

# Factors affecting the production of verb inflections in Greek aphasia

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## Introduction

Verb inflection errors are commonly observed in the speech of aphasic individuals, but the errors are selective and not evenly distributed across different functional categories (e.g., Friedman & Grodzinsky, 1997). An investigation of verb inflection errors in seven Greek aphasic individuals showed more errors in aspect and tense than in agreement (Varlokosta et al., 2006). Moreover, the productions revealed a large proportion of repetition and lexical errors in addition to pure inflectional errors.

The presence of different types of errors raises the question of the nature of the underlying deficit in the production of the functional categories. An erroneous production of a verb may involve an error in morphological suffixation, preserving the verb stem; an error in lexical selection, preserving the inflection; and a mixed error, involving both the morphological suffixation and the verb stem. Because all verbs in Greek are affixed, a bare stem is not a possibility as it would result in an illegal word. According to Levelt's (1999) model of word production, morphological suffixation errors indicate a breakdown at the level of diacritical (lexical–semantic) features, whereas lexical and mixed lexical–morphological errors reflect additional difficulty in lexical selection. Repetition errors involve the least amount of computation and thus may indicate a difficulty in affixation during phonological encoding.

To address the above question, we re-examined the productions of the Greek speaking aphasic individuals studied by Varlokosta et al. (2006) by re-classifying the errors as morphological, lexical, or mixed. A second aim was to examine the contributions of severity of spoken language impairment, verb familiarity, regularity, and presence of consonant cluster to the performance per functional category.

## Materials and methods

The errors of seven aphasic individuals performing a sentence completion task were categorized into errors in morphological suffixation, word form errors, and mixed errors. The sentences were constructed to test subject–verb agreement, tense, and aspect, using eight verbs balanced for

familiarity, regularity (in aspectual formation), and presence of consonant cluster in the stem. Errors in morphological suffixation involved the correct production of the verb with an erroneous inflection. Errors in word form involved the correct production of the inflection but in an incorrect verb or a non-word. Mixed errors involved both morphological suffixation and word form errors. An independent severity index of spoken language was computed from the speech samples elicited from two picture description tasks, following the procedures described in Faroqi-Shah and Thompson (2004).

## Results

The aphasic participants made more morphological suffixation errors than either word form or mixed errors (Table 1). The same pattern of errors was observed within each functional category.

Half or more of the morphological suffixation errors in each functional category were repetitions of the base forms of the verbs. The remaining errors were predominantly morphological substitution errors. The morphological substitution errors in agreement revealed a preference for the 3rd.singular, which formed about half of the substitution errors (8/15). The morphological substitution errors in aspect revealed a preference for the imperfective form, evidenced by 21 substitutions of the perfective for the imperfective form versus 7 substitutions of the imperfective for the perfective form. The preference for the imperfective aspect could not be attributed to difficulty in computing the perfective form for the irregular verbs: a breakdown of the morphological errors in aspect by verb regularity did not reveal any consistent pattern, indicating that the participants were avoiding the perfective aspect irrespective of regularity. Tense substitution errors were too few to reveal any pattern. However, of the 29 substitution errors in aspect, 25 also involved errors in tense. Interestingly, an additional 27 of the productions in the sentences testing for aspect involved tense errors with no errors in aspect.

A one-way ANOVA showed no significant effect of consonant cluster in the total number of errors in agreement [ $F(1, 54) = 0.26$ , ns], tense [ $F(1, 54) = 0.02$ , ns], or aspect [ $F(1, 54) = 0.00$ , ns]. Multiple regression analyses per functional category with patient severity, familiarity and regularity as predictors and total number of errors as outcome showed that severity accounted for the largest proportion of the variance in agreement ( $R^2 = 0.35$ ), with familiarity and regularity contributing only small addi-

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Table 1  
Distribution of error types per functional category

Error type	Agreement (%)	Tense (%)	Aspect (%)	Total (%)
Morphological	37 (72.5)	37 (86)	61 (63)	135 (71)
Repetition	17	30	32	
Substitution	15	7	29 <sup>a</sup>	
Other	5	0	0	
Lexical	11 (21.5)	1 (2)	18 (19)	30 (16)
Mixed	3 (6)	5 (12)	17 (18)	25 (13)
Total/No. productions	51/224 (23)	43/112 (38)	96/224 (43)	190 (100)
Tense			27 (12) <sup>b</sup>	

<sup>a</sup> Of which 25 were also tense errors and 1 was also an agreement error.

<sup>b</sup> Counted as correct for aspect.

tional amounts of variance ( $R^2$  change = 0.12 and 0.04, respectively). Severity was the only variable accounting for the variance in tense ( $R^2 = 0.66$ ) and aspect ( $R^2 = 0.66$ ).

### Discussion

The predominance of morphological suffixation errors over either lexical or mixed errors, together with the selective nature of the inflectional errors indicate a breakdown at the level of selection of diacritical features. The high proportion of repetition errors and the use of the unmarked forms (3rd.singular, imperfective aspect) (Philippaki-Warburton, 1973) may indicate difficulty in affixation. Lexical and mixed errors likely reflect additional difficulty in lexical selection; these errors are notable given the constraints of a sentence completion task where the verb is provided. Severity accounted for most of the variance in performance across all functional categories. Lack of an effect of regularity in aspectual formation may be attributed to the fact that in Greek both regular and irregular verbs are affixed, which presumably leads to the same amount of phonological burden. The high proportion of dual aspect-tense errors in the sentences testing for aspect, together with the large number of tense-only errors in the same sentences, indicates that in Greek, the computation of tense and aspect are closely interrelated.

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### References

- Faroqi-Shah, Y., & Thompson, C. (2004). Semantic, lexical, and phonological influences on the production of verb inflections in agrammatic aphasia. *Brain & Language*, 89, 484–498.
- Friedman, N., & Grodzinsky, Y. (1997). Tense and agreement in agrammatic production. Pruning the syntactic tree. *Brain & Language*, 56, 71–90.
- Levelt, W. J. M. (1999). Models of word production. *Trends in Cognitive Sciences*, 3, 223–232.
- Philippaki-Warburton, I. (1973). Modern Greek verb conjugation: Inflectional morphology in a transformational grammar. *Lingua*, 32, 193–226.
- Varlokosta, S., Valeonti, N., Kakavoulia, M., Lazaridou, M., Economou, A., & Protopoulos, A. (2006). The breakdown of functional categories in Greek aphasia: Evidence from agreement, tense, and aspect. *Aphasiology*, 20(8), 723–743.