

The P600 for singular ‘they’: How the brain reacts when John decides to treat themselves to sushi

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Introduction

- Mismatch in features between a pronoun and its antecedent causes increased processing effort and elicits a P600 (Osterhaut & Mobley 1995).
- ‘John/Mary decided to treat themselves to sushi’ can be expected to elicit a P600. But why?

Option 1: P600 because of number violation

- John/Mary: [+singular] themselves [-singular]

Someone

Some man / woman

The participant

John / Mary

... themselves ...

Intuitive reason

Option 2: P600 because of gender violation

- John/Mary: [±feminine] themselves [0-feminine]

Someone

Some man / woman

The participant

John / Mary

... themselves ...

Option 3: P600 because of number + gender violation

- John/Mary: [±feminine +singular] themselves [0-feminine -singular]

Someone

Some man (woman)

The participant

John (Mary)

... themselves ...

What if ‘*the participant*’ elicited P600 but not ‘*someone*’?

1. ‘someone’ is notionally plural
2. ‘the participant’ not 0-feminine
 - ‘the’ triggers visualizing a specific person associated with default gender

To avoid (2), we tested participants who frequently interacted with non-binary and transgender individuals (around half of whom identified as being gender non-binary themselves).

Procedure

Participants:

- Right-handed monolingual native speakers of English from Hampshire College
- “High-practice” as measured by a survey looking at knowledge of gender neutral pronouns and frequency of interaction with non-binary individuals
- 22 “binary” participants (15 female, 7 male) and 20 “non-binary” participants

Stimuli:

Antecedent	Example sentences
Generic ambiguous	Someone in this group needs to pull themselves together
	Some people in this group need to pull themselves together
Generic unambiguous	Every woman must learn to stand up for themselves
	All women must learn to stand up for themselves
Specific ambiguous	The stranger poured themselves a cup of coffee
	The strangers poured themselves a cup of coffee
Specific unambiguous	John decided to treat themselves to some sushi
	John and Mary decided to treat themselves to some sushi

50 sentences per antecedent type (overall 400)
400 unrelated distractors with no pronouns. 1200 sentences for other related experiments

Procedure:

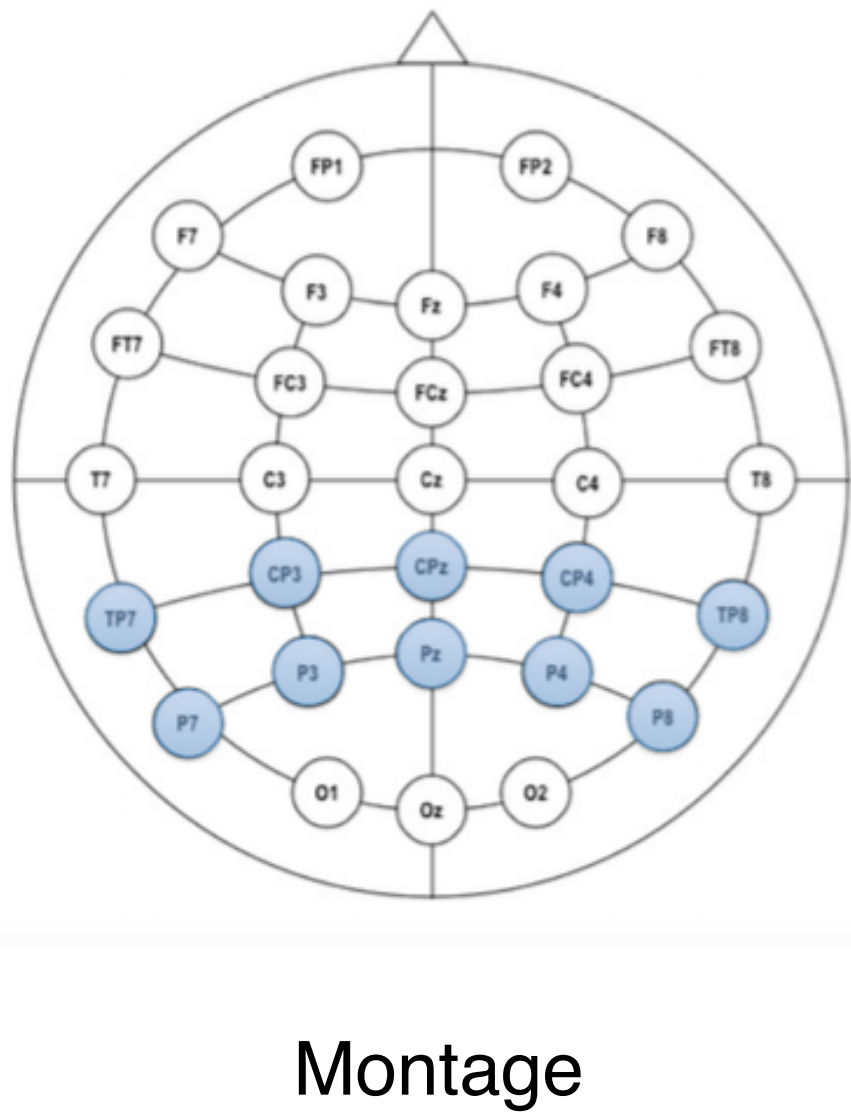
- Participants heard sentences through headphones
- Answered comprehension questions for 1/10th data
- Data collected over two sessions between 1 to 2 weeks apart

