

Noun and verb comprehension and production in bilingual individuals with anomic aphasia

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Abstract

This paper investigates noun and verb comprehension and production in two groups of late bilingual Greek (L1)/English (L2) speakers: individuals with anomic aphasia, and a control group of non-brain injured individuals matched for age and gender. There were no significant differences in verb or noun comprehension between the two groups in either language. However, verb and noun production in a picture naming task was significantly worse in the bilingual individuals with anomic aphasia in both languages than in the control group. Anomic aphasic individuals also showed genuine verb impairments in both Greek and English. Moreover, even though residual second language proficiency was overall poorer than first language proficiency, this did not have a significant impact on the findings. Overall, the findings support the uni-directional hypothesis that verbs are more difficult to retrieve than nouns because their linguistic structure is inherently more complex than that of nouns. The potential underlying level of breakdown of the specific verb impairment is discussed in relation to the serial model of word processing.

Keywords: anomic aphasia, bilingualism, verb/noun comprehension and production, uni-directional hypothesis, serial model of word processing

1. Introduction

There are many studies showing dissociations in noun and verb processing in aphasic individuals across a number of different languages. Some studies suggest a double dissociation between noun or verb impairments and type of aphasia, linking specific verb impairments to Broca's aphasia and noun impairments to anomic aphasia (see Druks 2002). Other studies show that the verb-noun dissociation may not be confined to Broca's aphasia, as verb retrieval was also more impaired than noun retrieval in anomic individuals (Bastiaanse 1991; Breedin & Martin 1996; Jonkers & Bastiaanse 1996; Berndt et al. 1997; Bastiaanse & Jonkers 1998). However, anomic individuals have also been found to have similar difficulties retrieving nouns and verbs (Luzatti et al. 2002). Following on from Levelt's serial model of language production (Levelt et al. 1999), such dissociation may arise from a potential breakdown during one of three relatively distinct stages:

1. Concept formation.
2. Lexical selection including lemma retrieval.
3. Word formation or morpho-phonological processing.

An activated concept spreads some of its activation to the corresponding lemma which is selected when its activation level equals or exceeds the ratio of its activation to the sum activation of all (competing) lemmas. The syntactic or grammatical information of

the lemma becomes available upon its selection and activation. Noun lemmas contain information about grammatical properties like their syntactic category (e.g. +noun), gender and number, whereas verb lemmas contain information about syntactic category (e.g. +verb), person, tense and mood. Also note that syntactic category (noun, verb, adjective, etc.) is a property only at the lemma level (Levelt et al. 1999).

Lemma retrieval is always part of word production, independent of the syntactic context or the task. Only selected lemmas will become activated during morpho-phonological encoding. Semantic substitutions are considered to result from spreading activation within the conceptual network that in turn leads to a failure in lemma selection or the activation of two lemmas at the same time which may explain the syntactic constraint of substitution errors in normal speakers, that is, substitution errors within the same syntactic category (Levelt et al. 1999). Furthermore, lexical selection and lemma activation must be language specific because of the language-specific nature of the grammatical information contained in lemmas. Language specificity must also be preserved further down in the model because of language-specific morphological and phonological rule systems of different languages.

Research into bilingual word processing has been greatly influenced by the Revised Hierarchical Model (RHM) (Kroll & Stewart 1994), which incorporated the dominant view that (abstract) word forms of the two (or more) languages are stored in separate lexicons that are connected with one common storage at the conceptual (semantic) level (Kroll & De Groot 1997). Stronger links from the second language (L2) to the first language (L1) than from L1 to L2 are assumed in the RHM, as well as a stronger connection between concept information and L1.

A combination of the serial model (Levelt et al. 1999) and the RHM (Kroll & Stewart 1994) would suggest that a bilingual model for word retrieval and production is based on a number of assumptions: (1) the first stages of the model, conceptual preparation and accessing the lexical concept are non-language specific; (2) the other stages, lexical selection or lemma activation and morphological, phonological - and phonetic - encoding, are language specific; (3) L1 is more conceptually mediated than L2, which is represented by the stronger link between lexical concept and L1 lexical selection; and (4) asymmetric translation effects with faster L2-L1 translation are represented by the stronger link from L2 to L1 than from L1 to L2.

