A neural signature of the Hebrew Accusative Marker *et*

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Background. The present study examines the processing of the Hebrew accusative marker using EEG and a judgment task in monolingual adults. Previous cross-linguistic reveal a distinct contrast between grammatical transitive sentences and ungrammatical double nominative/accusative structures in languages like Japanese [5], German [3], and Korean [4]. These differences are reflected in rating patterns and observed P600/N400/LAN brain signals associated with morphosyntactic errors in ungrammatical sentences [7]. Diverging from the languages above, Hebrew has a unique case marking system; the nominative case remains unmarked, while the accusative marker *et* precedes only definite objects [1,6, 10]. As for word order, alongside the canonical N_{nom}-V-N_{acc} structure (where N_{nom} is the nominative case, V is the verb, and N_{acc} is the accusative case), the use of *et* allows for the non-canonical N_{acc}-V-N_{nom} order that is relatively infrequent [10] (see Table 1). Unlike languages such as German, the structure N_{nom}-V-N_{nom} exists in Hebrew, although it represents a residual archaic construction that is infrequently encountered in colloquial speech [1]. Consequently, our study not only contributes to the cross-linguistic discussion on the integration of the accusative marker but also unveils a distinctive pattern of such phenomenon.

Design. We examined the integration and evaluations of the Hebrew accusative marker in a group of monolingual adults (N=40) using an auditory EEG task. Participants were presented with simple transitive sentences manipulated by Condition. Each condition included 41 items using two lists, totaling 328 items. Participants listened to sentences and provided binary grammaticality ratings as their brain signals were recorded.

Analysis. Both the behavioral and ERP data were analyzed using mixed-effect modelling with Participant and Item as random effects. In the ERP data, the model included 4 conditions (N_{nom}-V-N_{acc}, N_{acc}-V- N_{nom}, N_{nom}-V- N_{nom}, N_{acc}- V- N_{acc}) x 6 (ROI: Left Anterior, Right Anterior, Left Posterior, Right Posterior, Right Central, and Left Central) in 2 time-windows (N400/ LAN: 300-500; P600: 500-800) for each critical region (ACC1, NP1, ACC2 and NP2) separately.

Results and Discussion. As anticipated, monolingual adults showed sensitivity to the accusative marker, as reflected in lower ratings for ungrammatical conditions compared to grammatical ones. The participants were also quick to reject sentences with the ungrammatical Nacc-V-Nacc structure, indicating awareness of the accusative marker's characteristics. Despite consistent response times for grammatical sentences, suggesting no extra processing costs, sentences with N_{nom}-V-N_{acc} received higher ratings than N_{acc}-V-N_{nom}, consistent with previous research [10].

In EEG analysis, word order sensitivity emerged at 200ms with the ACC1/silence, revealing a LAN separation between N_{nom}-initial and N_{acc}-initial (Fig. 3 and 4). Accusative marker sensitivity appeared at 400ms with the second ACC/silence and NP2, where the ungrammatical N_{acc}-V-N_{acc} differed significantly from N_{nom}-V-N_{acc}, mirroring RT data. That is, despite low acceptability ratings for N_{nom}-V-N_{nom}, adults exhibited similar RTs and brain signal patterns as other grammatical conditions. N_{nom}-V-$_{Nacc}$ showed significant differences from the two N_{acc}-initial structures at 600ms, indicating processing challenges for the latter. Previous research suggests reanalysis costs in N_{acc} -initial sentences and that pragmatic influences on N_{acc}-V- N_{nom} availability [2,9]. Given sentence isolation, licensing of N_{acc}-V- N_{nom} sentences may be hindered.

Conclusion. This study aims to test the integration of the accusative marker where there are no 'classical' overt nominative and accusative cases. Behavioral data align with expected patterns, yet similar processing times were seen except for N_{acc}-V-N_{acc}. As for the EEG, consistent with reaction time findings, adults exhibit distinct brain signals between N_{acc}-V-N_{acc} and other conditions at 400ms and 600ms.

Table 1. Example of experimental items

ROI	AdvP	*et*/silence1	NP1	Verb	AP	*et*/silence2	NP2
N_{nom}-V-N_{acc}	*baboker*,		*ha-more*	*yecayer*	*maher*	*et*	*ha-leycan*.
	in-the morning		**DEF**-teacher	will-draw	quickly	**ACC**	**DEF**-clown
N_{acc}-V-N_{nom}	*baboker,*	*et*	*ha-more*	*yecayer*	*maher*		*ha-leycan*.
	in-the morning	**ACC**	**DEF**-teacher	will-draw	quickly		**DEF**-clown
*N_{nom}-V-N_{nom}	*baboker*,		*ha-more*	*yecayer*	*maher*		*ha-leycan*.
	in-the morning		**DEF**-teacher	will-draw	quickly		**DEF**-clown
*N_{acc}-V-N_{acc}	*baboker,*	*et*	*ha-more*	*yecayer*	*maher*	*et*	*ha-leycan*.
	in-the morning	**ACC**	**DEF**-teacher	will-draw	quickly	**ACC**	**DEF**-clown

