

### Introduction

•Dissociations between verb related functional categories have consistently been reported in non-fluent agrammatic aphasia (e.g., Burchert, Swoboda-Moll, & de Bleser, 2005; Friedmann & Grodzinsky, 1997; Nanousi et al., 2006). These dissociations are often attributed to the differential demands functional categories place on speakers' processing system (e.g., Fyndanis, Varlokosta, & Tsapkini, 2012; Kok, van Doorn, & Kolk, 2006).

•However, studies reporting such dissociations did not always match their conditions in terms of ±presence (and number) of words intervening between the cue and the target functional category/verb form. For instance, in order to test tense and subject-verb agreement, Friedmann & Grodzinsky (1997) and Nanousi et al. (2006) auditorily administered sentence completion tasks in which, although there were no intervening words between the cue and the target in the agreement condition (e.g., *Xθés to ayóri perpátise* Yesterday the boy walked-3<sup>rd</sup>.sg > *Xθés ta ayórja perpátisan* Yesterday the boys walked-3<sup>rd</sup>.pl), in the tense condition 1-2 words intervened (e.g., *Xθés to ayóri perpátise* Yesterday the boy walked > *Avrio to ayóri tha perpátisi* Tomorrow the boy will walk). Interestingly, both studies found agreement to be significantly better preserved compared to tense. Thus, this dissociation might be attributed—at least partly—to the between-condition design differences in these studies.

•The goal of the present study is two-fold: to address the question whether the dissociations between functional categories in non-fluent agrammatic aphasia are genuine (that is, not attributable to design differences); and to explore whether the deficit in this neurological condition is representational or computational in nature.

### Methods

•Two versions of a sentence completion task were auditorily administered to five Greek-speaking individuals with non-fluent agrammatic aphasia, with at least a 5-day interval in between.

•Both versions tested agreement, tense, and aspect using the same trials. In the 1<sup>st</sup> version, however, there were no intervening words between the cue and the target, while in the 2<sup>nd</sup> version, 2-3 words intervened between the cue and the target.

**Example of tense condition** - 1<sup>st</sup> version: *Mésa se misí óra esí xθés mírases ta óóra* Within half an hour you **yesterday distributed** the gifts (lit.) > *Mésa se misí óra esí avrio tha mirásis ta óóra* Within half an hour you **tomorrow will distribute the gifts** (lit.); 2<sup>nd</sup> version: *Xθés esí mésa se misí óra mírases ta óóra* Yesterday you within half an hour **distributed** the gifts (lit.) > *Avrio esí mésa se misí óra tha mirásis ta óóra* Tomorrow you within half an hour **will distribute** the gifts (lit.)

### Predictions

•If the intervening words cause a drop in the aphasic participants' performance (compared to the "baseline" task version), then this would be an indication that the deficit in non-fluent agrammatic aphasia is computational in nature, and that at least a component of the processing limitation of agrammatic speakers involves a reduction in the capacity of the input phonological buffer/component of their working memory system.

### Results

Raw and percent accuracy scores in the two completion task versions, and statistical comparisons (by Fisher's exact test for count data).

	PK	PG	VC	IK	EP	Total
<b>Agreement:</b>						
1 <sup>st</sup> task	26/30 (87%)	23/30 (77%)	17/30 (57%)	23/30 (77%)	22/30 (73%)	111/150 (74%)
2 <sup>nd</sup> task	18/30 (60%)	24/30 (80%)	18/30 (60%)	14/30 (47%)	20/30 (67%)	94/150 (63%)
1 <sup>st</sup> vs. 2 <sup>nd</sup>	<i>p</i> = .039	<i>p</i> = 1	<i>p</i> = 1	<i>p</i> = .033	<i>p</i> = .779	<i>p</i> = .047
<b>Tense:</b>						
1 <sup>st</sup> task	23/30 (77%)	27/30 (90%)	12/30 (40%)	23/30 (77%)	26/30 (87%)	111/150 (74%)
2 <sup>nd</sup> task	11/30 (37%)	25/30 (83%)	10/30 (33%)	16/30 (53%)	29/30 (97%)	91/150 (61%)
1 <sup>st</sup> vs. 2 <sup>nd</sup>	<i>p</i> = .004	<i>p</i> = .707	<i>p</i> = .789	<i>p</i> = .103	<i>p</i> = .353	<i>p</i> = .019
<b>Aspect:</b>						
1 <sup>st</sup> task	20/30 (67%)	7/30 (23%)	11/30 (37%)	9/30 (30%)	12/30 (40%)	59/150 (39%)
2 <sup>nd</sup> task	13/30 (43%)	9/30 (30%)	11/30 (37%)	7/30 (23%)	14/30 (47%)	54/150 (36%)
1 <sup>st</sup> vs. 2 <sup>nd</sup>	<i>p</i> = .119	<i>p</i> = .771	<i>p</i> = 1	<i>p</i> = .771	<i>p</i> = .795	<i>p</i> = .634
<b>1<sup>st</sup> task:</b>						
Agr vs. T	<i>p</i> = .506	<i>p</i> = .299	<i>p</i> = .302	<i>p</i> = 1	<i>p</i> = .333	<i>p</i> = 1
Agr vs. Asp	<i>p</i> = .125	<i>p</i> = .000	<i>p</i> = .195	<i>p</i> = .000	<i>p</i> = .018	<i>p</i> = .000
T vs. Asp	<i>p</i> = .568	<i>p</i> = .000	<i>p</i> = 1	<i>p</i> = .000	<i>p</i> = .000	<i>p</i> = .000
<b>2<sup>nd</sup> task:</b>						
Agr vs. T	<i>p</i> = .121	<i>p</i> = 1	<i>p</i> = .069	<i>p</i> = .797	<i>p</i> = .006	<i>p</i> = .812
Agr vs. Asp	<i>p</i> = .302	<i>p</i> = .000	<i>p</i> = .121	<i>p</i> = .103	<i>p</i> = .192	<i>p</i> = .000
T vs. Asp	<i>p</i> = .793	<i>p</i> = .000	<i>p</i> = 1	<i>p</i> = .033	<i>p</i> = .000	<i>p</i> = .000
1 <sup>st</sup> task total	69/90 (77%)	57/90 (63%)	40/90 (44%)	55/90 (61%)	60/90 (67%)	281/450 (62%)
2 <sup>nd</sup> task total	42/90 (47%)	58/90 (64%)	39/90 (43%)	37/90 (41%)	63/90 (70%)	239/450 (53%)
1 <sup>st</sup> vs. 2 <sup>nd</sup>	<i>p</i> = .000	<i>p</i> = 1	<i>p</i> = 1	<i>p</i> = .011	<i>p</i> = .749	<i>p</i> = .006

Note: 1<sup>st</sup> task: non distant cues; 2<sup>nd</sup> task: distant cues

### Discussion

•The results indicate that:

(a) the dissociations between functional categories (Aspect < Tense/Agreement) found for three of the five agrammatic participants (PG, IK, EP) are genuine;

(b) the presence of intervening words between the cue and the target can cause a significant drop in the performance of at least some agrammatic individuals on the better preserved categories (in this study: agreement and tense); this is the case with two of the agrammatic participants (PK, IK).

•Thus, at least for these individuals, we argue for a processing limitation that possibly involves a reduction in the capacity of their input phonological component of the working memory system.

•The cue-target distance is probably one of the sources of the computational difficulty brain-damaged individuals with low capacity input phonological component encounter.

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