

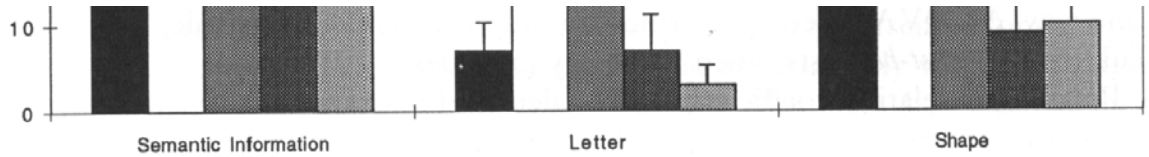


Figure 2. Mean percentage correct provision of semantic information, selection of initial letter for first or last name, and selection of shape of written name for each subject group. Note: percentage correct is based on varying denominators because the number of unnamed items varies across groups and across tasks. Chance for letter selection = 4 %; chance for shape = 25 %.

$p = 0{\cdot}010$. The anomic group named significantly more famous faces than all other groups, and also provided more correct, delayed names than the two AD groups. Correct naming significantly correlated with aphasia severity (WAB AQ), $r = 0{\cdot}76$, $p = 0{\cdot}001$, and with MMSE, $r = 0{\cdot}41$, $p = 0{\cdot}031$. There were no significant correlations between delayed naming and WAB AQ, $r = 0{\cdot}31$, $p = 0{\cdot}082$, or MMSE, $r = 0{\cdot}33$, $p = 0{\cdot}085$.

Figure 2 shows mean group performances for items that were not named correctly, but were candidates for TOT because they were correctly recognized. Significant group differences were found for the provision of correct semantic information. $F(4, 58) = 4{\cdot}33$, $p = 0{\cdot}004$, initial letter identification, $F(4, 57) = 5{\cdot}06$, $p < 0{\cdot}001$, and correct shape, $F(4, 56) = 4{\cdot}52$, $p = 0{\cdot}003$. The anomic group provided correct semantic information significantly more often than the moderate AD group. Provision of correct semantic information was positively correlated with WAB AQ, $r = 0{\cdot}71$, $p < 0{\cdot}001$, and with MMSE, $r = 0{\cdot}45$, $p = 0{\cdot}019$.

Initial letter selection was accepted as correct for either first or last names of the famous faces, but the vast majority of correct responses were for last names. Correct selection of initial letter was significantly above chance for the conduction, $t = -2{\cdot}62$, $p = 0{\cdot}014$, and Broca's groups, $t = -3{\cdot}92$, $p = 0{\cdot}001$ (chance = 1 out of 26 letters = 4%). Group comparisons revealed that the conduction group correctly identified more letters than the anomic and both AD groups; the Broca's group selected the correct initial letter more frequently than the moderate AD group. An examination of individual subject data in Table 2 reveals that seven out of 10 individuals with conduction aphasia, and eight out of 11 individuals with Broca's aphasia selected the correct initial letter at above chance levels. In contrast, only four out of 11 individuals with anomic aphasia, three out of 15 individuals with mild AD, and two out of 12 individuals with moderate AD correctly selected the initial letter at above chance levels. Correct initial letter selection was negatively correlated to WAB AQ, $r = -0{\cdot}50$, $p = 0{\cdot}003$, and was not correlated with mental status, $r = 0{\cdot}24$, $p = 0{\cdot}231$.

Regarding selection of correct shape, none of the mean group performances was significantly above chance level of 33% (one out of three choices) or 25% (one out of four choices, when 'no response' was considered). However, group comparisons indicated that the conduction group selected significantly more correct shapes than the mild and moderate AD groups, and the Broca's group selected significantly more correct shapes than the mild AD group. Individual data in Table 2 show that correct shape selection was above a conservative estimate of chance level (set at 40%) for four conduction, four Broca's, one anomic subject, two of the mild AD subjects and none of the moderate AD subjects. Data from individual subjects revealed that many gave 'no response' to the shapes, so that the mean scores for the AD groups were actually well below chance levels.

