SiLOrB and Signotate: A Proposal for Lexicography and Corpus-building via the Transcription, Annotation, and Writing of Signs

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Abstract

This paper proposes a system of standardized transcription and orthographic representation for sign languages (Sign Language Orthography Builder) with a corresponding text-based corpus-building and annotation tool (Signotate). The transcription system aims to be analogous to IPA in using ASCII characters as a standardized way to represent the phonetic aspects of any sign, and the writing system aims to be transparent and easily readable, using pictographic symbols which combine to create a 'signer' in front of the reader. The proposed software can be used to convert transcriptions to written signs, and to create annotated corpora or lexicons. Its text-based human- and machine-readable format gives a user the ability to search large quantities of data for a variety of features and contributes to sources, such as dictionaries and transcription corpora.

Keywords: transcription, orthography, annotation tools

1. Introduction

This paper proposes a system of standardized transcription and orthographic representation (Sign Language Orthography Builder; SiLOrB), which corresponds to a text-based and searchable dictionary- or corpus-building and annotation tool (Signotate). Though a few notation and transcription systems have been created for sign languages in the past (c.f. Stokoe, 1960; Hanke, 2004, and Sutton, 2010), none have yet become the standard, perhaps due to difficulty of use and structure that does not resemble the structure of signs. Consequently, sign language data is often presented with sign-by-sign or morpheme-by-morpheme glosses as a substitute for phonetic or phonemic transcriptions, even though this would be considered to be unacceptable for spoken language research. It also means that sign language corpora generally cannot be searched on the basis of phonetic aspects and that notes about articulation are not standardized. It is roadblock to lasting documentation and collaborative description.

While increasing use of any type of transcription and line drawings in sign language descriptions, dictionaries, and analyses is certainly a step in the right direction, line drawings and even videos do not indicate the same level of abstraction as a writing system. No matter how close it is to citation form, a line drawing or video clip is one example of a single signer with a specific dialect performing a sign. A writing system like SiLOrB has the potential to consistently represent the phonemic components of a sign with no distractors, and Signotate software allows for easy creation of such representations. Not only is this valuable for linguistic analysis, but it can be used to build easily-searchable and visibly transparent corpora and to create printed literature. While video or live signing is certainly the most reliable mode for communication (just as audio or live speaking is ideal for spoken languages), written language is a way to spread information in communities with limited access to video resources and to allow signers who are hesitant about being recorded to contribute to the conversation.

The sections below discuss the transcription and orthographic conventions used in SiLOrB (2), which aim to improve on existing systems, and the software that can be used to annotate texts with this type of notation (3). Both currently exist as early versions which aim to become a standardized and inclusive system for building sign language corpora.

2. Sign Language Orthography Builder (SiLOrB)

Past attempts at transcription or writing systems for sign languages have had shortcomings such as lack of completeness (e.g. limited non-manuals), use of non-standard characters (as in HamNoSys and SignWriting), and linear organization (as in HamNoSys and Stokoe notation). The SiLOrB transcription system is designed to be analogous to the IPA used for spoken languages: a universal set of ASCII characters and multi-character 'codes' which correspond to individual phonetic components of a language (Clark, 2018). It is transparent, customizable, and creates sign language texts which can be searched based on phonetic or phonemic aspects. The conventions it establishes can be easily incorporated as a system of organization and presentation for lexicons and other texts. It is both machine-readable and human-readable, and has been created with both signers and linguists in mind.

The SiLOrB system also corresponds to pictographic symbols which can be used to create orthographic representations of signs. Each code has a direct and predictable impact on the appearance of a sign's written form, though most symbols are combinatory. For example, a single complex symbol is used to depict the orientation and shape of a hand (see Figures 1-3). This type of symbology allows for a less linear representation which more accurately reflects a sign's articulation and phonemic structure. The sections below discuss basic aspects of the transcription (2.1) and writing (2.2) systems. Those who are interested in the full current version can visit https://bleegiimuusclark.com/home/silorb-sign-language-writing/.

