

Neural Correlates of Conflict During Interpersonal Communication Observed in Dorsolateral Prefrontal Cortex using NIRS

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Introduction

Background

Stroop tasks are designed to elicit conflict between stimulus dimensions and/or response choices.¹⁻³

-Delay in reaction time and activity in specialized neural circuits are taken as evidence for biomarkers of conflict.¹⁻³

QUESTION:

Does conflict between gesture and word engage canonical language systems, such as Wernicke's and Broca's areas, or is it associated with more domain-general systems tied to social function?

Subjects

- 34 healthy volunteers: 27 male, 7 female; mean age: 24

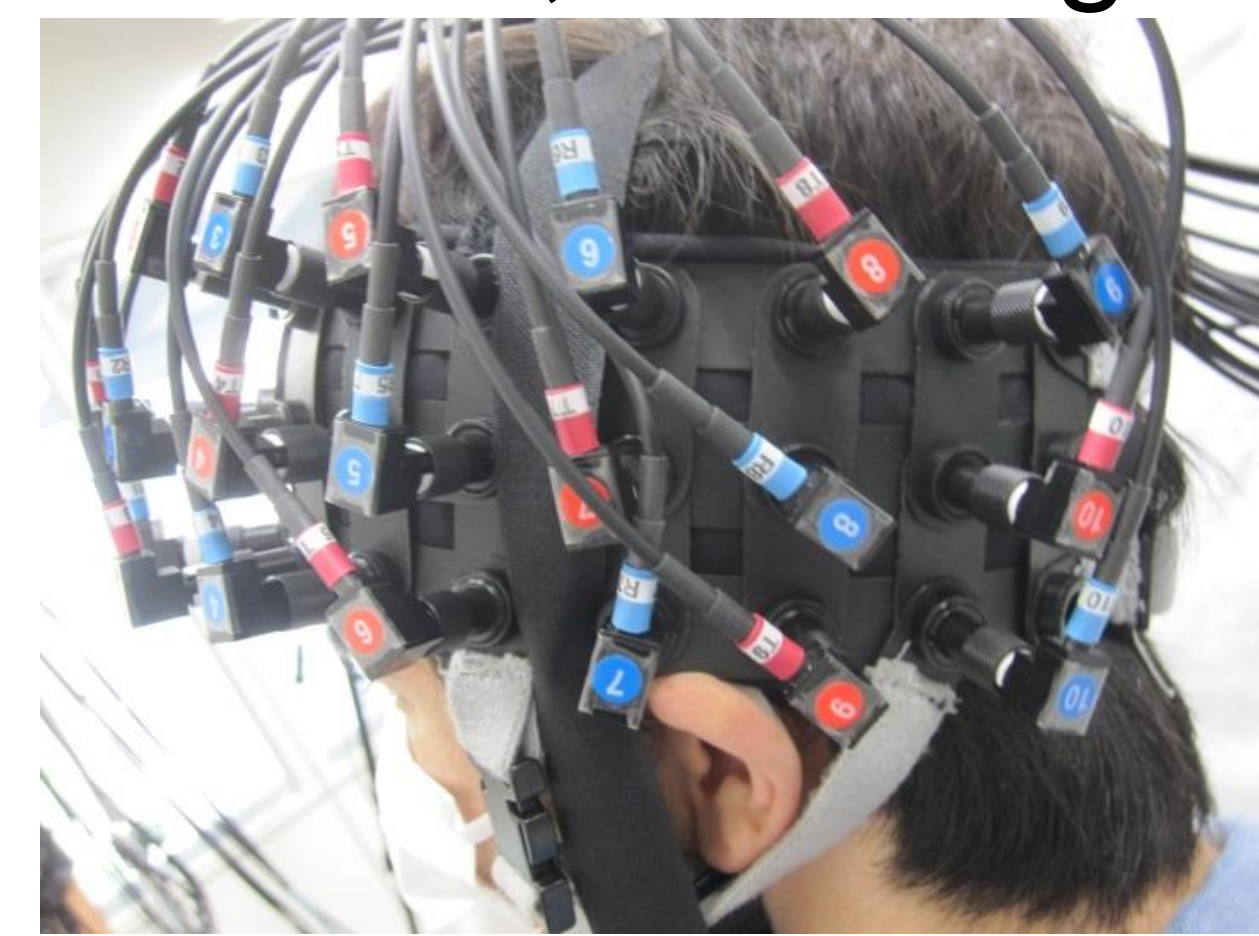


Figure 1. fNIRS optode layout with emitters (red) and detectors (blue) on left hemisphere

Media

- 648.25, SfN 2014

- A pdf version of this poster is available here:

<http://fmri.org/publications/Yahil-et-al-SFN-Poster-2014.pdf>



- You can also get the poster by scanning the QR code on the left.