In order to examine items potentially in TOT more closely, contingency tables were created (Tables 3–7) that display the correct and incorrect initial letter selection relative to the provision of correct or incorrect semantic information. These data were not analysed statistically due to some of the sample sizes being small ($< 5$), but are presented for their descriptive value. Of particular interest is the comparison of the correct initial letter selection for items that had correct versus incorrect semantic information. Tables 4 and 5 for the Broca's and conduction groups, respectively, show that correct selection of the initial letter did not appear to be dependent upon the provision of correct semantic information. In

**Table 2. Individual subject performance (percentage correct) on naming 25 famous faces and, for those items that were potentially in TOT, percentage correct for provision of semantic information about the person (semantic), selection of correct initial letter for first or last name, and selection of correct shape of the name. Note that the denominator for semantic, letter, and shape varied across subjects as items were named correctly or rejected for not being candidates for TOT because they were not recognized**

| Group | Subject | WAB AQ | Name | Semantic | Letter | Shape |
|---|---|---|---|---|---|---|
| Anomic | 23 | 88·5 | 28% | 53% | 0% | 24% |
| | 27 | 76·0 | 72% | 100% | 0% | 0% |
| | 32 | 81·0 | 40% | 79% | 0% | 36% |
| | 33 | 92·0 | 80% | 100% | 0% | 60% |
| | 35 | 77·0 | 76% | 100% | 0% | 0% |
| | 37 | 88·6 | 44% | 100% | 0% | 0% |
| | 41 | 88·4 | 56% | 100% | 10% | 0% |
| | 48 | 88·8 | 72% | 75% | 33% | 33% |
| | 51 | 90·9 | 48% | 100% | 23% | 9% |
| | 52 | 90·2 | 64% | 88% | 14% | 0% |
| | 53 | 90·3 | 52% | 100% | 0% | 17% |
| | 55 | 90·6 | 84% | 100% | 0% | 0% |
| *M* | | 86·9 | 60% | 91% | 7% | 15% |
| SD | | 5·6 | 18% | 15% | 11% | 20% |
| Broca's | 2 | 58·0 | 24% | 73% | 47% | 60% |
| | 3 | 54·4 | 8% | 76% | 29% | 35% |
| | 5 | 46·0 | 13% | 65% | 55% | 25% |
| | 7 | 60·4 | 36% | 100% | 0% | 58% |
| | 8 | 76·6 | 64% | 100% | 29% | 43% |
| | 9 | 49·0 | 16% | 29% | 6% | 0% |
| | 14 | 68·6 | 20% | 100% | 33% | 19% |
| | 30 | 71·6 | 28% | 83% | 27% | 45% |
| | 31 | 40·3 | 0% | 0% | 38% | 20% |
| | 40 | 63·9 | 16% | 71% | 0% | 35% |
| | 49 | 58·6 | 20% | 75% | 17% | 17% |
| *M* | | 58·9 | 22% | 70% | 25% | 33% |
| SD | | 11·1 | 17% | 31% | 18% | 19% |
| Conduction | 4 | 49·2 | 40 | 43% | 36% | 33% |
| | 6 | 46·5 | 4% | 14% | 45% | 48% |
| | 11 | 45·4 | 4% | 38% | 50% | 50% |
| | 16 | 80·8 | 20% | 47% | 0% | 6% |
| | 19 | 38·4 | 0% | 29% | 17% | 8% |
| | 21 | 82·0 | 40% | 100% | 36% | 67% |
| | 28 | 82·5 | 52% | 100% | 0% | 11% |
| | 34 | 85·0 | 28% | 94% | 0% | 39% |
| | 43 | 63·4 | 40% | 91% | 14% | 14% |
| | 46 | 60·8 | 4% | 87% | 100% | 86% |
| *M* | | 63·4 | 23% | 64% | 30% | 36% |
| SD | | 18·0 | 19% | 33% | 31% | 27% |

| Group | Subject | MMSE | Name | Semantic | Letter | Shape |
|---|---|---|---|---|---|---|
| AD Mild | 29 | 23·0 | 60% | 100% | 0% | 0% |
| | 40 | 23·0 | 0% | 86% | 0% | 14% |
| | 39 | 22·0 | 8% | 71% | 33% | 50% |
| | 30 | 21·0 | 8% | 57% | 0% | 0% |
| | 33 | 21·0 | 32% | 100% | 0% | 0% |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 70 | 21·0 | 64% | 0% | 0% | 0% |
| | 31 | 19·0 | 24% | 90% | 0% | 0% |
| | 37 | 19·0 | 4% | 100% | 50% | 0% |
| | 61 | 19·0 | 12% | 0% | 0% | 0% |
| | 28 | 18·0 | 48% | 100% | 0% | 0% |
| | 32 | 18·0 | 36% | 92% | 0% | 50% |
| | 46 | 18·0 | 32% | 100% | 0% | 0% |
| | 55 | 18·0 | 12% | 92% | 15% | 0% |
| | 66 | 18·0 | 0% | 0% | 0% | 0% |
| | 69 | 18·0 | 12% | 62% | 0% | 0% |
| *M* | | 19·7 | 23% | 75% | 7% | 9% |
| SD | | 1·9 | 21% | 15% | 15% | 15% |
| AD Moderate | 45 | 17·0 | 56% | 86% | 17% | 33% |
| | 68 | 17·0 | 32% | 50% | 0% | 0% |
| | 60 | 16·0 | 8% | 30% | 20% | 0% |
| | 47 | 15·0 | 16% | 100% | 0% | 0% |
| | 67 | 14·0 | 8% | 50% | 0% | 0% |
| | 63 | 13·0 | 0% | 0% | 0% | 0% |
| | 56 | 12·0 | 0% | 60% | 0% | 0% |
| | 62 | 12·0 | 4% | 50% | 0% | 0% |
| | 59 | 11·0 | 12% | 20% | 0% | 40% |
| | 64 | 11·0 | 0% | 18% | 0% | 0% |
| | 49 | 10·0 | 0% | 0% | 0% | 0% |
| | 54 | 08·0 | 4% | 39% | 0% | 35% |
| *M* | | 13·0 | 12% | 42% | 3% | 10% |
| SD | | 2·9 | 17% | 31% | 7% | 17% |

