

EEG analysis of Brazilian sign language comprehension

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Sign languages result from the effort of the deaf community to discover and create ways to communicate and they reach the complexity of any other spoken language, which includes: phonology, morphology, syntax; semantic and pragmatic fields. Phonology divides the minimal distinctive units of each arm, hand, and face movement. Morphology can be applied to create many different words from the same radical. Syntax defines the word gesture positions of all the symbols into the phrase. Word meanings are correlated with the gesture movements, but these movements are far from being just mimics. They have their own abstractions and can create a large semantic field. As any other language, the sign language depends on the effect created by the gestures so the signer could evaluate their practical meanings and power of expression.

ASL is a very well known sign language, and neuroscience has shown that most of the neural areas involved with oral languages production and comprehension are also involved in ASL processing. The Brazilian Signed Language (Libras) is gaining importance in the Brazilian deaf community. Its first dictionary was recently published, but nothing is known about its brain processing. The present paper investigated the brain activity associated with the comprehension of signed charades and stories by a group of Brazilian deaf people that uses Libras as their first language. The EEG methodology used here is the same employed by our group to study charade and story comprehension in oral languages (Foz, et al., *Pediatric Neurology*, 2002/26: 106–115).

The most peculiar fact in the present results is the common enrollment of neurons at parietal-medial (PZ), central (C3, C4), and frontal (F3, F4) bilateral areas in Libras decoding. Frontal verbal areas (F7, FP1, F3) and left temporal areas (T3, T5) are also involved with the linguistic processing. The visual stimulus created by the sign languages comprehend facial expression, hand shape and movement, and the relative position of the hand in respect to the body. The activation of the central and parietal areas of the left hemisphere may be involved with the hand shape processing. It is near Wernicke's area, whose neurons are in charge of accessing the semantics of the words. Also, the hand parietal area makes connections with pre-motor cortex, and probably with Broca's area. The position of the hands in relation to the body is also processed by neurons in the parietal areas, whereas hand movements are processed by neurons at temporal medial areas.

The results show some similarities between Libras and oral languages processing such as the involvement of the oral language areas at frontal and temporal sites. But they also show the activation of central and parietal areas probably involved in motion processing of hands and arms and the activation of widely right brain areas may be involved in some visual representation of the signs and the spatial reference used in sign languages. These results seem also to point to a common neural processing for both Libras and ASL, which may indicate a particular neural structure for sign language comprehension.