

## Patterns of morphological breakdown in English agrammatic aphasia

### Introduction

Individuals with agrammatism show selective deficits with respect to functional categories. Several accounts have been proposed to accommodate these patterns, without yielding a unified one (e.g. Arabatzi & Edwards, 2002; Bastiaanse & Thompson, 2003; Lee, 2003; Friedman & Grodzinsky, 1997, Thompson, Fix & Gitelman, 2002).

The Tree Pruning Hypothesis (TPH; Friedmann & Grodzinsky, 1997) explains the agrammatic errors based on the syntactic tree (proposed by Pollock, 1989), attributing the selective patterns of dissociation to an inability to project higher nodes in the tree. The TPH, thus, predicts (a) that the Complementizer Phrase (CP) is more difficult to project than the Inflectional Phrase (IP) and (b) that, within IP, the Tense Phrase (TP) is more difficult to project than the Agreement Phrase (AgrP). This hypothesis has been proposed by data from Hebrew, Arabic, and English-speaking aphasic patients (e.g. Friedmann & Grodzinsky, 1997; Friedman, 2002).

In contrast, others attribute functional category deficits to a morphological impairment. Arabatzi & Edwards (2000; 2002) described eight English agrammatic speakers who showed frequent omissions and substitutions of inflectional morphology, indicating that patients were often able to access IP elements but had impaired feature checking. In a case study of a neurologically impaired individual, Thompson et al. (2002) reported that their patient showed intact complex sentence structures, demonstrating projection to CP, but had difficulty with bound morphology within IP (e.g. tense, agreement and aspect).

This study examines the production of complementizers, tense, and agreement morphology in English-speaking agrammatic patients within the framework of the TPH.

### Methods

#### Participants

Four male individuals with agrammatic aphasia participated in this study, FG, LC, KB and SL. All were pre-morbidly right-handed (except for SL), native English speakers, had documented evidence of left hemisphere stroke, and were at least two years post onset. Participants were between 35-64 years old, and had between 16-18 years of education. All had normal hearing and vision. The diagnosis of agrammatic aphasia was based on Western Aphasia Battery (AQ 64.5-82.4, Kertesz, 1982), performance on the Northwestern Assessment of Verbs and Sentences (Thompson, unpublished) and spontaneous speech production patterns.

### Experiment 1

#### Procedure

Production of complementizers (*if*, *whether*, or *that*), tense (-*ed*) and agreement (-*s*) was examined, using a structured sentence elicitation task. For the Complementizer condition, picture pairs depicting a matrix and an embedded clause were used to elicit target sentences. Participants were asked to produce a sentence putting the two pictures together, e.g. *They wonder if (whether) the man is calling the woman*. For tense (-*ed*) and agreement (-*s*) conditions, a temporal adverb card (i.e. *yesterday* or *nowadays*) and an action-describing picture were used. The participant was asked to produce a sentence by describing the action in a picture with a temporal adverb, e.g. *Yesterday/Nowadays the man called/calls the woman*. Percent correct was computed for each condition, and errors were also analyzed for tense and agreement conditions.

## Results

The percent correct data indicated that all participants showed better production of complementizers as compared to tense and agreement (see Figure 1). In fact, three showed 95% accuracy in producing complementizers. Concerning tense and agreement, FG and LC performed better for agreement (75% and 65%, respectively) than for tense (45% and 25%, respectively). KB and SL produced zero correct responses for tense and agreement markers.

The error data showed that all participants made a greater number of substitution errors as compared to omission (bare stem) errors (see Table 1). FG and LC substituted *-s* for *-ed* as in (1) more frequently than *-ed* for *-s*. KB and SL produced *-ing* substitutions for both *-ed* and *-s* as in (2).

- (1) *Yesterday* the man *calls* a woman.
- (2) *Yesterday* the boy is *painting* the girl.  
*Nowadays* the boy is *painting* the girl.

## Experiment 2

The Verb Inflection Test (Bastiaanse & Thompson, unpublished) was used to further examine participants' verb inflection ability, focusing on the relationship between tense and agreement. Ten regular and five irregular verbs were elicited in seven categories: nonfinite (infinitive, modal, and present progressive) and finite (present singular, present plural, past and past participle). To elicit inflectional forms, a picture stimulus depicting the target action was used. Under the picture, a sentence was written with the verb missing. The participant was asked to complete each sentence by providing the correct verb form based on the picture stimulus presented. Each response was scored as 'correct' if a correct form of the verb was provided. Participants' errors were also analyzed.

### Results

Percent correct data for each inflection category are provided in Figure 2. The participants performed better in nonfinite conditions (mean (SD) = 84 (4.04)) than in finite conditions (mean (SD) = 33 (2.08)) (Wilcoxon  $z = -2.521$ ,  $p = .012$ ).

Considering past tense (*-ed*) and present singular categories (*-s*), performance varied (see Figure 3). FG and SL performed better in present singular (60% and 20%, respectively) than in past tense category (53% and 13%, respectively). However, FG overused *-s* and *-ed* across categories, substituting *-s* in 5/15 cases for present plural (e.g., *The boys walks*) and in 4/15 cases in past tense, and SL overused *-ing* across categories, 98% (64/65). LC, in contrast, performed better on past tense (67%) than present singular (40%), and KB produced zero correct responses for both categories.