Bilingual aphasia provides an important avenue to investigate whether any dissociation between noun and verb processing is language specific or whether such dissociation is the result of universal, linguistic differences. Overall, there have been few studies comparing noun and verb processing in bilingual individuals with aphasia (Kremin & De Agostini 1995; Sasanuma & Park 1995).

In this paper, we have investigated noun and verb comprehension and production in Greek-English speaking, bilingual individuals with anomia. Greek-English bilingual aphasia is of particular interest because of the linguistic differences between the two languages. Like English, Greek is a stem-based language, but with a more complex morphology than English (Holton et al. 1997). First, morpho-phonological word forms are inflected according to *grammatical category*, for instance 'skoup-izi' is a verb ['he/she sweeps'] and 'skoup-a' is a noun ['broom']. Thus, nouns and verbs are differentiated by different suffixes. Each stem in Greek is bound, and only projected at the phonological word level after the correct inflectional suffix is attached to the stem at the morphological level (Kehayia 1990). Nouns in Greek also inflect for gender at the morpho-phonological level and are marked for masculine, feminine and neuter gender. Overall, grammatical information plays a crucial role in Greek in the selection and

retrieval of the appropriate phonological representation or ‘lexeme’ via language-specific processes operating during morphophonological encoding.

The main aim of this study is to investigate whether a verb-noun dissociation is specific to anomic aphasic subjects’ native (Greek/L1) or second language (English/L2).

2. Method

2.1 Subjects

Twelve Greek-English speaking, bilingual individuals with fluent, anomic aphasia participated in the study. The age of the participants was within the range of 65-85 years. There were eight males and four females. Residual proficiency in the native language (L1) was better than in the second language (L2) as measured on the Greek and English version of the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass & Kaplan 1983; Tsolaki 1997).

Table 1. Mean performance of the bilingual aphasic group on the Greek and English versions of the BDAE

| | <i>Aphasic Greek (L1)</i> | <i>Group English (L2)</i> |
|----------------------------------------|-----------------------------------|-----------------------------------|
| BDAE ratings | | |
| Severity | 4-5 | 3-4 |
| Melody | 6.3 | 5.8 |
| Phrase length | 6.4 | 5.4 |
| Articulatory agility | 6.3 | 6.2 |
| Grammatical form | 6.2 | 5.1 |
| Repetition | 8.0 | 8.0 |
| Paraphasias | 6.3 | 5.7 |
| Word finding | 3.0 | 2.7 |
| Auditory comprehension (percentile) | 65.7 | 48.1 |
| BDAE subtests | | |
| Word discrimination | | |
| Body parts | 65.3 | 60.3 |
| Commands | 15.3 | 12.3 |
| Complex ideation | 12.3 | 8.6 |
| Responsive naming | 5.9 | 3.4 |
| Confrontation naming | 23.7 | 20.6 |
| Animal naming | 89.9 | 78.9 |
| | 7.8 | 5.6 |

However, all participants were (premorbidly) fluent speakers of Greek and English, in that they had conversational command of both languages according to self-reports. For the individuals with aphasia, this was confirmed by family members. Table 2 presents detailed information about the participants:

Table 2. Individual subject data

| <i>Subject</i> | <i>Gender</i> | <i>D.O.B</i> | <i>Lesion</i> | <i>Aphasia Type</i> | <i>Y.P.O</i> | <i>Education (years)</i> | <i>Exposure to English (years)</i> |
|----------------|---------------|--------------|----------------------------------------------------------|---------------------|--------------|--------------------------|------------------------------------|
| BA 1 | M | 1928 | L. CVA | Anomic | 7 | 3 | 52 |
| BA 2 | M | 1918 | L cerebral infarct | Anomic | 5 | 2 | 53 |
| BA 3 | F | 1936 | *L fronto-parietal CVA | Anomic | 1 | 1 | 44 |
| BA 4 | M | 1943 | L parietal CVA | Anomic | 2 | 8 | 46 |
| BA 5 | F | 1933 | L internal capsule infarct | Anomic | 5 | 5 | 46 |
| BA 6 | M | 1934 | *L thalamus and posterior limb of the internal capsule | Anomic | 2 | 11 | 41 |
| BA 7 | M | 1939 | L. basal ganglia involving thalamus and external capsule | Anomic | 3 | 6 | 47 |
| BA 8 | M | 1928 | L. basal ganglia | Anomic | 5 | 3 | 49 |
| BA 9 | M | 1930 | *L. thalamic-internal capsule infarct | Anomic | 2 | 6 | 40 |
| BA 10 | F | 1929 | L. external capsule | Anomic | 1 | 6 | 45 |
| BA 11 | F | 1932 | L. MCA CVA involving parietal lobe | Anomic | 2 | 2 | 39 |
| BA 12 | M | 1930 | L. CVA | Anomic | 5 | 5 | 47 |

