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Basal Ganglia and Linguistic Performance: A Case Study

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Introduction

Agrammatic aphasia does not only derive from cortical lesions, but also from subcortical lesions involving the basal ganglia (Damasio et al., 1982). It has been suggested that the basal ganglia are involved in linguistic/syntactic sequencing (Chan et al., in press) and in aspects of semantic integration, such as assignment of thematic roles (Kotz et al., 2003), among other things. Against this background, the linguistic profile of a Greek-speaking individual with a lesion in the basal ganglia is examined.

Methods

A right-handed male Greek-speaking agrammatic individual, aged 49, with a lesion in the basal ganglia (GT) and a control participant (AK) participated in five constrained tasks tapping syntactic and morphosyntactic abilities: a wh-question elicitation task, two anagram tasks, a sentence completion task and a sentence grammaticality judgment task. The last two tasks investigated the participants' ability to produce and comprehend/judge subject-verb Agreement, Tense, and Aspect, while the anagram tasks explored their ability to construct negative and affirmative sentences.

Results

The participants' results are presented in Table 1. GT performed significantly worse than AK in all cases except for affirmative sentences in the anagram task I and for Agreement in the completion task. GT was found severely impaired in the production of wh-questions, and significantly more impaired in constructing negative sentences, compared to affirmatives. He performed significantly worse on Aspect than on Tense and Agreement in both production and comprehension/judgment, while he produced Agreement significantly better than Tense.

Discussion

It is evident that GT has severe difficulties with both syntax and morphosyntax. Thus, his results confirm his previous diagnosis as agrammatic speaker. This is compatible with the view that agrammatism may arise not only from lesions in cortical structures but also from subcortical lesions affecting the basal ganglia (Damasio et al., 1982). GT's selective morphosyntactic deficit in comprehension/judgment could be attributed to his difficulty judging the compatibility of adverbials (particularly, aspectual ones) with verb forms, which seems to be a type of integration deficit. Therefore, these data appear to support the proposal that the basal ganglia are partially responsible for aspects of semantic integration (Kotz et al., 2003). More general integration problems are possibly the source of GT's selective difficulties in the completion task as well, where he performed significantly worse on Aspect and Tense than on Agreement. Unlike Agreement, Aspect and Tense require integration of both grammatical and extralinguistic/conceptual knowledge. Last, GT's data on the anagram tasks are in line with Chan et al.'s (in press)

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finding that linguistic/syntactic sequencing is subserved by the basal ganglia.

Table 1. Participants' Raw (%) Accuracy Scores in the Five Tasks and Statistical Comparisons (by Fisher's Exact Test for Count Data)

	GT	AK	GT vs. AK
Why-question Elicitation Task	14/36 (39%)	36/36 (100%)	*p=.000*
Anagram Task 1			
Negative Sentences	2/16 (13%)	16/16 (100%)	*p=.000*
Affirmative Sentences	13/13 (100%)	13/13 (100%)	*p=1*
Anagram Task 2			
Negative Sentences	1/18 (6%)	18/18 (100%)	*p=.000*
Affirmative Sentences	13/18 (72%)	18/18 (100%)	*p=.000*
Sentence Completion Task			
Agreement	53/56 (95%)	56/56 (100%)	*p=.243*
Tense	24/56 (43%)	52/56 (93%)	*p=.000*
Aspect	10/56 (18%)	49/56 (88%)	*p=.000*
Sentence Grammaticality Judgment Task			
Agreement	39/56 (70%)	55/56 (98%)	*p=.000*
Tense	35/56 (63%)	50/56 (89%)	*p=.002*
Aspect	23/56 (41%)	43/56 (77%)	*p=.000*
Anagram 1	*p=.000*	*p=1*	*n.a.*
Anagram 2	*p=.000*	*p=1*	*n.a.*
Agreement vs. Tense (Compl.)	*p=.000*	*p=.118*	*n.a.*
Agreement vs. Aspect (Compl.)	*p=.000*	*p=.013*	*n.a.*
Tense vs. Aspect (Compl.)	*p=.007*	*p=.527*	*n.a.*
Agreement vs. Tense (Judgm.)	*p=.550*	*p=.113*	*n.a.*
Agreement vs. Aspect (Judgm.)	*p=.004*	*p=.001*	*n.a.*
Tense vs. Aspect (Judgm.)	*p=.037*	*p=.130*	*n.a.*

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