## Discussion

The data from experiment 1 indicated that projection of CP was intact, while IP projections were impaired in our participants, a pattern not predicted by the TPH. With regard to TP and AgrP, when the data from both experiments were considered, no clear advantage for agreement over tense was seen. These findings suggest that, rather than a syntactic deficit, our agrammatic patients' difficulty reflected faulty implementation of morphological rules (Arabatzi & Edwards, 2000, 2002; Thompson et al., 2002). Relatively preserved nonfinite forms as compared to finite forms and frequent substitution errors, using a variety of inflectional

morphemes, suggest that the ability to distinguish contexts where verb inflection was required from where it was not was intact. Thus, inflectional rules were present in their grammar, but instantiation of grammatical markers sometimes failed to operate, resulting in incorrect inflectional forms. Theoretical and clinical implications of these data will be discussed.

### References

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Figure 1. Percent correct responses in complementizers, tense, and agreement production in experiment 1 (n=20/condition).

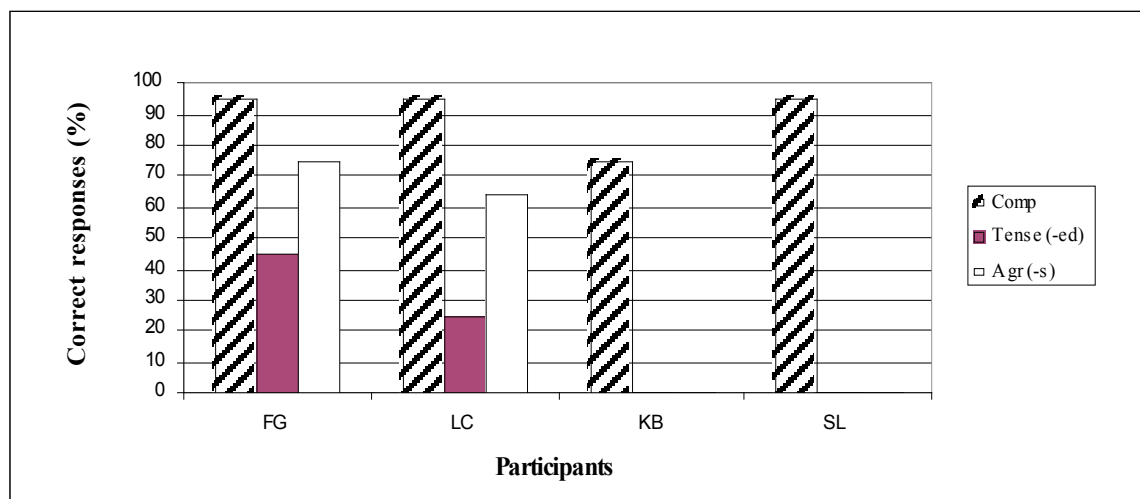


Table 1. Proportions of error types (both in number of occurrence and percent) in experiment 1.

Error types	FG	LC	KB	SL	Total
Omissions (bare stem)	2 (12)	4 (18)	0 (0)	1 (2.5)	7 (6%)
Substitutions					
-s for -ed	9 (53)	11 (50)	0 (0)	0 (0)	20 (17%)
-ed for -s	5 (29)	1 (5)	0 (0)	0 (0)	6 (5%)
-ing	0 (0)	0 (0)	40 (100)	34 (85)	74 (64%)
Total number of substitutions	14 (82)	12 (55)	40 (100)	34 (85)	100 (84%)
Others*	1 (6)	6 (27)	0 (0)	5 (12.5)	12 (10%)
Total number of errors	17 (100)	22 (100)	40 (100)	40 (100)	119 (100%)

\* Note: Other errors include unintelligible and “I don’t know” responses.

Figure 2. Production accuracy for finite vs. nonfinite verb inflections in experiment 2 for each participant.

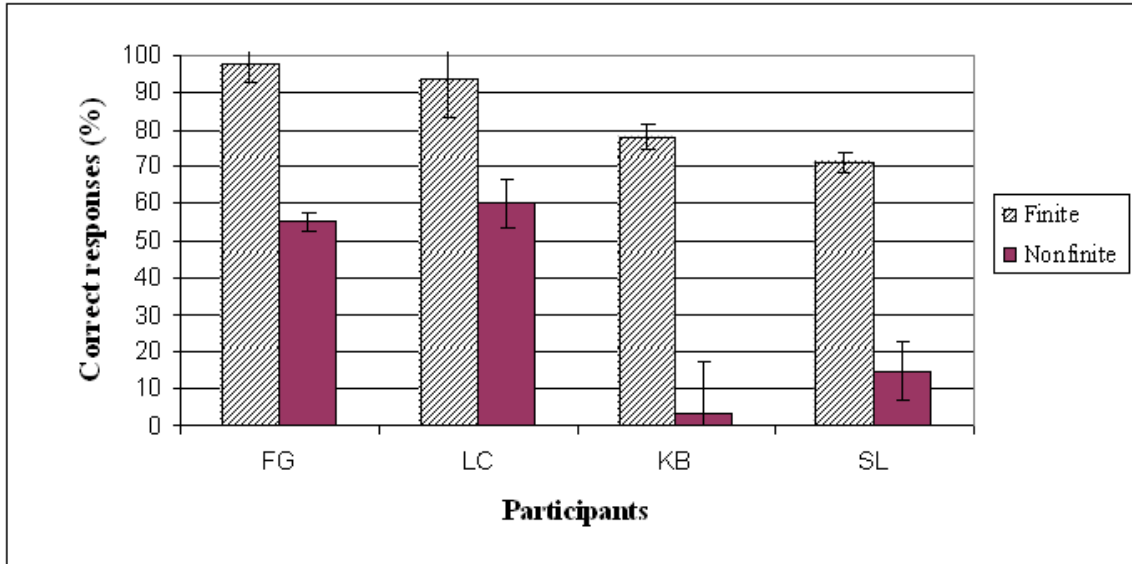


Figure 3. Percent correct production for past tense (-ed) and present singular (-s) categories in experiment 2.

