Signed Language Transcription and the Creation of a Cross-linguistic Comparative Database

Justin M. Power, David Quinto-Pozos, Danny Law | The University of Texas at Austin

10th Workshop on the Representation and Processing of Sign Languages: Multilingual Sign Language Resources; LREC 2022

Transcription in language comparison

- The availability of signed language data has rapidly increased in the form of online dictionaries[1,2,3,4] and corpora[5,6,7,8].
- But, there are few cross-linguistic comparative databases that include easily comparable representations of the forms of signs[9].
- Transcription has played a crucial role in the cross-linguistic comparison of spoken languages, but less of a role in the comparison of sign languages.

Sign Change project uses transcription techniques (HamNoSys[10]) to create a comparative database of basic vocabulary for 13 signed languages.

Research questions

How much time is required for well-trained transcribers to complete transcriptions of signs?

Once completed, how similar are the transcriptions that were produced by the trained transcribers?

Data and methods

Transcribers

- Two undergraduate research assistants
- Both were L2 adult learners of ASL who had taken multiple classes (approx. 225 face-time hours over 18-month period)
- Initial training period in HamNoSys of 1 month + part-time work in project for 1 year.
- Training instructed transcribers to produce narrow transcriptions

Signs

- 100 basic vocabulary signs from *Vlaamse Gebarentaal* (VGT, or Flemish Sign Language[11]); neither transcriber had previous experience with VGT
- 63 one-handed signs, 37 two-handed signs
- Words consisted of Nouns (n=45), Verbs (n=19), Adjectives (n=26), Adverbs (n=7), and Pronouns (n=3).

Comparison Methodology

- Levenshtein distance to pairwise compare the difference between transcriptions and to derive similarity scores from those differences.

1 difference (in handshape) / 8 symbols in the longest transcription (3 handshape, 2 orientation, 1 location, 2 movement) = 0.125. Thus, similarity score is 1-0.125=0.875

Timing

Time to complete a transcription

- Together, the transcribers averaged 95.2 seconds (*SD*=38.1) per transcription
- But, they completed their transcriptions at different rates on average.
  - Transcriber-1 (*M*=82.2 seconds, *SD*=26.7)
  - Transcriber-2 (*M*=108.3 seconds, *SD*=43.1)
  - Transcriber-1 significantly faster, on Welch's t-test, $t(166.6) = -5.1$, $p < .001$

Effect of the transcription system on transcription time

- More HamNoSys symbols → Longer transcription times
  - Significant positive correlation, $r(200) = .72$, $p < .001$.

- Hence one-handed signs were transcribed more quickly than two-handed signs
  - One-handed signs = 84.8 seconds (*SD*=31.4)
  - Two-handed signs = 113.1 seconds (*SD*=41.8)
  - Significant positive correlation, $r(200) = .36$, $p < .001$.

Effect of the type of sign on transcription time

- Phonological complexity (measured by number of HamNoSys symbols) is unevenly distributed across parts of speech and semantic categories in VGT.
- For example, pronouns and numeral signs in VGT were transcribed using relatively few symbols, whereas nouns, body part signs, and non-iconic signs were transcribed using comparatively more symbols; see Table 1.

Part of speech	Mean symbols per transcription	Mean time (seconds)
Pronoun (n=6)	12.0 (6.0)	63.2 (16.9)
Adverb (n=14)	14.4 (4.8)	72.4 (13.0)
Verb (n=38)	17.7 (7.1)	89.7 (31.6)
Adjective (n=52)	18.2 (8.6)	96.1 (43.4)
Noun (n=90)	23.6 (10.7)	102.8 (38.1)
Semantic category		
Numeral (n=10)	7.8 (2.5)	59.9 (16.0)
Body part (n=26)	20.3 (7.8)	91.2 (31.3)
Color (n=10)	18.5 (9.5)	100.2 (41.8)
Semiotic category		
Non-iconic (n=18)	20.2 (9.1)	97.6 (34.2)

Table 1. Average transcription time (in seconds) and length of transcription in selected lexical categories. Standard deviations are in parentheses in the two rightmost columns.