Data collection and Analyses

- Data collection and preprocessing**
 - Data was collected from 30 scalp locations at 1000 Hz and down-sampled to 200 Hz
 - Band pass filter: 0.1 to 30 Hz.
 - Any participant with greater than 35% trials rejected was excluded from analyses. (2 binary and 2 non-binary excluded)

- Data analyses**
 - P600: Mean amplitude singular ‘themselves’ — Mean amplitude plural ‘themselves’
 - Time window: 500 to 800 ms
 - Electrodes: Posterior electrodes (PZ, P4, CP4, P8, TP8, P7, P3, CP3, CPZ, TP7)

- ANOVA : Specificity x Ambiguity x Group

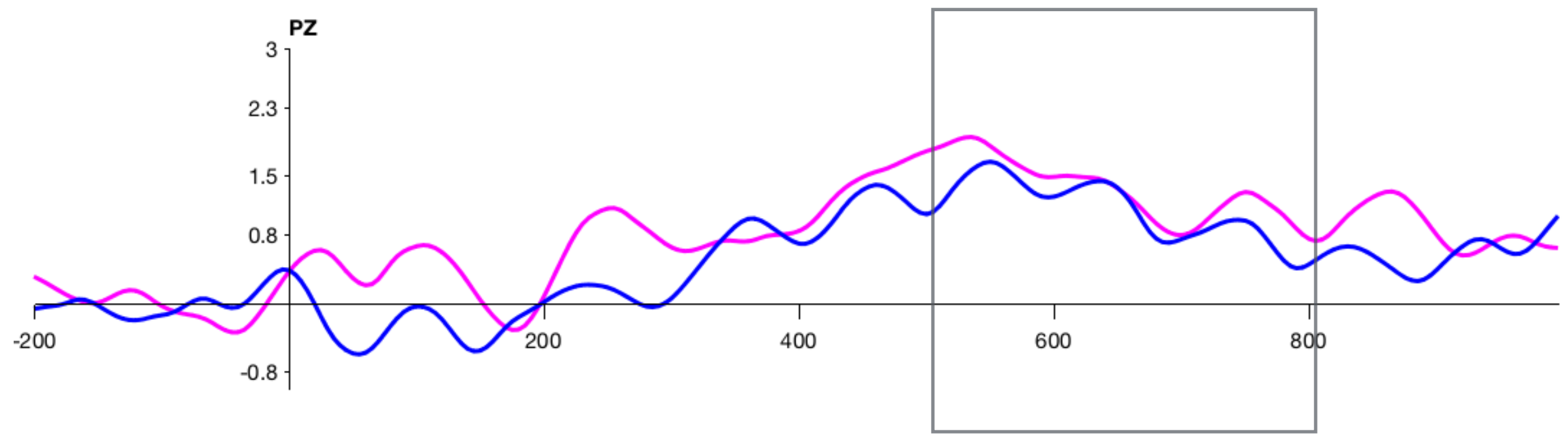


Results

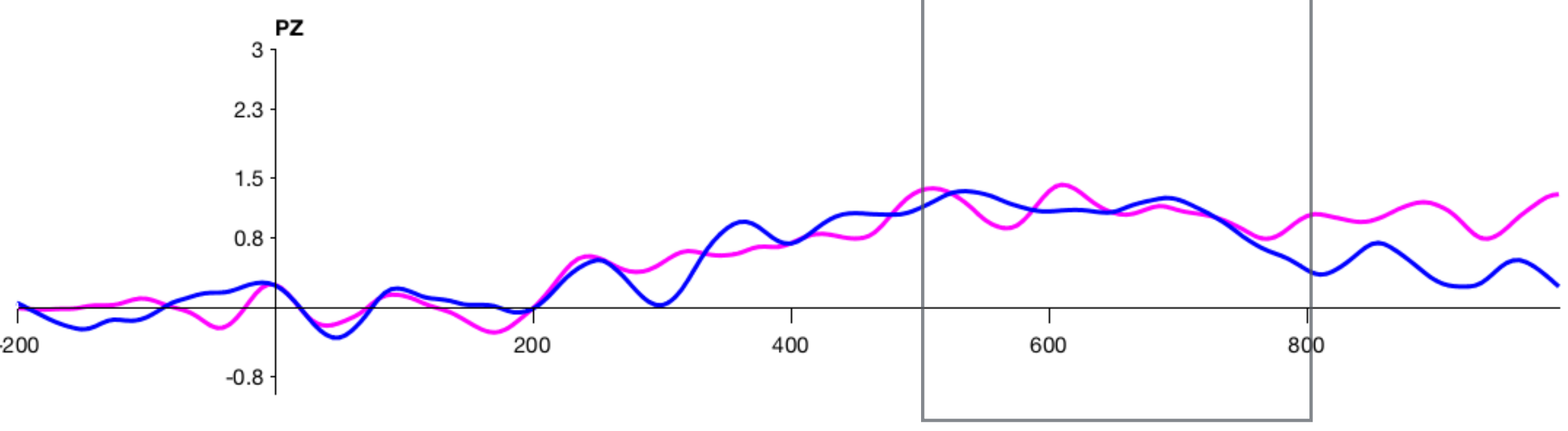
- Main effect of Specificity (p < 0.05)
 - Specific > Generic i.e. the participant / John ... themselves ... > someone / some man ... themselves ...
- Interaction effect of Specificity x Ambiguity (p < 0.05)
- No effect of group (i.e. no difference between binary and non-binary individuals). Data collapsed across groups for plots