Key: BA = bilingual aphasia (Note: all subjects in this Table were born in Greece and their school education took place in Greece only.); M = male; F = female; D.O.B. = date of birth; Y.P.O = years post onset; CVA = cerebral vascular accident; L. = left; MCA = middle cerebral artery

All subjects' lesion sites were diagnosed using CT except those marked with an *, who were diagnosed using MRI scans.

2.2 Materials

The Greek Object and Action Test (GOAT) was designed to assess verb and noun access and retrieval in bilingual aphasic speakers. The GOAT was previously piloted in a group of twenty non-brain injured, bilingual Greek-English speakers aged between 55 to 75 years. Items that were named with 80% accuracy or more were included in the

test. Both the noun and verb subtests contained 55 items each. Stimuli were concrete nouns and verbs depicted on photographs showing the object or the action. The same sets of target items were included in tests for noun/verb comprehension and noun/verb production. The results of four subtests of the GOAT are reported in this study: object/noun comprehension, action/verb comprehension, object/noun naming, and action/verb naming. There were no significant differences between the mean word frequencies for nouns (mean = 89.31 per million) and verbs (mean = 69.95 per million) across all subtests of the GOAT (Kucera & Francis 1970). None of the Greek words in the test are English cognate words.

2.3 Procedure

The order of language (Greek or English) and task (comprehension or production) was counterbalanced across the participants. There was at least one week in between the assessment of each of the two languages.

Comprehension: Subjects were asked to point to the correct photograph from a set comprising the target object or action and the two semantic distractors for each target object or action. Each subject was asked to point to the picture of the object or action matching the spoken word heard. Two examples in the target language were provided before testing.

Word production: Subjects were asked to name the object or action depicted on the photograph in the target language. Two examples in the target language were provided before testing.

3. Results

Overall accuracy of noun and verb comprehension and production was analysed using a repeated measures ANOVA with Language (Greek versus English) and Condition (verbs vs nouns) as within subject variables.

As expected, overall comprehension of objects and actions was relatively intact in the bilingual individuals with anomic aphasia. As can be seen in Figure 1, mean accuracy scores for confrontation naming were respectively: L1V% = 62.7 (\pm 25.3); L1N% = 67.3 (\pm 23.4); L2V% = 46.4 (\pm 16.7); L2N% = 58.1 (\pm 16.6). There were significant differences for Language [$F(1, 11) = 7.71, p < .05$] and Condition ($F(1, 11) = 21.81, p < .001$), but the interaction between Language and Condition was not significant ($F(1, 11) = 3.56, ns$). Poorer L2 than L1 proficiency is often found in bilingual aphasia (Fabbro 1999) and was observed in each of the Greek-English speaking anomic patients who participated in the current study.

