

## THE EFFECT OF MODALITY ON SIGNAL SPACE IN NATURAL LANGUAGES

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Natural language in the visual-gestural modality provides an opportunity to discover which aspects of sub-lexical structure are common between the two language modalities<sup>a</sup>—spoken language and signed language—and which aspects result from emergent properties grounded in the signaling and perceptual systems. The project reported here finds that there are fundamental differences in how words are constructed in each modality, offering evidence that contrastive features in both types of phonological system are emergent, not innate. What *is* shared are more general design features, such as those proposed by Hockett (1960): i.e., *productivity*, *arbitrariness*, *discreteness*, etc. However, the findings suggest that the principle of *duality of patterning* is in need of refinement if it is to apply across modalities.

A dataset of 1,868 signs in Kenyan Sign Language (KSL) were coded for 39 formational characteristics, such as *number of hands*, *handshapes*, *palm orientation*, *finger orientation*, *type of movement*, *manner of movement*, *1<sup>st</sup> major area*, *2<sup>nd</sup> major area*, *1<sup>st</sup> minor area*, etc. During coding and analysis, minimal pairs were gathered that differed by the narrowest possible degree—i.e., by only one formational feature.

Previous researchers have mentioned that sign languages have few minimal pairs (Sandler 1996: 202; Brentari 1998: 4; Kooij 2002: 160), but a comprehensive account of phonological contrasts has not been available until now. The results of the current study finds that there are around 370 true

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<sup>a</sup> Tactile Sign Language used by deaf-blind individuals could be an emerging third natural language modality (Edwards 2014)

minimal pairs in the dataset, with only 40 signs that contrast with more than one other sign.<sup>b</sup> Conservatively calculating from the set of recombinable elements in the language indicated by minimal pairs, there are millions of possible signs,<sup>c</sup> a very large combinatoric space for a primarily monosyllabic language; and much larger than monosyllables in spoken languages (Kirby & Yu 2007).

Why do sign languages have such a large phonological space? A likely explanation relates to the fact that signs are not comprised of strings of segments as are words in spoken languages; and therefore cannot use sequential, syntagmatic structure to construct words and create distinct form-meaning mappings. Instead, as the present study suggests, signed words depend on a multitude of simultaneous features for boundless *productivity* in word creation.

These features are also *discrete* and have *arbitrary* properties,<sup>d</sup> but they do not fully conform to Hockett's view of *duality of patterning*, which appears to rest on syntagmatic contrast such that segments can be reordered (e.g., 'tack', 'cat', and 'act' [Hockett 1960: 92]). Thus, some refinement of Hockett is necessary to incorporate language without strings of segments.

## References

- Brentari, D. (1998). *A Prosodic Model of Sign Language Phonology*. Cambridge, MA: MIT Press.
- Edwards, T. (2014). *Language Emergence in the Seattle DeafBlind Community*. PhD Thesis. University of California Berkeley.
- Hockett, C. F. (1960). The Origin of Speech. *Scientific American*, 203(3), 88–96.
- Kirby, J. P. and A. C. L. Yu. (2007). Lexical and phonotactic effects on wordlikeness judgments in Cantonese. *Proceedings of the 16th International Congress of Phonetics Science*: 1389–1392.
- Kooij, E. van der. (2002). *Phonological Categories in Sign Language of the Netherlands*. LOT.
- Sandler, W. (1996). Phonological features and feature classes: The case of movements in sign language. *Lingua* 98: 197–220.

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<sup>b</sup> I.e., there are not large “rhyming” clusters, such as in English: ‘saw’, ‘paw’, ‘law’, ‘thaw’, ‘raw’, etc. In sign language, an example of such a cluster is signs with the same movement and handshape, but different locations. The biggest cluster in KSL contains six signs.

<sup>c</sup> Based on the following phonemes in KSL: 33 handshapes, 29 locations, 5 absolute orientations, 3 path shapes, 4 path directions, 6 manners of movement, 6 syllable types, and 10 other misc. features

<sup>d</sup> They also have many motivated, non-arbitrary properties—a topic beyond the scope of this paper.