Averaged waveforms for electrode PZ

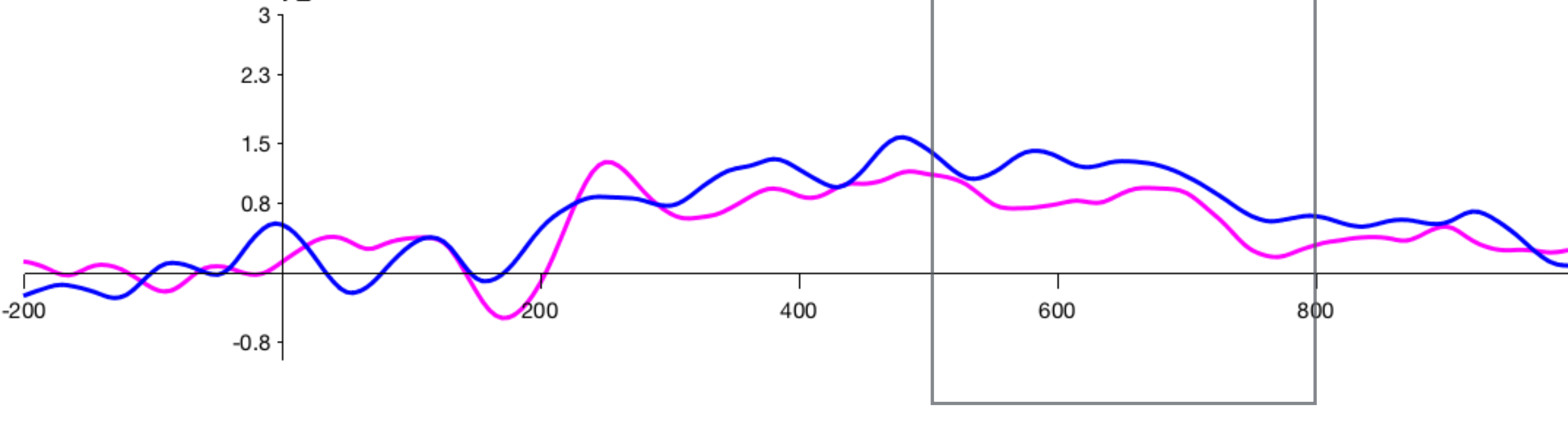
Someone vs. Some people



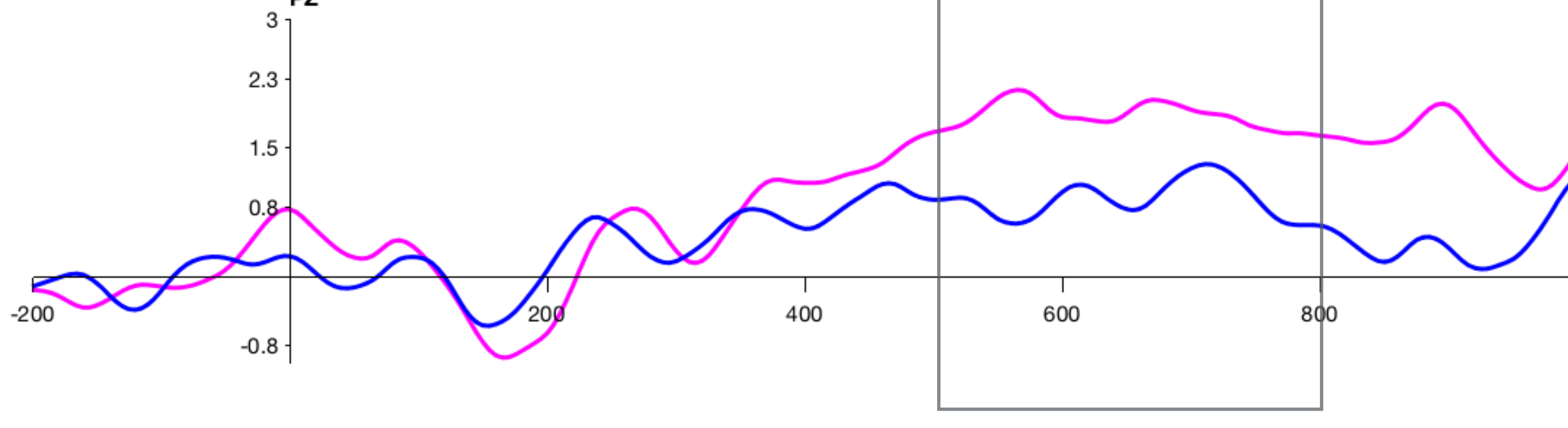
The participant vs. The participants



Some man vs. Some men

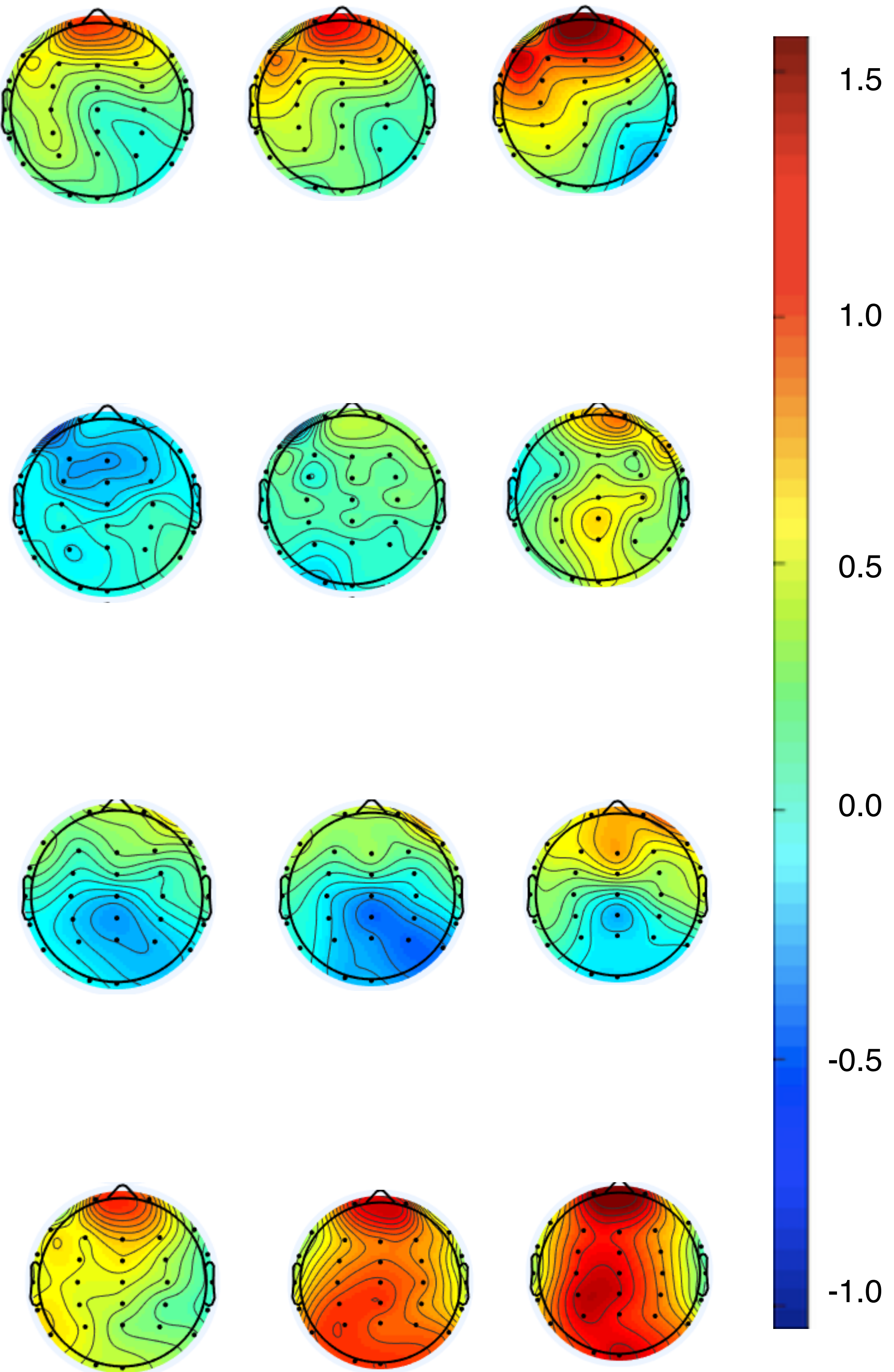


John vs John and Mary



Scalp maps for singular - plural

300-500 500-800 800-1000



Time locking trigger: /s/ in ‘themselves’

Conclusion

Summary:

- P600 for masculine / feminine names
- No P600 for antecedents with ambiguous gender
 - ‘the participant’ is also 0-feminine
- Suggests P600 for singular ‘themselves’ can be attributed gender mismatch (± feminine vs 0-feminine) and not number mismatch (+singular vs -singular)

Implications:

- If an antecedent is 0-feminine (either because we don’t know the gender or because we know the person identifies as being