**Table 3. Contingency table for subjects with anomic aphasia ($n$ = 10) indicating correct or incorrect letter selection relative to provision of acceptable semantic information**

| | Incorrect semantic | Correct semantic | Total |
|---|---|---|---|
| Incorrect letter | 14 (100%) | 65 (92%) | 79 (93%) |
| Correct letter | 0 (0%) | 6 (8%) | 6 (7%) |
| Total | 14 | 71 | 85 |

**Table 4. Contingency table for subjects with Broca's aphasia ($n$ = 11) indicating correct or incorrect letter selection relative to provision of acceptable semantic information**

| | Incorrect semantic | Correct semantic | Total |
|---|---|---|---|
| Incorrect letter | 37 (71%) | 80 (76%) | 117 (74%) |
| Correct letter | 15 (29%) | 26 (24%) | 41 (26%) |
| Total | 52 | 106 | 158 |

**Table 5. Contingency table for subjects with conduction aphasia ($n$ = 12) indicating correct or incorrect letter selection relative to provision of acceptable semantic information**

| | Incorrect semantic | Correct semantic | Total |
|---|---|---|---|
| Incorrect letter | 49 (67%) | 65 (64%) | 114 (66%) |
| Correct letter | 24 (33%) | 36 (36%) | 60 (34%) |
| Total | 73 | 101 | 174 |

**Table 6. Contingency table for subjects with mild Alzheimer's disease ($n = 15$) indicating correct or incorrect letter selection relative to provision of acceptable semantic information**

| | Incorrect semantic | Correct semantic | Total |
|---|---|---|---|
| Incorrect letter | 14 (93%) | 62 (94%) | 76 (94%) |
| Correct letter | 1 (7%) | 4 (6%) | 5 (6%) |
| Total | 15 | 66 | 81 |

**Table 7. Contingency table for subjects with moderate Alzheimer's disease ($n = 12$) indicating correct or incorrect letter selection relative to provision of acceptable semantic information**

| | Incorrect semantic | Correct semantic | Total |
|---|---|---|---|
| Incorrect letter | 50 (98%) | 38 (95%) | 88 (97%) |
| Correct letter | 1 (2%) | 2 (5%) | 3 (3%) |
| Total | 51 | 40 | 91 |

other words, there were many instances when aphasic individuals could not verbally communicate semantic information about a given famous face, but were able to indicate the correct initial letter of their name. Tables 3, 6, and 7 show that few correct initial letter selections were made by the anomic and AD groups regardless of whether or not correct semantic information was provided.

## Discussion

The anomic group was clearly superior to the other groups regarding naming ability, a finding consistent with their relatively mild aphasia. However, the Broca's, conduction, and both AD groups did not differ regarding immediate, or delayed, correct naming of famous faces. This relative equality provided a useful baseline from which to examine their possible TOTs. For items correctly recognized, but not named, all groups provided some basic identifying semantic information for at least half of the items, suggesting a fair number of items potentially in TOT.

The most striking finding was the relatively high frequency of correct initial letter selection by conduction and Broca's aphasia groups in contrast to the anomic group and both AD groups. The conduction and Broca's groups were able to select the correct initial letter for the first or last name on 30% and 25% of unnamed famous faces, respectively. Correct initial letter selection was not dependent upon being able to provide correct semantic information about the famous person. This differed from the typical TOT state observed in neurologically intact individuals, who can describe the person that they cannot name; however, the semantic task was dependent upon language abilities, and the ability to provide semantic information was correlated with aphasia severity. So there may have been instances in which semantic information was available, but could not be encoded into speech. Initial letter selection did not require speech production, and thus tapped knowledge that was not related to overall aphasia severity or naming ability.

