Brain Organization: Clues from Sign Aphasia

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Introduction

The general objective of our research is to study the neurobiology of language. American Sign Language (ASL) displays complex linguistic structure, but unlike spoken language, it cannot be defined by manipulating spatial relations. Sign is used in ASL as a full-blown natural entity (1) to encode grammatical relations (2), morphology (3), syntax (4), and many other aspects of world semantics (5). The core of spatial process is to depict the world in terms of spatial relations in real space and time (6). The main goal of the Salk ASL Aphasia Examination (SALAE) is to provide a reliable and valid assessment procedure to study sign language behavior. It includes a battery of tests, including speech, language, perception, memory, and reasoning tasks, and experimental tasks which probe spatial mapping into the different areas of facial expressions in ASL.

Brain Lesions of LHD and RHD Deaf Signers

- Left Hemisphere Damaged Signers
  - LHD-101
  - LHD-102
  - LHD-103
  - LHD-104
  - LHD-105
  - LHD-106
  - LHD-107
  - LHD-108
  - LHD-109
  - LHD-110
  - LHD-111
  - LHD-112
- Right Hemisphere Damaged Signers
  - RHD-201
  - RHD-202
  - RHD-203
  - RHD-204
  - RHD-205
  - RHD-206
  - RHD-207
  - RHD-208
  - RHD-209
  - RHD-210
  - RHD-211

Findings

Brain Organization for Geometric Aspects of Sign Language. In this section, we review examples of the mechanisms underlying the organization of sign language in the brain. We then discuss how the findings of our sign aphasia studies can be used to inform the development of new models of sign language processing. The goal is to understand how different brain regions contribute to the production and comprehension of signs. We focus on two main areas: the role of the left hemisphere in sign language and the role of the right hemisphere in spatial processing.

Spatial Discourse Deficits in RHD Signers

- RHD-205
- RHD-206
- RHD-207
- RHD-208

Different Deficit Patterns in 4 RHD Signers

- Grammar: Spared
- Cognition: Sparred
- Discourse: Impaired

Spatial Cognition Impairment in RHD

- Deficits in LHD but not RHD on ASL
- Profiling of Sign Characteristics
- Sample Item on ASL

Neglect for Spatial Cognition but not Sign Language in a RHD Signer

- Evidence for Left-Visual Neglect in RHD
  - Super JH
- Neglect for Spatial Cognition

Dissociation between Affective and Linguistic Facial Expressions in RHLH Deaf Signers

- Superimposed lesions of LHD & RHD

Conclusions

The overarching goal of this program of studies is to elucidate the neurobiological foundations of human language, especially as they relate to the production and comprehension of sign language. Using a combination of lesion and neuroimaging paradigms, we aim to identify the neural substrates that support the higher-order processes involved in language cognition, particularly in the context of sign language. By examining the patterns of brain activation and lesion localization in deaf signers, we hope to gain insights into the neural mechanisms underlying language processing, and to contribute to the broader understanding of the neurobiological basis of human language.