The Neural Signature of Spoken Language

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During evolution, the human being was the only creature that achieved to adapt biologically evolved complex language[3]. Therefore, the cerebral architecture of spoken language differs fundamentally from the neural organization of written language, which represents a purely cultural achievement[23]. According to a currently popular view, spoken language developed from a "proto-sign" language, given that there were evolutionary considerable advantages connected to spoken language[2]. In the contemporary form, spoken language and sign language are therefore both naturally developed complex communications systems that enable an exchange of information between individuals, based on a circumscribed control system and implemented very similarly in the human brain[13].

Since the establishment of imaging techniques for investigating cognitive functions in the human brain for about fifteen years ago, the knowledge about the neural signature of language in the human brain has changed radically[15]. While at the beginning of the 21th century one adhered to the classical neurological model, which primarily postulated the existence of two language centres (the inferior frontal "Broca's area" and the superior temporal "Wernicke's area") in the left hemisphere[21], it is now believed that a widely branched network of cortical hubs, knodes, and modules in the left and in the right hemisphere is involved in the processing of speech perception and expression[5,11,22]. In turn, these modules are connected to each other by major inter- and intra-hemispheric fibres of white matter and consequently guarantee the exchange of information on diverse levels of linguistic and primarily acoustic respectively visual-motoric information[4]. The areas that are relevant for sign and spoken language are concentrated in the territory around the left and the right Sylvian fissure and establish the "core language system"[14,24]. In respect of language acquisition, vital importance has been attached to the question of labor division, because it has been shown that the perisylvian regions of the right hemisphere are optimized for the processing of pre-linguistic information[7,10,18–20].

The latest neurobiological models emphasize the importance of the integration of aspects from spatial and temporal processing of language relevant information in the human brain[6]. They draw a highly complex picture of language processing, which integrates and processes semantic, syntactic, and prosodic information by referring to various dorsal and ventral streams[1,25]. So far, there has been little effort to reconcile the process requirements of these models with the neuroanatomical architecture at the micro- and macroscopic level. However, there is evidence to suggest that perisylvian macro- and microscopic hemispherical asymmetries, which possess a specific importance for the functioning of certain areas while processing language, exist[8,9,12,16,17].

The talk is going to give you a wide overview about the current research concerning the connection between spoken language and the human brain and will inform you about possible parallels and differences between neural signatures of spoken language and sign language.

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