Fig 1. Judgment task- Ratings

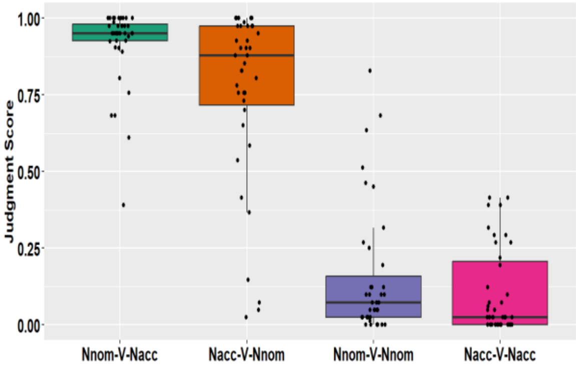


Fig 2. Judgment task- Log-transformed RTs

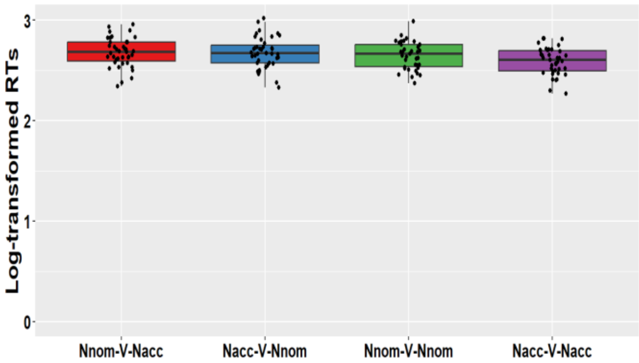


Fig3. ERP results- ACC1

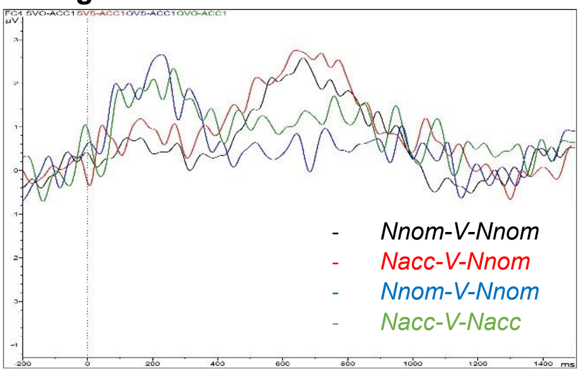


Fig4. ERP results- NP1

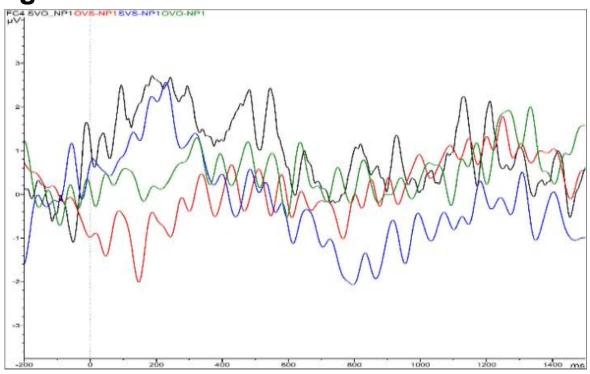


Fig 5. ERP results- ACC2

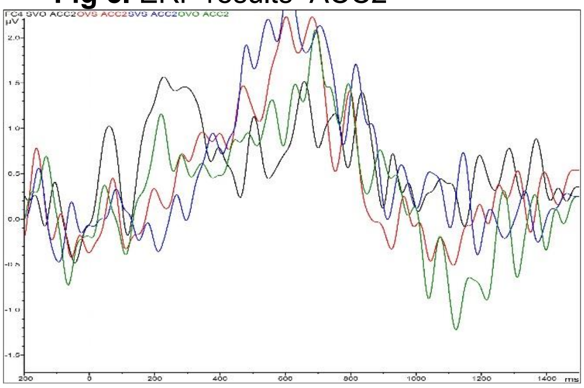
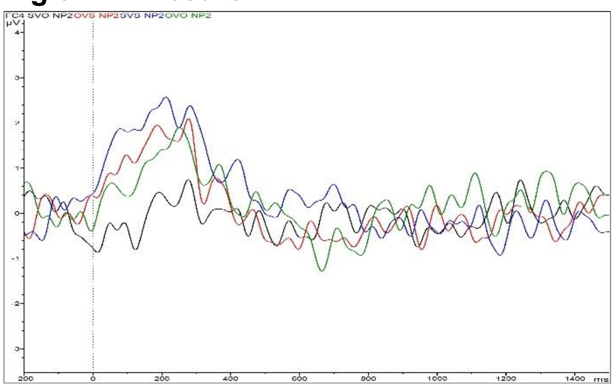


Fig 6. ERP results- NP2



References

[1] Danon, G. (2001) *Linguistics.* [2] Friedmann, N., & Costa, J. (2011) *Language Acquisition*. [3] Frisch, S., & Schlesewsky, M. (2005) *Cognitive Brain Research*. [4] Khan, A., Sung, J. E., & Kang, J. W. (2019) *Information Fusion*. [5] Mueller, J. L., Hirotani, M., & Friederici, A. D. (2007) *BMC neuroscience*. [6] Næss, Å. (2004) *Lingua*. [7] Pereira Soares, S. M., Kupisch, T., & Rothman, J. (2022) *Brain Sciences.* [8] Pickering, M. J., & Gambi, C. (2018) *Psychological bulletin*.[9] Rösler, F., Pechmann, T., Streb, J., Röder, B., & Hennighausen, E. (1998) *Journal of memory and language.* [10]Shlonsky, U. (1997) *Clause structure and word order in Hebrew and Arabic: An essay in comparative Semitic syntax.*