Reliability

Similarity of transcriptions

- Average similarity of a pair of full transcriptions = 0.69 (*SD*=0.18) for all 100 pairs

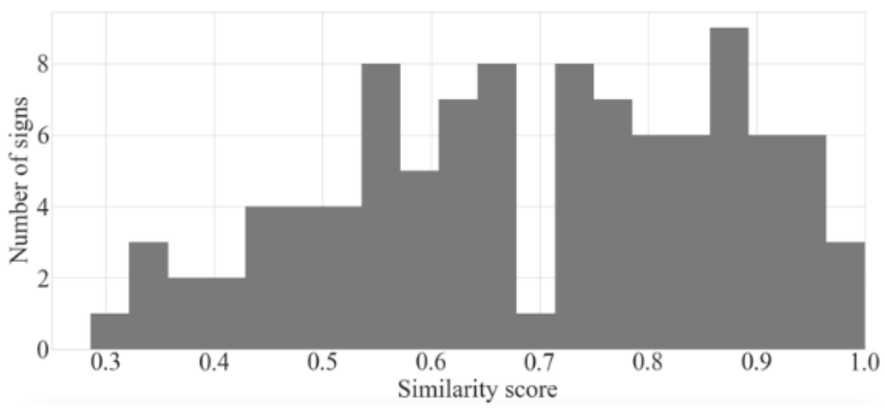

Figure 1. Distribution of similarity scores for all 100 pairs of signs.

Similarity by sign parameter

- Handshapes (*M*=.88, SD=.24) and symmetry values (*M*=.87, *SD*=.32) scored highest for similarity, followed by locations (*M*=.76, *SD*=.30), orientations (*M*=.67, *SD*=.33), and movements (*M*=.63, *SD*=.29).

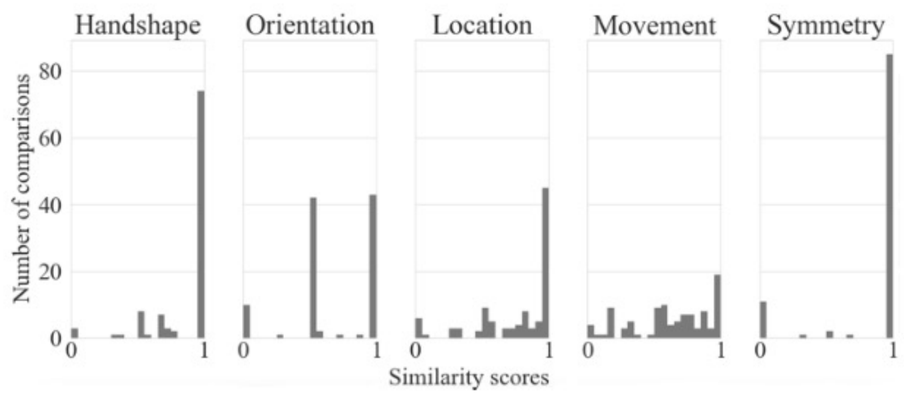

Figure 2. Comparison of similarity scores by parameter.

Discussion

How much time is needed to create a comparative database of transcribed lexical signs?

Number of signs	Time (hours)
1000	26.5
2000	52.9
5000	132.3
10000	264.6

Table 2. Calculated time expected to transcribe databases of various sizes, based on the results in this study.

Why are handshapes transcribed more reliably than other parameters?

- Iconicity: Transcribers may be more accurate if the transcription symbols are more iconic, although we did not test this empirically.
  - Handshape symbols (such as) are highly iconic, whereas, for example, palm-facing symbols are less iconic

- Signed language pedagogy: Transcribers may be more attuned to identifying handshapes versus other parameters.
  - Handshapes are explicitly taught (e.g., fingerspelling and handshape charts) to L2 learners.

