

Does Gesture Play a Special Role in the Brain's Processing of Language?

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Background

People of all ages, cultures, and backgrounds gesture when they speak. What function do these hand movements serve? Although there is consensus that gesture plays an important role in language production, there is considerable theoretical debate as to what role gesture plays in language comprehension (Clark, 1996; Kelly, 2001; Kelly, Barr, Church, & Lynch, 1999; Krauss, 1998; Krauss, Morrel-Samuels, & Colasante, 1991; McNeill, 1992). At the core of this debate is the fact that previous research has relied on indirect behavioral measures that do not provide access to the underlying neurocognitive processing of speech and gesture. The present research addresses this issue by using a more direct neurocognitive measure: event-related potentials (ERPs). ERPs measure electrical brain activity and have been used successfully in previous research on the neural processing of language.

Methods

In Study 1, adult participants watched videos of speech and gesture, in which the gesture conveyed the same, complementary or different information as the accompanying speech. ERPs were recorded to the speech in these different gesture contexts. In Study 2, participants watched videos similar to Study 1, but the gesture was replaced with digitally-inserted visual information (a vertical or horizontal line representing different dimensions of the objects) that either conveyed the same, complementary or different information as the speech. The goal of Study 2 was to determine whether the results from Study 1 were due to gesture *per se*, or simply any visual information that preceded speech.

Results

The results from Experiment 1 have been published (Kelly, Kravitz & Hopkins, in press) and reveal that gestures not only influence ERPs to speech, but also that the gesture influence is late (N400) and early (sensory, P1-N1 and P2 components) in the brain's processing of speech. This suggests that gestures may affect not only high-level semantic processing of speech, but also low-level phonological processing as well.

Study 2 is currently in progress to determine whether the results from Study 1 are unique to gesture, or whether any

meaningful visual information will have a similar impact on the brain's processing of speech.

Discussion

Researchers know very little about the neural time course of how gestures influence speech comprehension. This question bears on important theoretical issues in language research: are there aspects of language processing that are impervious to contextual influence? When does a gestural context influence the neural processing of language? In addition, the results will address a debate in the literature about the "specialness" of the relationship between speech and gesture in language processing (McNeill, 1992). Finally, by taking ERPs to speech using real-time, multimodal videos, this project makes an important methodological contribution to the neuroscientific investigation of language processing.

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