

# Morphological triggers and the P600: ERP evidence for morphological expectations during sentence comprehension

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## Introduction

The P600 is elicited by ungrammatical words in sentences, **but there is more about the P600 for us to understand.** Morphological complexity of the critical word is often fully confounded with grammaticality.

Frequently cited example<sup>6</sup>:

Grammatically correct: *The cat will eat the food.*

Grammatically incorrect: *The cat will \*eating the food.*

“Eating” is both grammatically incorrect AND morphologically more complex than “eat”.

**Balanced stimulus design** (fully crossing complexity and grammaticality) overcomes this confound<sup>7</sup>. BUT, information about how complexity modulates the P600 may be lost by collapsing over levels of complexity in order to study effects of grammaticality.

**Morphological decomposition** is indexed by ERPs<sup>1,3,5</sup>. P600 amplitude varies based on morphological cue **predictability** and **retrievability**<sup>8</sup>.

**Our goal:** Investigate the interactions between morphological complexity and grammaticality on the P600 during sentence comprehension.

## Methods

**Participants:** 14 college-aged right-handed English monolinguals

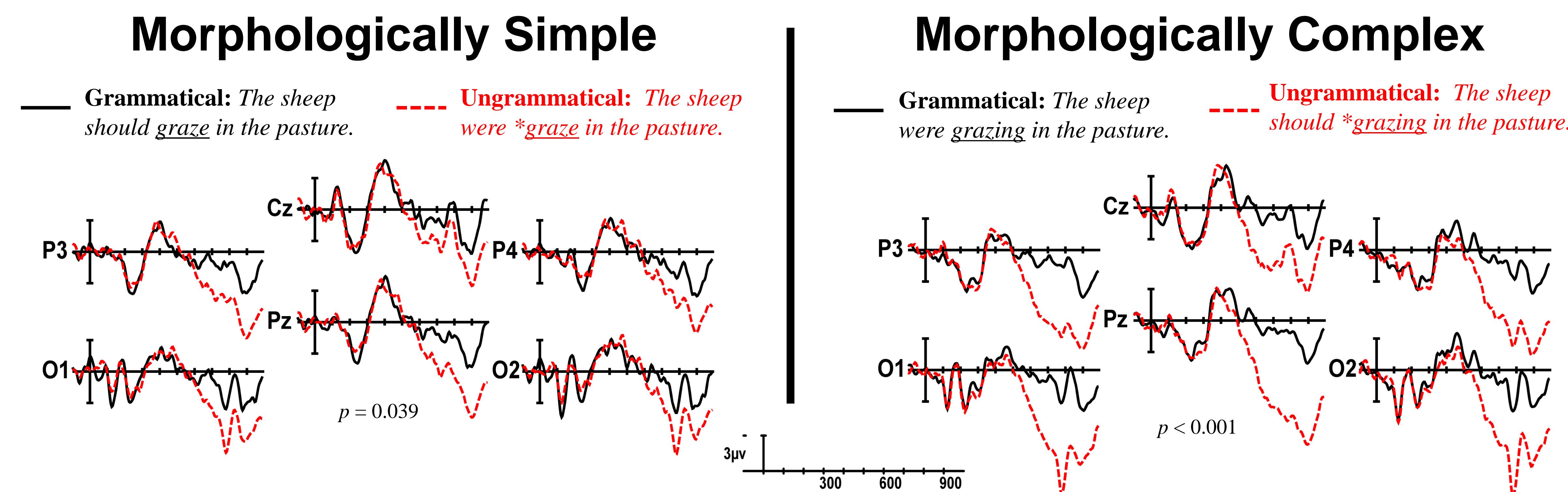
**Stimuli:** Fully-crossed 2 (morphological complexity) by 2 (grammaticality) design. Example:

- 1) Grammatical, morphologically simple:  
*The sheep should graze in the pasture.*
- 2) Grammatical, morphologically complex:  
*The sheep were grazing in the pasture.*
- 3) Ungrammatical, morphologically simple:  
*The sheep were \*graze in the pasture.*
- 4) Ungrammatical, morphologically complex:  
*The sheep should \*grazing in the pasture.*

**Procedure:** Visual word-by-word presentation of stimuli, continuous EEG recorded from 19 scalp electrodes (10-20 system). Acceptability judgment at end of sentence. ERPs computed to onset of critical (underlined) word. Words presented for 300ms, 350ms ISI.