2.1 Transcription

The system described here is based on what is known about phonemic distinctions in sign languages (see Jepsen et. al., 2015; Crasborn et. al., 2000), and aims to improve on existing forms of transcription. An early version of SiLOrB was used to write Sivia Sign Language (Clark, 2017), and the current version (2.0) is expanded based on

additional phonological distinctions used in ASL, Hawai'i Sign Language, and a few others. SiLOrB breaks a sign's articulation into the familiar categories of 1) shape and orientation of the hands, 2) location, 3) movement, and 4) non-manuals. Each category is specified with a capital letter code followed by the applicable phonetic information in a set order. A user can choose to describe a sign at the level of detail necessary for their objective, in order to fit the language's phonology or morphology, or even to record contrasting phonemic and surface forms of a sign. Because categories and descriptors are additive rather than mandatory, morphemes consisting of fewer components, such as a modification to handshape, a type of movement, or a facial expression, can be depicted individually as well.

After the specification of the dominant or non-dominant hand (D or ND), palm and finger orientation are given, followed by groups of fingers and their positions. 'DND^Vc*%A^+', for example, means that both hands (DND) are in a palms upward (^), fingers forward (V) position with all the fingers rounded (c) and making contact (*). Then both hands change (%) to palms bodyward (A), fingers upward (^) orientation with all the fingers extended (+). Locations (L) consist of a regional code and optional further specification of placement and contact, as in 'Lzv>< o' describing a location in zero space (z) below the waist (v) and near the vertical center (><), which is close to the torso but does not make contact (o). Movements (M) often consist of a direction and a path, as in 'M^sm' for upward movement (^) with a short trajectory (sm). Non-manuals (NM) give a part of the body followed by a position or movement code. 'NMM*' describes the mouth (M) in a pursed position. Thus, the sign for 'fire' in Sivia Sign Language (LSSiv) is transcribed as 'DND^Vc*%A^+; Lzv o; M^sm; NMM*' (see Figure 1).

For simpler signs which do not utilize every aspect, unnecessary categories are simply deleted from the transcription. The LSSiv sign for Peru, for example, uses only the dominant hand (D) in a consistent orientation and shape: forward palm (V) and upward fingers (^) with the index (1) and middle (2) spread (w). Its location (L) is simply the forehead (fh) with contact (x), and there are no movement or non-manual components. Thus, the transcription for 'Peru' is 'DV^12w; Lfhx'.

SiLOrB transcription has also changed from its original version to use more iconic coding conventions which limit language barriers for users who are not fluent in English. Though top-level category codes and some specifiers are based on English terms, arrow-like characters (^, v, <>, ><, >>, <<, A, V) are used for orientation, movement, and location specifiers. Similarly, emoticons are the inspiration for many mouth shapes, such as ')' for a smile and 'P' for an exposed tongue. Other codes are chosen to resemble a corresponding orthographic symbol, such as '%' for a change in position (as in Figure 1) or '*' for contact made with the fingertips.

Distinctions such as 'in' (toward the center) versus 'toward the dominant side' are clarified using digraphs (>< versus <<). Instead of requiring the absolute direction of each hand, 'inward' and 'outward' options allow a user to reference a vertical center line. This creates a distinction between mirrored and purely directional movement, and allows both types to be described with the same value for both hands (e.g. both hands inward or both hands toward the dominant side). This is one of the ways SiLOrB is geared toward phonemic representation and searchability, along with its hierarchical organization.

2.2 Written Representations

As with transcription, the objectives for the writing system are clarity, consistency, and ease of use. Some conventions are inspired by existing systems, such as the use of white for the palm and black for the back of the hand, as in SignWriting (Sutton 2010). The basic structure combines SignWriting's 'drawing of a signer' approach with some linear elements which add to its consistency and readability for longer texts. SiLOrB is described as 'non-linear' in contrast to systems like HamNoSys or Stokoe notation, which simply list handshape, orientation, etc. from the left to right. SiLOrB instead uses many combinatory symbols and works largely from the center outward. It does have linear components, however, due to handshape changes which are listed from left to right on both sides, the depiction of non-manuals on the far right, and formatting which standardizes the height of each component to resemble a line of text.