Experimental Design

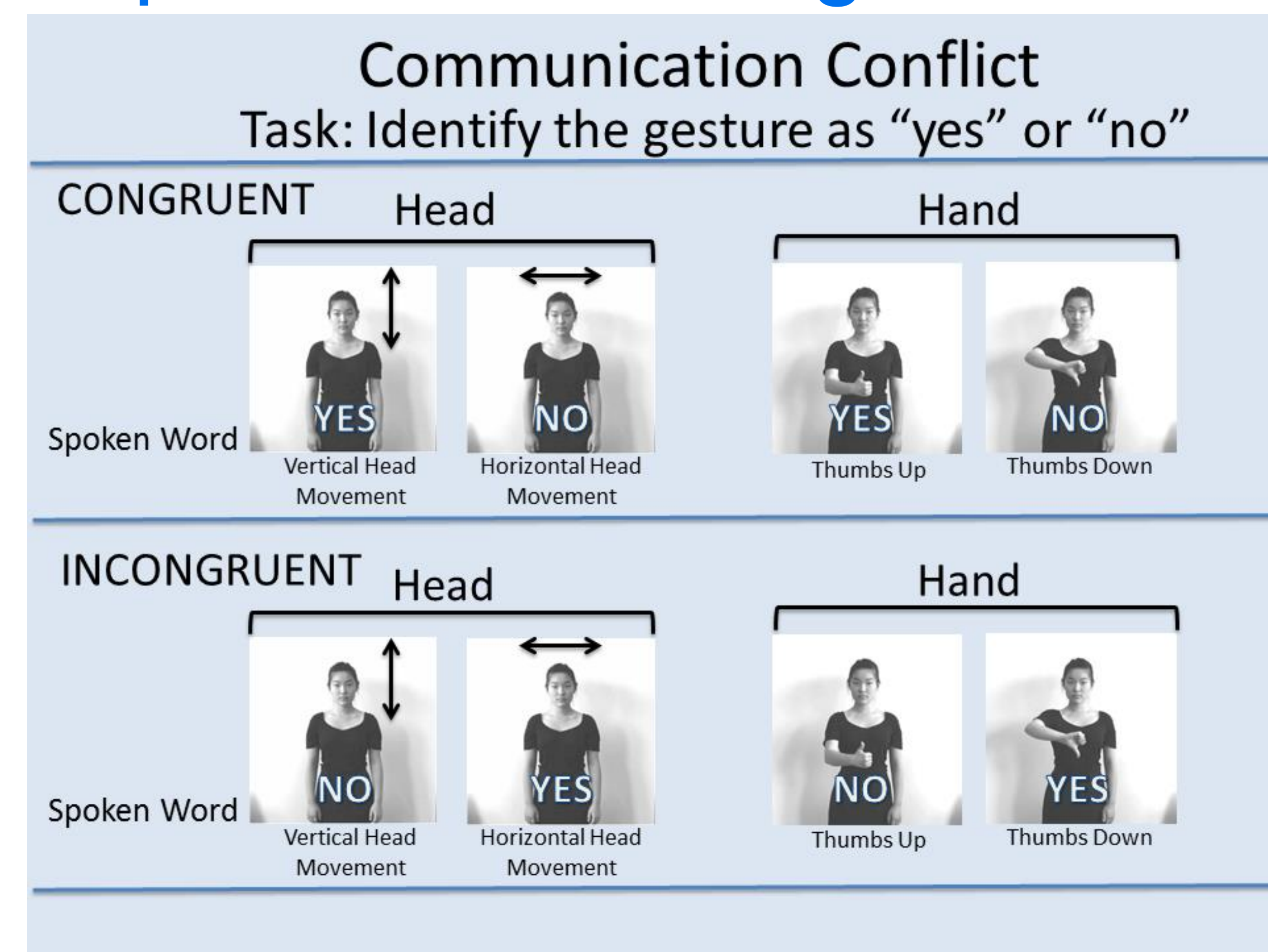


Figure 2. Video: head shake, nod, thumbs up, thumbs down. Audio: "yes" and "no." Gestures are congruent or incongruent with spoken word

- Subjects use button responses to indicate the meaning of thumb or head movements as "yes" or "no."
- 6 each of congruent and incongruent-dominant blocks, alternated with 15s rest
- 4 trials per block, ISI: 3.75s

