Untangling vertical and horizontal processes in the evolution of handshapes

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In Guido’s most recent post in this miniseries on sign language manual alphabet evolution, he discussed the role of character mapping on networks in phylogenetic inference. He pointed out how we used this approach to infer evolutionary pathways of languages and why this step in exploratory data analysis is important, given the complexity of the underlying signal in this data set. In this post, I take up the topic of handshape evolution in more detail, explaining some of the complexities involved in studying sign language evolution and looking specifically at how we can identify vertical and horizontal processes in the evolution of handshapes.

We know very little about how signs and handshapes evolve. There have been a few studies—most of them from decades ago—comparing American Sign Language in videos and dictionaries from the early 20th century with then contemporary forms (Battison et al. 1975; Frishberg 1975). One study in particular argued that, as a sign language emerges in a community of signers, crystallizing into a stable linguistic system, signs evolve in a quasi-teleological way from earlier, more gesture- or pantomime-like forms to more language-like forms, cutting similar evolutionary pathways leading to more constraints on articulation and to general systematization.

But what happens (in this story) once sign languages become linguistic systems? Do they continue evolving, as happens in spoken languages? If yes, how? Investigating these kinds of questions was one of my motivations for tracking down historical examples of manual alphabets for over a dozen sign languages. The pay off (besides the thrill of the treasure hunt) is that, in tracing handshapes through historical examples and comparing them with contemporary sign languages, we can infer or, in some cases, deduce vertical and horizontal evolutionary processes affecting sign languages and handshape forms.

Consider part of the neighbor-net from the main paper including the Austrian-origin and Russian groups in the figure above. Russian 1835 is the earliest manual alphabet in our sample published in Russia (St. Petersburg); and Danish 1808, in the Danish subgroup, was published in Copenhagen. While the two manual alphabets are found in differing neighborhoods in the graph, they share a number of handshapes, some of which were (and still are) shared widely throughout Europe for reasons that we discuss in the main paper.
One such handshape represents the letter A in both Danish 1808 and Russian 1835. Note the position of the thumbs at the bottom of the figure above: in both early examples, the thumb is adjacent to the bent index finger. In an example from Danish SL in 1907 (and subsequently in 1926 and 1967), the position of the thumb has shifted across the index finger. For Russian SL, too, the position of the thumb in the contemporary handshape representing the Cyrillic letter A has crept across the index finger to the front of the fist (the handshape in the figure is my attempt to reproduce the source; see here for the real thing).

There are two points to note here in connection with evolutionary processes. First, these changes in thumb position appear to have a vertical aspect: as signers in a community used these handshapes and transmitted them to later generations, they also modified the forms in subtle ways, perhaps unconsciously in a process with analogies to sound change in spoken language. Second, the changes include a horizontal aspect: the forms evolved in similar ways, as the two signing communities converged on the same shape (apparently) independently, possibly due to similar articulatory or perceptual pressures. The horizontal aspect of this process contributes to signal incompatibility in the network graph: the more convergence, the less structured the neighbor-net will be (in this case, the more spiderweb-like).
In addition to the preceding example, a typical case of convergence can be seen in the independent creation of similar handshapes to represent the Greek and Cyrillic letter Г. Beginning again with the main neighbor-net in the figure above, we see that Russian 1835 and contemporary Greek SL are found in differing neighborhoods, with Greek in the French-origin group. The two languages, however, share the Г-representing handshape (the Russian form is from Fleri 1835; the Greek form is, again, my hand; see here for the real one). Because Greek SL is the only language in the French-origin group to share this handshape with the Russian group, there is a clear suggestion of a horizontal process that resulted in similar handshapes across unrelated languages. The most likely processes are convergence due to the independent creation of iconic representations of the written letter; or lateral transfer—called borrowing in linguistics—via some historical instance of contact between signers of the two languages. (My intuition is the former explanation.)
The final example deals with a clear case of *borrowing*. The figure above shows the time-/taxon-filtered neighbor-net including historical manual alphabets up to about 1840, but only annotated with the relevant languages. The earliest two manual alphabets in our dataset were published in Madrid: Yebra 1593 and Bonet 1620. In neither do we see any trace of a handshape representing the letter W, which was not needed to represent the Latin alphabet. Later too, manual alphabets published in Spain in 1815, 1845, and 1859 did not include the letter W. In contrast, in Austrian 1786 (manual alphabet from 1786) and French 1799-1800 (as well as other languages), handshape forms representing the letter W are found in the earliest examples we have for those languages.

Some 160–230 years later, however, we find similar forms for W in contemporary Austrian, French, and Spanish SLs. We deduce that contemporary Spanish SL did not inherit the W-handshape from the 19th century Spanish manual alphabets. Instead, the handshape may have been borrowed from some other language, possibly French SL given its influence on deaf education in Europe, or possibly later from the International Sign manual alphabet.

As these examples show, there are different types of horizontal processes contributing to conflicting signal in the data set. Using the splits network graphs together with historical examples of manual alphabets we can untangle the horizontal signal in many cases. The approach has also given us some insight into evolutionary processes contributing to the diversity of contemporary sign languages, a topic we plan to investigate more fully in a follow-up paper.
References


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