Full orthographic representations of signs (created with Signotate; see Section 3) combine pictographic symbols which are arranged as a 'signer' facing the reader. A location symbol is placed in the center with the hands (a combined shape and orientation symbol) on either side and movement to the outside of each hand. Non-manuals are given with the location if applicable (e.g. a central torso image may have markers for hands making contact with that location and for movement of the torso itself), and additional non-manuals occurring on other parts of the body are represented on the far right. Figure 1 shows the orthographic representation of the Sivia Sign Language (LSSiv) sign for 'fire' described in the previous section: 1) the center drawing of a torso indicates zero space and circles show that the hands are near a low and central part of the torso; 2) the hand symbols on either side show a change from palm up with fingers in a rounded position to palm bodyward with fingers extended, 3) movement arrows depict a short upward path, and 4) the face on the right edge shows pursed lips. (See B. Clark 2018 for a full description of the current system and examples with corresponding videos.)

Figure 1: Written representation of the LSSiv sign for 'fire' (DND^Vc*%A^+; Lzv>< o; M^sm; NMM*)

As in the transcription system, simpler signs may not use all of the available parameters, and appear with fewer symbols. The sign for 'coca' uses only the dominant hand and has no movement, so its orthographic representation is much shorter, as seen in Figure 2. The sign consists of an extended index finger touching a puffed out cheek. This is also an example of symbology that combines

locative and non-manual aspects in a single region (here, the head).

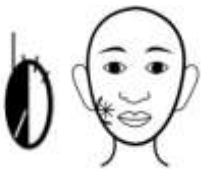

Figure 2: Written representation of the LSSiv sign for ‘coca’ (D><^1+; Lchk*; NMchk<>d)

Figure 3 shows the sign for 'cacao', which uses the non-dominant hand as its location and only moves on one side. The dominant hand with palm down and bent fingers moves outward repeatedly over the non-dominant hand with palm up and extended fingers. Again, a single unit depicts the features of the non-dominant hand and serves as the location for the dominant hand.

Figure 3: Written representation of the LSSiv sign for ‘cacao’ (Dv><r ND^><+; Lnd; M<>#)

3. Signotate Software

Software called Signotate is currently being developed to create written signs based on their SiLOrB transcriptions. It is also a tool for creating documents such as a transcript or a lexicon consisting of many annotated signs. Like SiLOrB, Signotate is designed to be intuitive for a variety of users and customizable for a variety of tasks. The following sections discuss specific features of sign entry (3.1) and search functions (3.2). Those who are interested in the project can visit https://github.com/Signotate to find out more and keep up with the latest updates.

3.1 Sign Entry

While SiLOrB transcription code and orthographic symbols can be created by hand as video annotations or entries in a lexicon, the Signotate software application provides an easy way to convert transcriptions into written signs and to create a lexicon or a transcript from multiple entries. It facilitates quick transcription in the field, allowing transcribers to rapidly add collected data to a corpus. Figure 4 shows the application’s interface, which guides a user to enter a sign’s transcription in the four main categories of hand, location, movement, and non-manuals. The default form is a one-handed sign which occurs on the dominant side of the body, though a user can choose to switch to the non-dominant side. For two-handed symmetrical signs, a ‘dual-sided’ option automatically copies a transcription to the non-dominant side as well, and for asymmetrical signs, an ‘asymmetrical’ option allows a user to edit both sides individually.

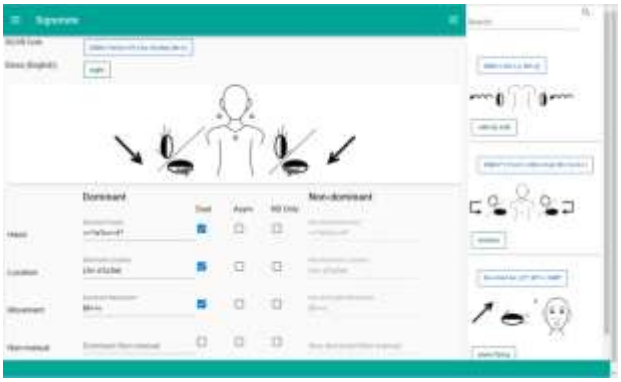

Figure 4: Screenshot of Signotate

Symbols appear in the upper box as codes are entered below to help ensure that the desired configuration is achieved. Additional signs in the same transcript or lexicon appear on the right panel with their transcriptions and glosses, and metadata can be entered below transcription codes. These fields allow a user to follow glossing and annotation conventions such as those outlined in Crasborn, Bank, & Cormier 2015, with the addition of standardized phonetic notation. Future implementations of Signotate may also include plugins for programs such as iLex or ELAN to allow written signs to appear along with time-aligned transcriptions.