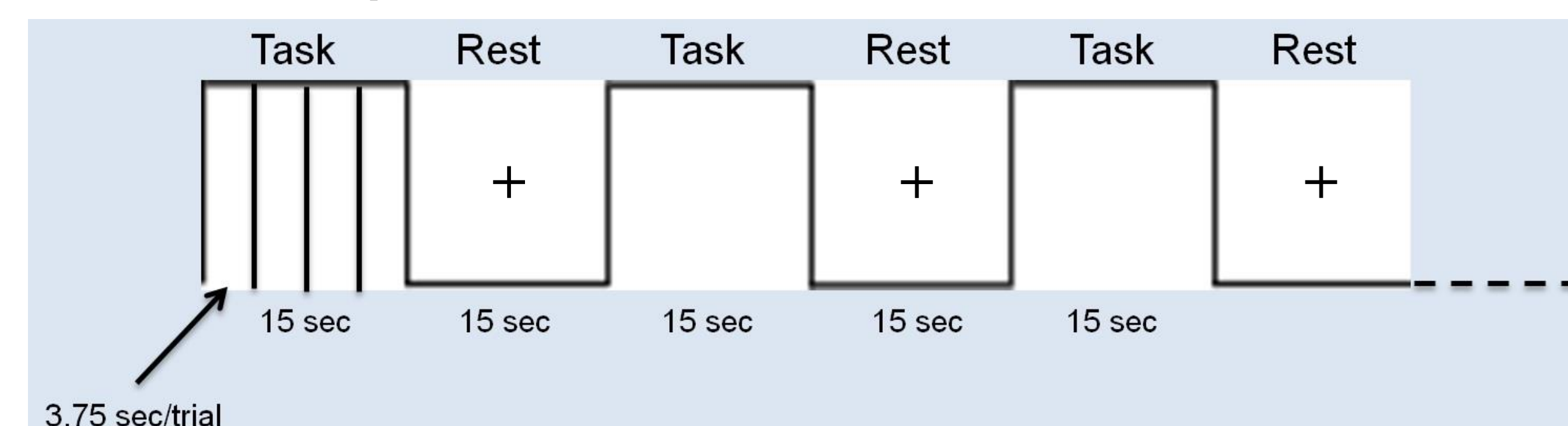


Figure 3. Task design: 15s task alternates with 15s rest. 4 trials per block. Fixed ISI of 3.75s.

fNIRS Acquisition

- Continuous-wave functional near-infrared spectroscopy (Shimadzu LABNIRS) sampled every 33ms.
- 30 channels registered to standard MNI coordinates using SPM-NIRS (Bioimaging and Signal Processing Lab, KAIST) and a 3D digitizing system (Polhemus Patriot)

