The neural correlates of comprehending American Sign Language-English code-blends

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Introduction

Bimodal bilinguals often "code-blend", producing signs and words simultaneously, which can facilitate comprehension in both the signed and spoken languages (Emmorey, Petrich, & Gollan, 2012. Bilingual processing of ASL-English code-blends: The consequences of accessing two lexical representations simultaneously. Journal of Memory and Language, 67:199-210).

Questions:

1) What brain regions are recruited during code-blend comprehension?
2) What brain regions mediate the behavioral facilitation observed for code-blend comprehension?
   - Is facilitation associated with increased or decreased activation?

Methods

Participants:

13 hearing native ASL-English bilingual adults (6 female, mean age = 26.85)

Task & Procedure:

60 unique items (trials) per language per subject

Semantic decision task:
Is it edible?

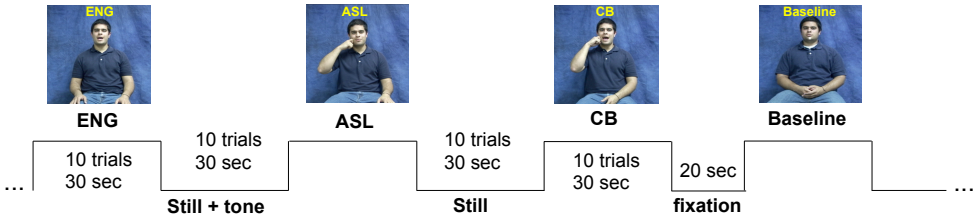
Control decision task:
Is the dot on the chin black?

Stimuli:

- 18 lists of 10 nouns (mean Celex frequency = 3.05, range = 0 - 6.41)
- Lists counterbalanced across subjects
- Baseline task: silent model at rest with dot on chin, ½ with audible tone

Each item filmed with hearing native signer producing:

a) an ASL sign translation (ASL)
b) an audiovisual English word (ENG)
c) signed and spoken word simultaneously (code-blend, or CB)



MRI acquisition

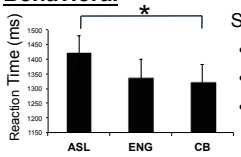
- GE 3T, gradient echo echo-planar imaging
- TR = 2s; FOV = 240mm; 30 4.5mm contiguous sagittal slices

MRI Analysis

- General linear model, multiple regression using AFNI
- Mixed effects group ANOVA on individuals' beta weights

Results

Behavioral

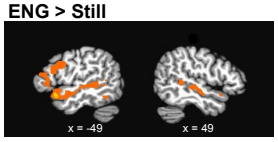


Semantic decisions were:

- faster for code-blends than for ASL, $p < .005$
- faster for English than for ASL, $p < .05$
- equally fast for English and code-blends

Language vs. Baseline

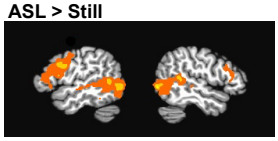
ENG > Still



English recruited:

L inferior frontal gyrus
L premotor cortex
L/R STG (anterior)

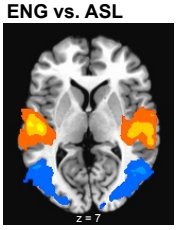
ASL > Still



ASL recruited:

L/R inferior frontal gyrus
L premotor cortex
L/R STG (posterior)
L Lingual gyrus

ENG vs. ASL



ENG > ASL
ASL > ENG

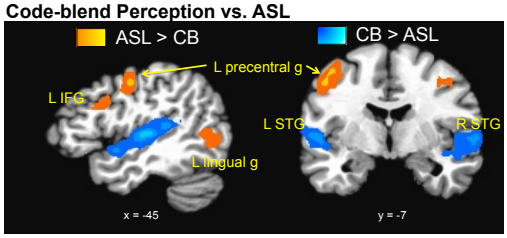
Code-blending

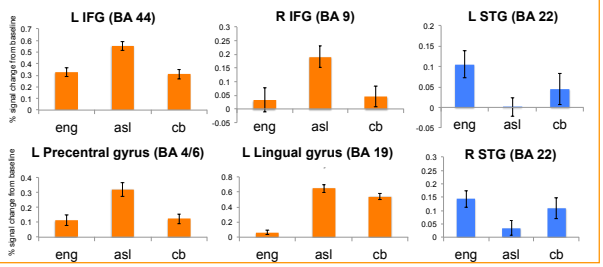
Code-blend > Still

Code-blends recruited:

L inferior frontal gyrus
L premotor cortex
L/R STG (anterior)
L/R STG (posterior)
L Lingual gyrus

Code-blend Perception vs. ASL





Conclusions

- Decreased activity for code-blend comprehension in frontal language and posterior visual regions may reflect reduced effort when ASL comprehension is aided by redundant cues from English.
- Similarly, in left STG the trend toward decreased activity during code-blend perception may reflect reduced effort when English comprehension is aided by redundant cues from ASL.

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