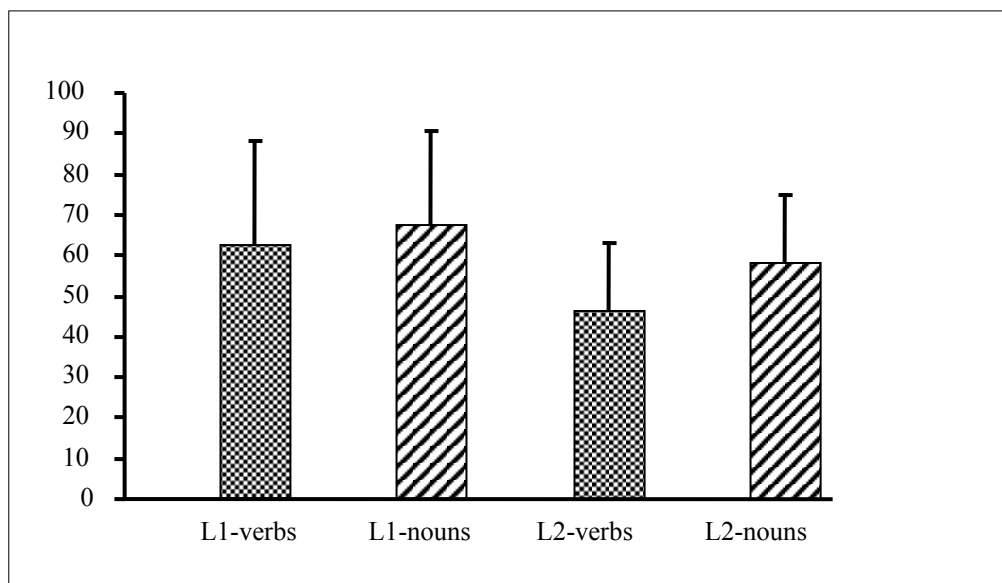


Figure 1. Mean percentages and standard deviations for object/noun naming and action/verb naming in L1 and L2 in the aphasic individuals

4. Discussion

The prevailing view of anomic aphasia is that anomic individuals have difficulties in retrieving the phonological form (the ‘lexeme’) of the target word (Goodglass 1993), namely, their difficulty arises at the morphophonological level. As discussed previously, the syntactic information of the target word is also important during the activation of its morphological representation. This is especially evident in Greek as words are inflected according to their grammatical category. In this manner, grammatical information also plays a crucial role in the selection and retrieval of the appropriate word form or ‘lexeme’ via language-specific processes during morphophonological encoding. Edwards (2002:249-50) recently defined the breakdown in fluent (Wernicke’s) aphasia as occurring “in accessing lexical items, which in turn arise from either semantically based problems or from problems in phonological representation”. Bachoud-Lévi & Dupoux (2003) found that semantic and syntactic features may influence phonological processes, such as retrieving the phonological representation of the target word.

Given the relatively small number of suffixation-errors and omissions made by the bilingual anomic patients in Greek (and English), it is unlikely that their specific verb-impairment in the anomic individuals arises at the level of morphological processing. Besides, the morphological processes underlying Greek verb and noun production seem to have the same degree of processing difficulty, namely retrieve and combine [root+suffix].

The anomic individuals made also very few phonological errors, which does not seem to support the assumption of specific phonological processing difficulty. However, it is possible that *access* to the morphophonological representation of the target words is affected in (bilingual) anomic aphasia, leaving the actual morphophonological representations themselves intact (Bastiaanse & Jonkers 1998; Jonkers 1998; Tsapkini et al. 2002). The specific verb impairment observed in both languages could then support the assumption of two separate storage mechanisms for lexemes according to

their grammatical category (Miceli et al. 1984; Williams & Canter 1987; Caramazza & Hillis 1991) or, alternatively, that semantic and syntactic information influence morpho-phonological processing (Edwards 2002; Bachoud-Lévi & Dupoux 2003).

An additional finding supporting the assumption that verb impairment might result from difficulty accessing the morphophonological representation of the target words is the word length effect that might have had an influence on the results. Inevitably, the Greek verbs used in the study were on average one phoneme longer than the Greek nouns, and all subjects used frequently the *-ing* form when responding to the action pictures in English. Consequently, the English responses to action pictures were also longer than the responses to the objects.

5. Conclusion

Overall, verbs were more difficult to produce than nouns during confrontation naming in either language spoken by the Greek-English anomic aphasic participants. These findings support the growing body of evidence showing specific verb impairments in anomic individuals as well as Broca's patients. Given that anomic patients experience difficulty retrieving the morphophonological form of the target word, the results of the present study have showed that specific information of the grammatical category is also important during word form retrieval.

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