Neuroimaging Results

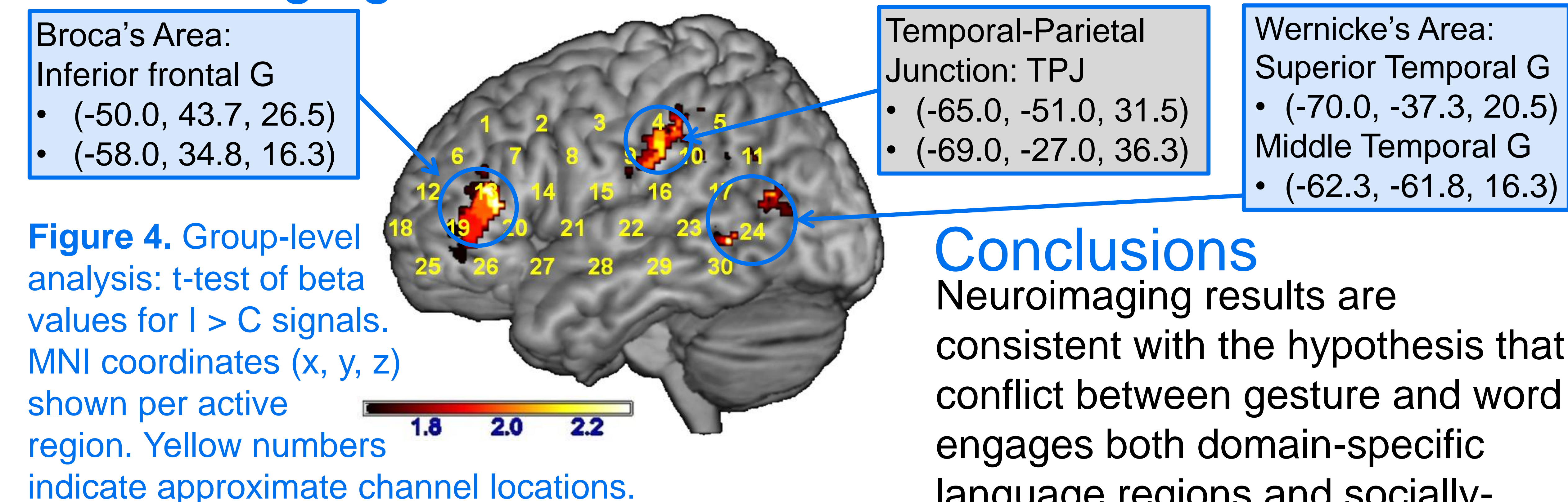


Figure 4. Group-level analysis: t-test of beta values for I > C signals. MNI coordinates (x, y, z) shown per active region. Yellow numbers indicate approximate channel locations.

fNIRS Analysis

- fNIRS oxyhemoglobin signals were low-pass filtered, detrended, and event-trigger averaged in MATLAB
- Channel locations were converted to MNI maps with SPM-NIRS (BISPL).
- A GLM was used to obtain beta values of event-triggered signals, incongruent greater than congruent (I > C), projected onto 3D brain

Behavioral Results

Within-subjects Analysis

-The difference in reaction time for congruent and incongruent trials was significant: $p < 0.05$, $df: 30$, two-tailed.

$\mu: 21\text{ms} \pm 9\text{ms}$ (SEM)

Group Analysis

-Congruent reaction time:

$\mu: 741\text{ms} \pm 28\text{ms}$ (SEM)

-Incongruent reaction time:

$\mu: 762\text{ms} \pm 30\text{ms}$ (SEM)

