



The Effects of Task on Processing Real-world, Animacy and Syntactically Violated Sentences



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Introduction

- Previous ERP studies report distinct ERP components to different types of violations between a critical verb and its preceding context. In particular, a P600 effect, classically associated with syntactic anomalies, has been described in association with animacy selection restriction violations between subjects and verbs^{1,2,3,4,5}. Often this so-called 'semantic P600 effect' is accompanied by an attenuated N400 effect. In contrast, real-world violations evoke a robust N400 effect but no P600 effect.
- Interestingly, when these violations are introduced mid-sentence, sentence-final words tend to evoke a sustained negativity effect (relative to sentence-final words in normal sentences). This sentence-final negativity may reflect resources associated with the engagement of cognitive resources during sentence wrap-up or the absence of processing after detecting violations mid-sentence. To investigate the cognitive underpinnings of this sustained negativity, the present study used a simultaneous self-paced reading/ERP technique⁵ while readers performed one of three tasks.

Methods

- **Materials:** (180 set of sentences)

Conditions	Explanation	Examples
Non-violation (NV)	Baseline condition against which the other conditions are evaluated.	For breakfast the boys would only eat toast and jam.
Real-world violation (RWV)	Sentences were constructed by replacing the critical verb of each non-violated sentence with verbs that were chosen pseudorandomly from sentences from another list.	For breakfast the boys would only watch toast and jam.
Animacy violation (AV)	Sentences were constructed by replacing the animate NP with an inanimate NP	For breakfast the eggs would only eat toast and jam.
Morphosyntactically violation (MV)	Sentences were constructed either violating subject-verb agreement or by replacing a finite verb with an infinitive one.	For breakfast the boys would only eats toast and jam.

- **Participants:**

- Exp. 1 and Exp. 2: 16 right-handed participants each
- Exp. 3: 24 right-handed participants

- ERPs were recorded as readers self-paced through each sentence word-by-word

- **Task:**

- Exp. 1: Acceptability judgments
- Exp. 2: Counting the number of violations introduced -- a task analogous to that used in Exp. 1 but which ensured that participants maintained attention until the sentence-final word.
- Exp. 3: Answering comprehension questions

- **Target Words:**

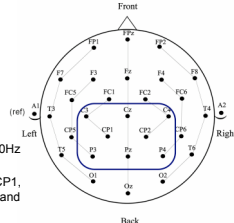
- critical word (CW); sentence-final word (SFW)

- **Time window:**

- N400: 300-500ms
- P600: 600-900ms

- 29 active tin electrodes, continuously sampled at 200Hz with a bandpass filter of 0.01-40Hz.

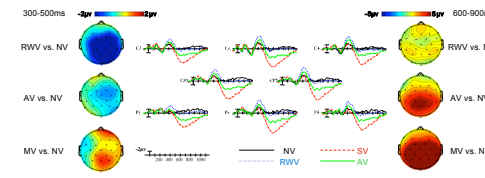
- A subset of centro-parietal electrodes (C3, Cz, C4, CP1, CP2, P3, Pz, P4) were used to analyze the N400 and P600 components.



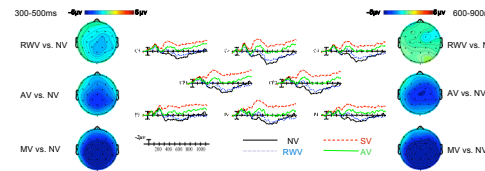
Results

Experiment 1: Acceptability Judgments

At the **CW**, RWVs evoked a robust N400 effect and a very small P600 effect; AVs evoked a small N400 effect and a medium P600 effect; and SVs evoked no N400 effect and a robust P600 effect.

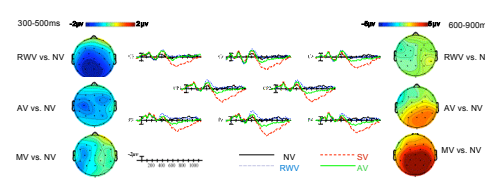


At the **SFW**, RWVs evoked a short-lived N400 effect; AVs and SVs evoked an N400 and a sustained late negativity effect.

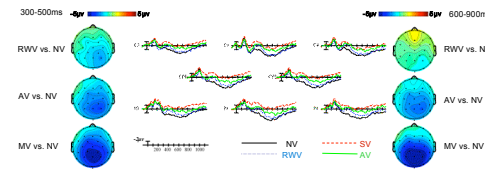


Experiment 2: Counting violations

At **CW**, RWVs evoked a robust N400 effect; AVs evoked a small N400 effect and a medium P600 effect; and SVs evoked no N400 effect and a robust P600 effect.

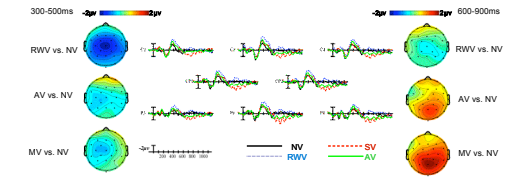


At **SFW**, RWVs evoked a short-lived N400 effect; AVs and SVs evoked an N400 and a sustained late negativity effect.

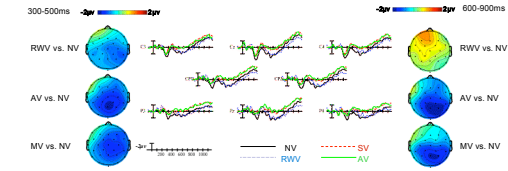


Experiment 3: Comprehension questions

At the **CW**, RWVs evoked an N400 effect; AVs and SVs evoked a P600 effect.



At the **SFW**, RWVs, AVs, and SVs evoked a similar-size N400 effect; Both AVs and SVs also evoked a similar-size late negativity effect.



Combined analysis - the interaction between Task and different violation effects.

Position	Time window (ms)	Violation effect		
		RWVs (vs. normal)	AVs (vs. normal)	SVs (vs. normal)
CW	300-500	Large N400 effect; No interaction with Task	Small N400 effect; No interaction with Task	No N400 effect
	600-900	Small P600 effect; Condition x Task: P600 effect becomes smaller across the 3 Tasks	Medium P600 effect; Condition x Task: P600 effect becomes smaller across the 3 Tasks	Large P600 effect; Condition x Task: P600 effect becomes smaller across the 3 different tasks
SFW	300-500	Small N400 effect; No interaction with Task	Medium N400 effect	Largest N400 effect;
	600-900	Prolonged negativity effect; No interaction with Task	Prolonged negativity effect; Condition x Task: Larger late negativity effect in judgment task (Exp 1) relative to other 2 tasks.	Prolonged negativity effect; Larger late negativity effect in judgment than the other 2 tasks.

Conclusions

- P600 effects were evoked by both syntactic and animacy violations, regardless of task.
- Task nonetheless interacts with the additional processes reflected by the P600 of the target word.
- Sustained negativities on sentence-final words following mid-sentence anomalies are likely to reflect an absence of processing rather than prolonged semantic processing.

References

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