Lexical Access in Sign Language: A Computational Model

Theories of lexical access have predominantly been built upon data from spoken language, which leaves open the question: How many of the conclusions truly reflect language-general principles as opposed to modality-specific ones? There are a number of ways the language processing architecture could be organized with respect to facts about the signed and spoken modalities. At one extreme, it's possible that because signed and spoken languages are perceived through different channels (auditory versus visual), they utilize different cognitive mechanisms for all but the most central (i.e., semantic) stages of processing. It is also reasonable that signed and spoken word recognition utilize similar cognitive mechanisms to access sub-lexical and lexical elements, with only the specific content differing across modalities (e.g., manual sign location vs. oral place of articulation).

Whereas neighbourhood density effects differ by task in spoken language (e.g., inhibitory in speech perception, facilitatory in speech production), the effect of neighbourhood density in sign language depends on the types of signs considered. When a target sign has many neighbors that share the same handshape, recognition is facilitated; when a sign has many neighbors that share the same location, recognition is inhibited (e.g., Carreiras, Gutiérrez-Sigut, Baquero & Corina, 2008). One interpretation of this is that lexical access is modality-specific as there are no correlates to location and handshape in spoken language.

Using a computational model, we explore the possibility that differences in sign and word recognition are in fact superficial and that a common mechanism underlies lexical access in both modalities. Chen and Mirman (2012) presented a computational model of word processing that unified opposite effects of neighborhood density in speech production, perception, and written word recognition. We present a spreading activation architecture that borrows the principles proposed by Chen and Mirman (2012), and show that if this architecture is elaborated to incorporate relatively minor facts about either 1) the time course of sign perception or 2) the frequency of sub-lexical units in sign languages, it produces data that match the experimental findings from sign languages. This work serves as a proof of concept that a single cognitive architecture could underlie both sign and word recognition.

Reference

Carreiras, M., Gutiérrez-Sigut, E., Baquero, S., & Corina, D. (2008). Lexical processing in Spanish Sign Language (LSE). *Journal of Memory and Language*, *58*(1), 100-122.

Chen, Q., & Mirman, D. (2012). Competition and Cooperation Among Similar Representations: Toward a Unified Account of Facilitative and Inhibitory Effects of Lexical Neighbors. *Psychological Review*, *119*(2), 417.