

Ali Idrissi^a, Meera Al-Kaabi^b & R. Muralikrishnan^c

^a United Arab Emirates University, ^b New York University, ^c New York University Abu Dhabi
r.muralikrishnan@nyu.edu

Introduction

Several case studies on agrammatic patients have documented a dissociation between tense and agreement in oral production versus grammaticality judgement in various languages [1,2,3,4].

A recent study [5] reported data from an Arabic-speaking agrammatic, who showed more impairment on tense than agreement in production, whereas in grammaticality judgement, the opposite pattern ensued.

Previous online studies have addressed the question of processing verb agreement and tense in a number of languages, but what are the neurophysiological correlates of processing agreement and tense violations in Arabic?

To this end, we designed an ERP study, in which we presented healthy native speakers with Modern Standard Arabic sentences that were either fully acceptable & well-formed, or were violations of subject-verb agreement (person / number / gender) or of tense. All our critical stimuli were semantically plausible sentences.

Methods

Participants:

- 28 (9 female) right-handed native speakers of Arabic
- Mean age: 22.14 years; Age-range: 19 – 27 years

EEG Data:

- Recorded using ActiCap fixed at the scalp; 25 Ag / AgCl electrodes
- Ground: AFZ; Reference: Left-mastoid
- Re-referenced to linked mastoids; Offline filter: 0.3 – 20 Hz bandpass

Procedure:

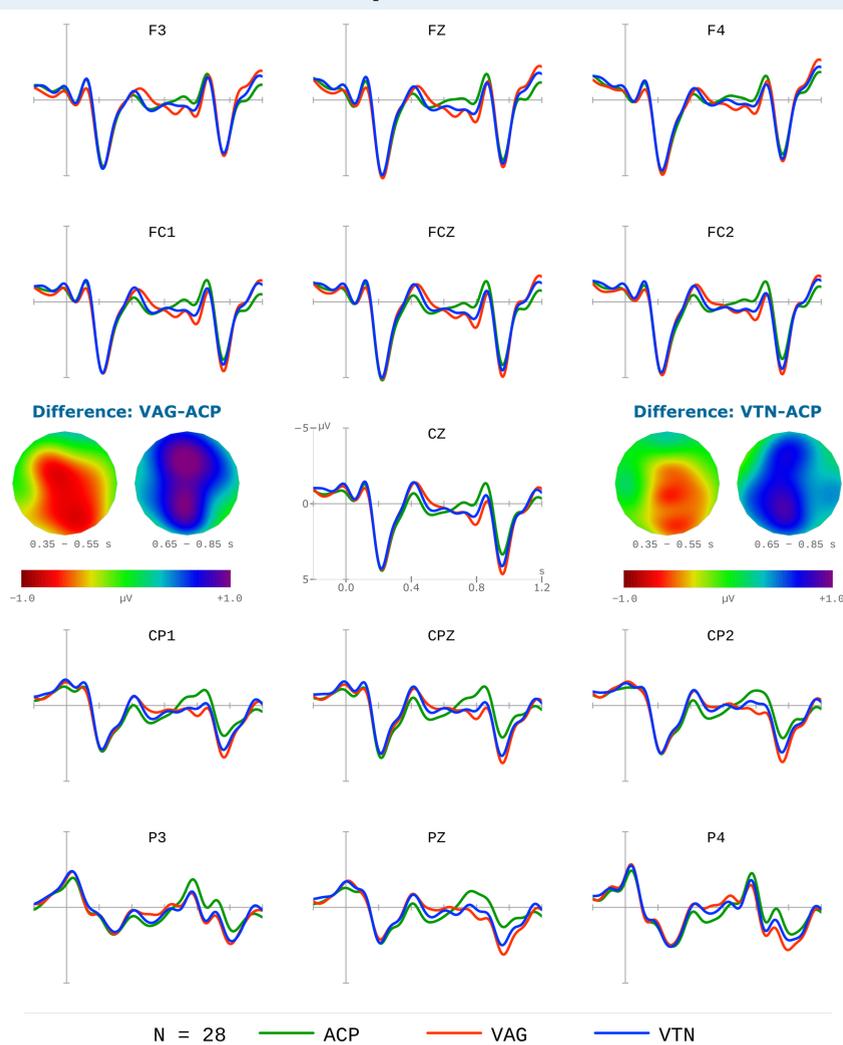
- Rapid serial visual presentation of stimulus sentence
- Tasks: Acceptability judgement followed by Probe detection

Materials:

- Sentences of the form: Adverb of time – Subject – Verb – PP.
- Subject noun : masculine / feminine animate common noun
 - Singular noun in sentences with a past tense adverb
 - Plural noun in sentence with a future tense adverb
- 3 Conditions (120 sentences in each condition per participant)
 - Acceptable / Violation of Agreement / Violation of Tense
- No combined violation of two features

Results

ERPs at the position of the verb



Significant effects for the violation conditions

- Negativities in the N400 time-window.
- Broadly distributed late positivities in the P600 time-window.

Possible effects for which further analysis is underway

- A couple of early effects for singular subjects in different conditions.

	ACP	بالأمس	الأستاذ	درّسَ	في الكلية.
		bi-l-'ams	'al-'ustadh	darras-a	fi
		[in-DEF-yesterday]	[DEF-teacher] _{3sg,M}	[teach] _{Past-3sg,M}	[DEF-college] [in]
					'Yesterday, the teacher taught in the college'.
	* VAG	بالأمس	الأستاذ	درّستُ / درّسوا / درّستُ	في الكلية.
		bi-l-'ams	'al-'ustadh	darras-at / darras-uu / darras-tu	fi
		[in-DEF-yesterday]	[DEF-teacher] _{3sg,M}	[teach] _{Past-3sg,F / Past-3pl,M / Past-1sg}	[DEF-college] [in]
					*'Yesterday, the teacher taught in the college'.
	* VTN	بالأمس	الأستاذ	سيدرّسُ	في الكلية.
		bi-l-'ams	'al-'ustadh	sa-yu-darris-u	fi
		[in-DEF-yesterday]	[DEF-teacher] _{3sg,M}	[teach] _{Fut-3sg,M}	[DEF-college] [in]
					*'Yesterday, the teacher will teach in the college'.

Discussion

Agreement violations: -

The negativity in our data, which can be plausibly classified as an N400 effect, and a tendency towards a left anterior negativity (for which further analysis is underway) suggest that Arabic does not treat verb agreement as a purely morphosyntactic feature, at least not in all cases, in contrast to English, Spanish or German [6, 7, 8].

Tense violations: -

The posterior negativity in the N400 time-window, together with a clear absence of a left anterior negativity effect for tense violations indicate that processing tense in Arabic involves lexical semantic rather than morphosyntactic processes. This is in contrast to data from English and Dutch [9, 10], both of which reported a LAN effect, and in line with results from French and Mandarin Chinese [11, 12].

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Author contributions: -

Ali Idrissi had the original idea for the experiment, funded the experiment and wrote the core of the stimuli as per design requirements.

Meera Al-Kaabi wrote the rest of the stimuli, checked for corrections & typos.

R. Muralikrishnan co-designed the experiment with Ali Idrissi, and was responsible for data collection and analysis.