3.2 Searchability

The system is indexed by articulatory features that a user inputs, so a Signotate corpus is instantly searchable by phonetic or phonemic components. Aspects like one- or two-handedness and symmetry or asymmetry are also included in searchable components, as well as some implications which are not explicitly expressed in transcription. For example, fingers described as ‘bent’ are also marked as extended, though SiLOrB coding only requires that ‘bent’ (r) be specified. Any field in metadata (e.g. glosses, morphemes, participants, location, timestamp, etc.) or code in the form of a sign (e.g. extended fingers, location, type of contact, movement direction, eye gaze, brow position, etc.) is searchable as well. Signotate is also able to perform SQL style searches. For example, one could search for signs that begin at any location below the waist, with the fingers oriented upward. Similarly, one could search for transcriptions that involve a person from Cusco who is between 25 and 30 years of age, and is not a native user of Peruvian Sign Language.

Signotate exists as both a web implementation and standalone desktop implementation. The desktop version, which stores its data locally in an SQLite database, can be used offline, while still enabling search across small to moderately-sized corpora. The web implementation, which is backed by Elasticsearch, is capable of searching across very large corpora. In the future, Signotate could support more complex searches and aggregations, such as phrasal search, or searches for grammatical or syntactic patterns. Signotate lexicons and transcripts can be imported from and exported to a human-readable yaml formatted file, as shown in Figure 5. (See https://bleegiimuusclark.com/signotate-v0-1-yaml/ for a complete example of this format.)

```
transcript:
- times:
    start: 1.51.416
    stop: 1.51.897
  usage: "typical"
  transcriptGlosses:
  - language: "English"
    gloss: "bee"
    morphStruct: "bee"
    signClass: "noun"
    usage: "typical"
  otherGlosses:
  - language: "English"
    label: "meaning1"
    gloss: "sting"
    morphStruct: "sting"
    signClass: "verb/noun"
    usage: "typical"
  sign:
    silorbCode: "D><^t*; Lchk; Mx#"
    properties:
      singleSided: "dominant"
      nonManual: false
    hands:
      silorbCode: "D><^t*"
      dominant:
        silorbCode: "><^t*"
        singleSided: "dominant"
        stages:
        - stageCode: "D><^t*"
          features:
          - palmIn
          - fingersUp
          fingerFeatures:
          - fingers:
            - 0
            - 1
            - 2
            - 3
            - 4
            features:
            - extended
            - tapered
            - contact
      nonDominant:
        singleSided: "dominant"
    location:
      silorbCode: "Lchk"
      dominant:
        silorbCode: "chk"
        singleSided: "dominant"
        stages:
        - stageCode: "chk"
          region: "chk"
          proximity: "near"
      nonDominant:
        singleSided: "dominant"
    movement:
      silorbCode: "Mx#"
      dominant:
        silorbCode: "x#"
        singleSided: "dominant"
        stages:
        - stageCode: "x#"
          other:
          - tap
          - repeated
      nonDominant:
        singleSided: "dominant"
```

Figure 5: Signotate yaml snippet for one sign

4. Conclusion

The culmination of SiLOrB and Signotate is the ability to build corpora of sign languages which include not only glosses and translations for videos, but annotation at several levels, including anything from phonetic features, morphemes, and single signs to extended texts such as narratives or conversations. The resulting corpora would utilize a detailed and universal format for talking about sign languages which is machine readable and easily used by language researchers and computational linguists for a variety of tasks including automated sign language transcription or analysis.

Descriptive, searchable, and standardized annotations combined with Signotate software open the door to new collaborative possibilities for sign linguists, for natural language processing researchers, and for signing communities. Aside from its descriptive and analytical advantages, these solutions will enable a user to create typed, alphabetized, and printed media for sign languages. Not only is this important for data preservation, presentation, and organization, but it can provide options for communities with limited access to video and online resources. The idiomatic nature, extensibility through documentation, and software suite help ensure high quality and long lasting documentation of sign languages for a variety of purposes.

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