non-binary), then the data suggest that one can use singular ‘they’ to refer to them without additional processing effort (assuming P600 is a good measure of processing effort)
- Despite having a morphological plural marking, no P600 was elicited when associating some singular antecedents with ‘themselves’. This suggests singular ‘they’ can be effective as a singular gender neutral pronoun
- Even people who have a lot of practice with using gender neutral pronouns and people who identify as being gender non-binary have additional processing effort when using singular ‘they’ for antecedents that are stereotypically male or female.
 - Would they also have additional processing effort while using singular ‘they’ for male presenting or female presenting individuals?

Further questions:

- Would we find similar results for people with no practice using gender neutral pronouns?
- Would gender neutral names like ‘Sam’ behave like ‘the participant’ ?
- Would stereotypically gendered common nouns like ‘the engineer’ or ‘the nurse’ behave like ‘John’ or ‘Mary’
- Can people adapt to expect ‘themselves’ with ‘Mary’? If yes, would it generalize to other unambiguous names?

Acknowledgments

This study was funded by grants from:

- The Foundation for Psychocultural Research Hampshire College Program in Culture, Brain, and Development
- The school of Cognitive Science at Hampshire College

Thanks to

- Anastasia Karavan and Kirsten Lydic for help with experimental setup and data collection
- Mara Breen, Giuli Dussias, Tal Linzen, Brian Dillon, Neil Stillings, Daniel Altshuler and Andrew Zito for inputs on the design and/or data interpretation