- Categorical perception: Transcribers may perceive handshapes more categorically than other parameters.
  - Handshapes are perceived categorically, whereas other parameters (such as location) may not be[2].

Future Questions

Is more time required to transcribe manual signs or spoken words?

- Transcription of spoken words in IPA may be faster than transcription of signs in HamNoSys. Why?
  - Arguably, the narrow phonetic transcriptions in our study are more fine-grained than the phonemic transcriptions (i.e., practical orthographies) that are typically used to transcribe a word list. However, this remains to be tested empirically.

Are some parts of manual signs (e.g., parameters) and of spoken words (e.g., consonants or vowels) easier to transcribe?

- Handshapes are more categorically perceived than other parameters[2].
- Stops in English are more categorically perceived than vowels[13].
- Does categorical perception affect transcription of signed and spoken languages?

Acknowledgments: Special thanks to the two transcribers. Thanks also to the conference organizing committee. And, thanks to Zachary Bricken for his assistance in creating this poster.

This research has been supported by NSF grant BCS-1941560 "Regularity and Genetic Relatedness of Sign Languages". As always, any opinions, findings, and conclusions or recommendations expressed here are those of the authors and do not necessarily reflect the views of the national Science Foundation.

References
1 Stumpf, M.R., Pizzio, A.L., Lucinda, J.O., Quadros, R.M. de, & Crasborn, O. (2020). SignBank da Libras. *Fórum Linguístico*, 17(4):5475–5487.
2 Caselli, N.K., Sehyr, Z.S., Cohen-Goldberg, A.M., & Emmorey, K. (2016). ASL-LEX: A lexical database of American Sign Language. *Behavior Research Methods*, 49:784–801.
3 Hochgesang, J.A., Crasborn, O., & Lillo-Martin, D. (2020). *ASL Signbank*. New Haven, CT: Haskins Lab, Yale University. https://aslsignbank.haskins.yale.edu/.
4 Morgan, H.E., Sandler, W., Stamp, R., & Novogrodsky, R. (2022). ISL-LEX v.1: An Online Lexical Resource of Israeli Sign Language. *LREC* 2022.
5 Johnston, T. & Schembri, A. (2007). Testing language description through language documentation, archiving and corpus creation: The case of indicating verbs in the Auslan Archive Corpus. In P. K. Austin, et al., (Eds.), *Proceedings of Conference on Language Documentation and Linguistic Theory*, 145–154. London: SOAS.
6 Prillwitz, S., Hanke, T., König, S., Konrad, R., Langer, G., & Schwarz, A. (2008). DGS Corpus Project. *LREC* 2008.
7 Schembri, A., Fenlon, J., Rentelis, R., Reynolds, S., & Cormier, K. (2013). Building the British Sign Language Corpus. *Language Documentation & Conservation*, 7:136–154.
8 Kimmelman, V., Komarova, A., Luchkova, L., Vinogradova, V., & Alekseeva, O. (2022). Exploring Networks of Lexical Variation in Russian Sign Language. *Front. in Psychology*, 12:740734.
9 Hanke, T., König, L., Wagner, S., and Matthes, S. (2010). DGS Corpus & Dicta-Sign: The Hamburg studio setup. *LREC* 2010.
10 Hanke, T. (2004). HamNoSys –Representing Sign Language Data in Language Resources and Language Processing Contexts. *LREC* 2004.
11 Vlaams GebarentaalCentrum. (2018). *VGT Signbank*. Gent, Belgium. https://vlaamsegebarentaal.be/signbank.
12 Emmorey, K, McCullough, S., & Brentari, D. (2003). Categorical perception in American Sign Language. *Language and Cognitive Processes*, 18(1):21–45.
13 Fry, D.B., Abramson, A.S., Elmas, P.D., & Liberman, A.M. (1962). The identification and discrimination of synthetic vowels. *Language and Speech*, 5(4):171–189.