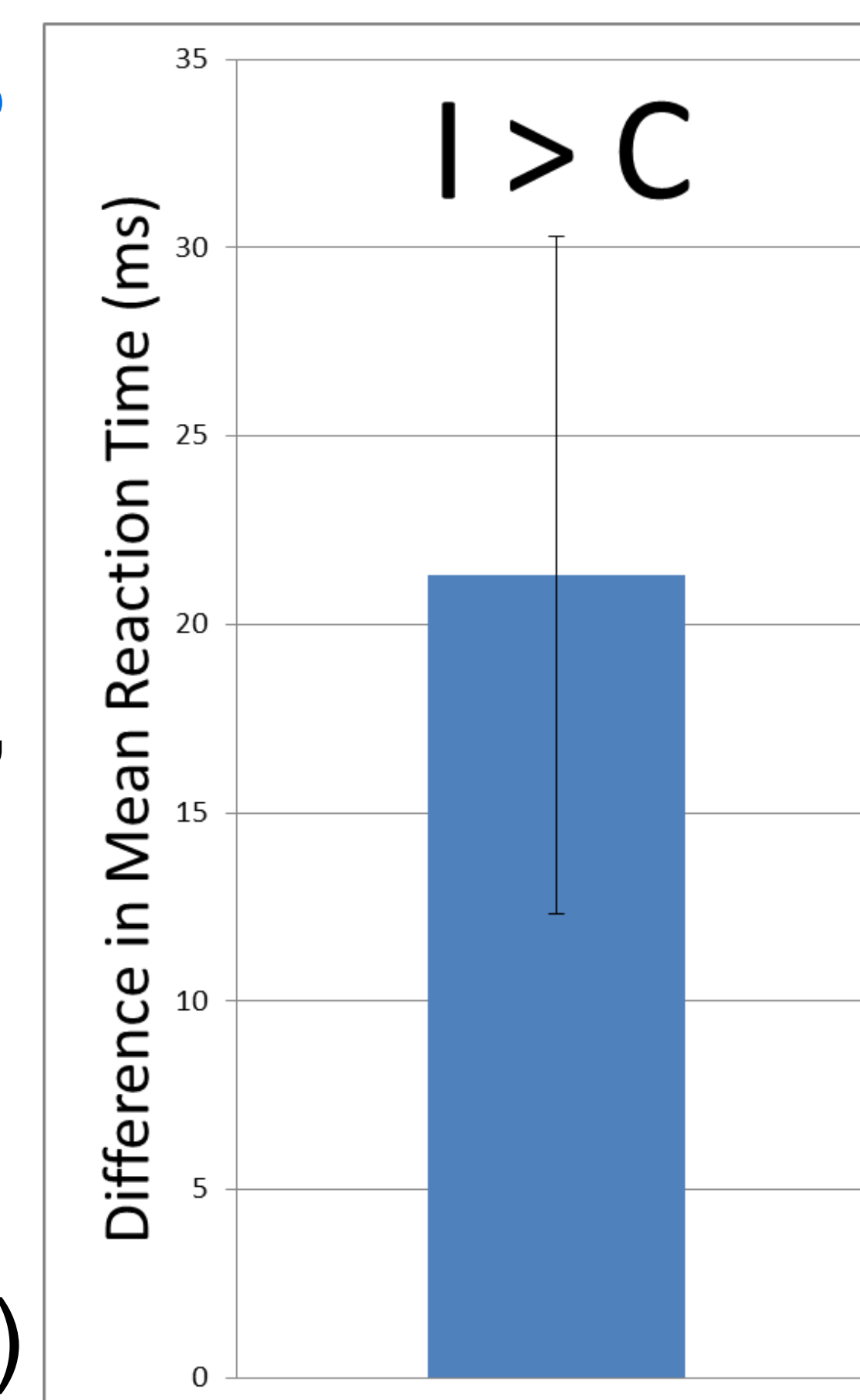


Figure 5. Reaction time differences (ms) for incongruent trials larger than congruent.

Conclusions

Neuroimaging results are consistent with the hypothesis that conflict between gesture and word engages both domain-specific language regions and socially-responsive neural circuitry.

Domain specific (blue boxes):

- Wernicke's Area: STG/MTG
- Receptive language
- Broca's Area: IFG
- Language production

Socially-responsive (gray box)

- Temporal-parietal junction: TPJ
- Social processing⁴

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