The group performances on the selection of the word shape of the proper names paralleled the initial letter selection in that the conduction and Broca's groups

performed the best. These findings were not robust, however, and a review of the individual data revealed that some subjects had a very clear sense of the word form (e.g. see Table 2 for Broca's Subject 2 and Conduction Subject 46); other subjects complained that the shape templates were too difficult, and performed below chance levels. In future studies or clinical endeavours we would explore alternative means of communicating word length or shape.

The partial word-form knowledge observed in individuals with conduction or Broca's aphasia may be similar to the TOT state observed in neurologically intact individuals, or it may reflect failure at even later stages of the lexical retrieval process that involve the phonological and phonetic representations of words (Butterworth 1992). The spoken output in conduction aphasia is frequently marred by phonemic paraphasias, even though articulatory agility is good. The *conduite d'approche* phenomenon, or sequential phonemic approximation, suggests that at times individuals with conduction aphasia have the correct phonological representation available against which to compare their production; but there appears to be a failure to assemble the phonology to activate the proper articulatory plan (Buckingham 1992, Kohn 1989). Individual sound production is typically unimpaired in individuals with conduction aphasia, so the breakdown is likely to occur prior to motor planning.

In contrast, individuals with Broca's aphasia frequently have difficulty implementing the correct motor plan for speech. Thus some of their TOT states may reflect a breakdown in the final stages of speech production. However, if TOT in Broca's aphasia reflected only an impairment with articulatory implementation, then they should have had an even higher percentage of correct initial letter selection. It seems most likely that the anomia observed in Broca's aphasia, as well as conduction aphasia, reflects not only late-stage disturbances of lexical retrieval as shown by the TOT states, but also instances of failed lemma retrieval. For example, the semantic paraphasias produced by several of our subjects may be considered failures of lemma access (Garrett 1984, 1992).

The anomic aphasia group provided semantic information for 91% of the unrecalled names, but rarely had initial letter or shape information. The lack of word-form knowledge by the individuals with anomic aphasia was consistent with the findings of Goodglass *et al.* (1976). Garrett (1984) suggested that anomic aphasics may have lost the linking address from the lemma to the word form. In that case they might have semantic and syntactic knowledge about the word, but not the word-form knowledge necessary to access the target correctly. This was despite the fact that their overall naming ability was less impaired than the other groups. Thus, it appeared that access to phonology was more of an all-or-none phenomenon with the anomic group, as opposed to the groups with conduction or Broca's aphasia.

The individuals with AD rarely evidenced word-form knowledge during anomia. However, the mild AD patients provided semantic information for about 75% of the unnamed faces. Although the quality of the semantic information provided by the mild AD patients was not rich, it provided evidence of some available, appropriate information about the person in question. The profile of those with mild AD was most similar to that of anomic aphasia, and may suggest a breakdown within the lemma representation or the lexical pointer; that is, at an earlier stage in the lexical retrieval process than that observed during TOT. In the moderate AD group much less semantic information was provided for unnamed

faces (42%), suggesting that semantic specification may have been inadequate to activate phonology in many instances. This would be consistent with anomia associated with an ensuing deterioration of semantic memory (Bayles and Kaszniak 1987).

These findings with proper nouns were consistent with the marked superiority of conduction and Broca's groups in selecting correct initial letter for common nouns (Bruce and Howard 1988, Goodglass *et al.* 1976). Even though the retrieval of proper nouns may be more difficult than common nouns, the breakdown in the lexical retrieval process did not appear to differ. This consistency may reflect an impairment in phonological and articulatory processes which would be common regardless of common-noun versus proper-noun retrieval, as opposed to failure at the lemma level which may be the underlying deficit in the case of relatively selective proper-name deficits (Lucchelli and DeRenzi 1992, Semenza and Zettin 1989).

Although this report emphasized group trends, and in fact group differences by aphasia type are consistent with those of other researchers (Goodglass *et al.* 1976), individual subject data emphasized that not all individuals within a diagnostic group conformed to a similar pattern. For example, in the conduction group, as shown in Table 2, Subject 46 selected 100% of initial letters correctly, but Subject 34 did not select any correctly. Clinically, it would be useful to discern a given patient's word-form knowledge during instances of anomia. In some patients, partial word-form information can be used to self-cue the target word (Bruce and Howard 1988, Nickels 1992). Identification of the initial letter can also help to repair communication breakdown, by giving the listener a clue. These findings have prompted us to take a more active approach to discerning whether our aphasic patients have partial lexical knowledge during instances of name-retrieval failure, and to encourage the use of compensatory strategies such as initial letter identification for certain aphasic individuals.

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## Appendix

Example of the shape templates that were created by tracing around the outline of the printed names on the right.

Mark Twain

Bob Hope

George Burns