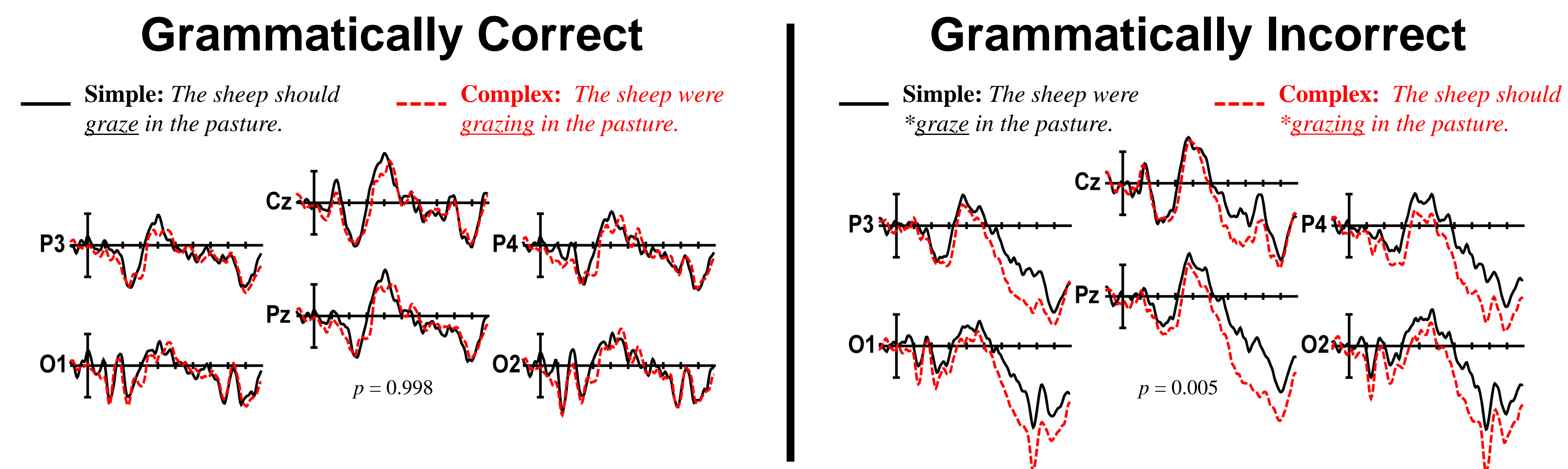
## Results

### Effects of Grammaticality



**Both morphologically simple and complex ungrammatical stimuli elicit a P600. The P600 is larger for complex ungrammatical stimuli than for simple ungrammatical stimuli.**

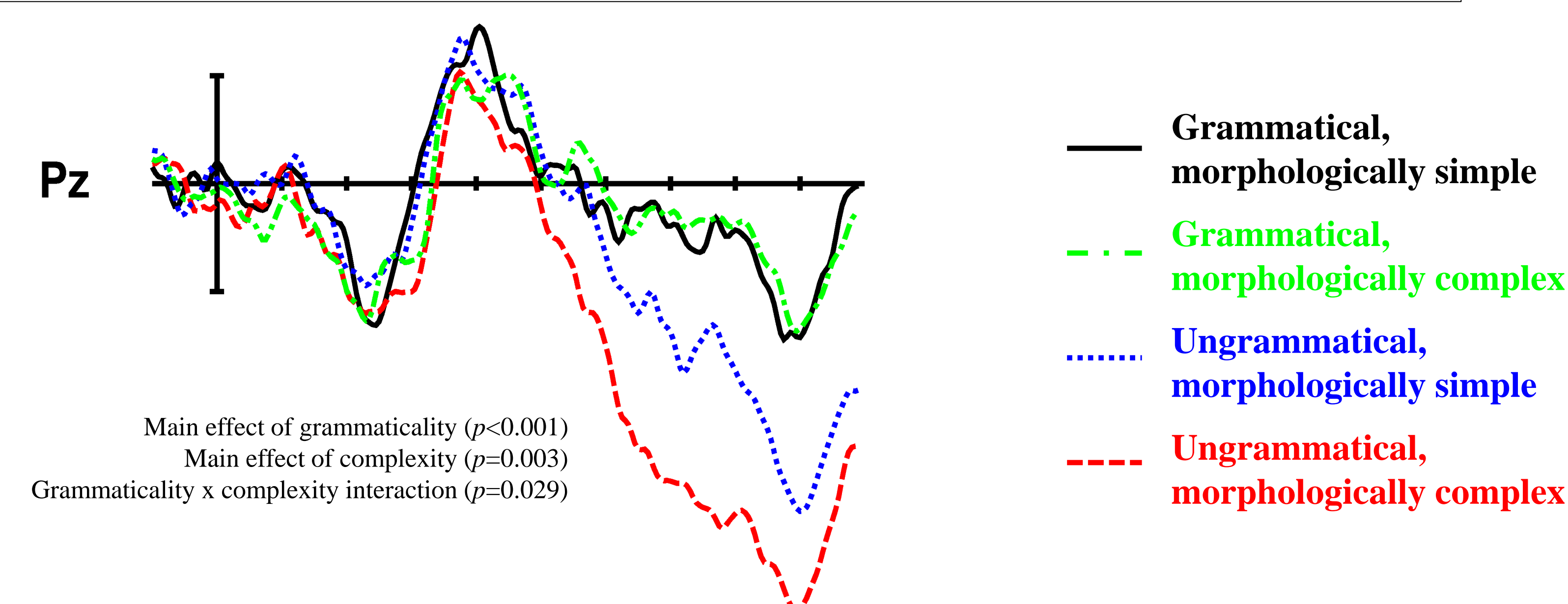
### Effects of Morphological Complexity



**Morphological complexity only has an effect on the P600 when the stimulus is ungrammatical.**

### Interaction between grammaticality and complexity

**Morphologically complex stimuli elicit a larger P600 only when the stimulus is ungrammatical.**



## Conclusions

**There is no unique effect of morphological complexity on the P600. Overt morphological cues (e.g., -ing) elicit a more robust response only when stimuli are ungrammatical.**

**Methodological implications:**

- Challenges for comparing effects of grammaticality as indexed by the P600 when stimuli vary in morphological complexity.
- Stimuli that confound or balance across levels of complexity do not totally characterize reanalysis of morphosyntax.

**Theoretical implications:**

- (Re)processing difficulty is a function of expectation and memory retrieval difficulty<sup>2,4,8,9</sup>
- Complex ungrammatical stimuli (e.g., “grazing”, preceded by a modal verb): highly unexpected, marked with the “-ing” feature, which nothing in your memory matches: expectation fail, retrieval fail → big P600
- Simple ungrammatical stimuli (e.g., “graze”, preceded by is/are/were): unexpected but less so, is unmarked for features, so nothing to search for in memory: less of an expectation fail, no real retrieval fail → smaller P600
- Grammatical conditions: all expectations are met, no need to attempt retrieval. → no P600

## Future Directions

Consider effects of word length/morpheme saliency: graze vs. grazes (-s is shorter and less salient than -ing)

## References

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