Expressive and receptive language in people with early brain injury.

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Introduction

The purpose of the present study was to examine the functional neuroanatomy of audiovisual discourse comprehension in people with early unilateral periventricular brain injury (Figure 1) as compared to a group of sibling controls. We also relate activity in specific regions of interest to behavioral measures of receptive and expressive language.

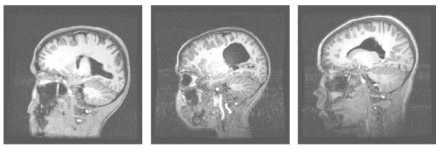

Figure 1. Sagittal views of three people with early periventricular injury. This type of injury, generally occurring during the early third trimester, typically effects white matter in the area of the ventricles.

The Present Study

Participants.
Participants were 16 people with early periventricular brain injury (LH injury: n = 9; RH injury: n = 7; age range 7 years - 30 years) and 27 typically developing sibling controls (age range 8 years - 32 years). The groups were roughly matched on age (p = .94, *n.s.*).
General Design.
Functional MRI (3T) was performed while participants watched a female storyteller narrating a story from Aesop's fables, during which audiovisual content was manipulated in four conditions:

1) Gesture: The speaker made meaningful, speech-associated gestures.
2) Self-Adaptor: The hand movements were semantically unrelated to the speech.
3) No-Hand-Movement: The speaker kept her hands in her lap, but information from the face was available.
4) No-Visual-Input: Participants heard the story while viewing a fixation cross.

Behavioral Measures: Outside the scanner, participants received the CELF receptive and expressive language measures (Semel et al., 1995), and the Johnson-Newport grammaticality judgment task on two separate testing days (Johnson & Newport, 1989).

Results

We examined several inferior frontal, inferior parietal, and posterior temporal ROIs (Figures 2-4). Only comparisons with the Gesture condition are reported. We also examined the relation between fMRI activation and performance on the language measures. Correlations between inferior frontal activation during Gesture and language ability are reported in Table 1.

Table 1.
Correlations between activation in inferior frontal regions during the Gesture condition and receptive and expressive language measures for each group.

	Left Hemisphere			Right Hemisphere		
Pars Opercularis (BA 44)	Siblings	LHD	RHD	Siblings	LHD	RHD
CELF-RLS	0.02	0.03	0.39	-0.22	0.44	0.09
CELF-ELS	0.34	-0.29	0.45	-0.07	0.37	-0.14
Newport Day 1	0.31	-0.83**	0.61	-0.04	-0.2	-0.42
Newport Day 2	0.37	-0.75*	0.82*	0.05	-0.13	-0.37
Pars Triangularis (BA 45)	Siblings	LHD	RHD	Siblings	LHD	RHD
CELF-RLS	0.24	-0.08	-0.05	0.31	0.19	-0.07
CELF-ELS	0.45*	-0.41	-0.02	0.55**	-0.09	-0.02
Newport Day 1	0.33	-0.74*	0.46	0.51**	-0.66	-0.02
Newport Day 2	0.33	-0.52	0.65	0.48*	-0.68	0.4

Note. LHD = Left Hemisphere Damage. RHD = Right Hemisphere Damage. CELF-RLS & CELF-ELS = Clinical Evaluation of Language Fundamentals Receptive and Expressive Language Scales. Newport Day 1 & 2 = Newport Grammaticality Day 1 & Day 2. * p < .05. ** p < .01

Conclusions

• For siblings, audiovisual information from hand movements led to greater activation, bilaterally, relative to the other conditions.

•This pattern held somewhat for people with RHD, but it was less prominent for people with LHD.

•For people with LHD, increased activation in the left inferior frontal gyrus was associated with decreased performance on language measures.

Figure 2. *Typical Siblings*. Inferior frontal, inferior parietal, and posterior superior temporal ROIs for all conditions.

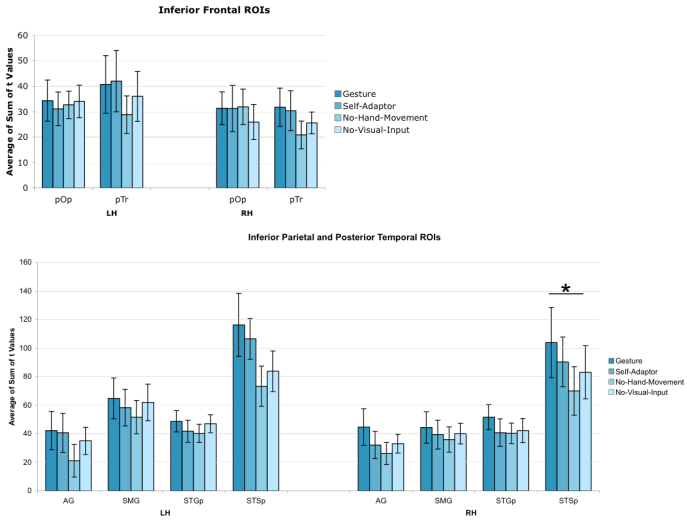

Figure 3. *People with Left Hemisphere Damage*. Inferior frontal, inferior parietal, and posterior superior temporal ROIs for all conditions.

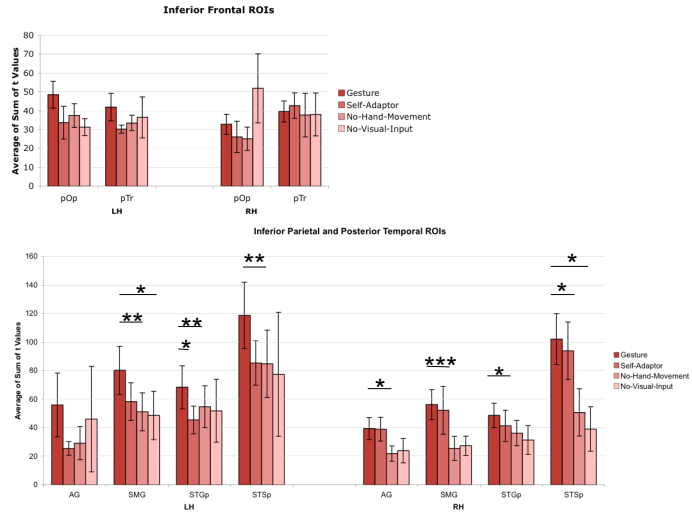

Figure 4. *People with Right Hemisphere Damage*. Inferior frontal, inferior parietal, and posterior superior temporal ROIs for all conditions.

References. Johnson, J. S., & Newport, E. L. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology, 21*, 60-99.
Semel, E., Wiig, E., & Secord, W. (1995). *Clinical Evaluation of Language Fundamentals (3rd Ed.)*. San Antonio, TX: The Psychological Corporation.
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