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WRITING SIGN LANGUAGES: ANALYSIS OF THE EVOLUTION OF THE SIGNWRITING SYSTEM FROM 1995 TO 2010, AND PROPOSALS FOR FUTURE DEVELOPMENTS

Claudia S. Bianchini, Fabrizio Borgia

Abstract: SignWriting (SW) is a system for representing Sign Languages (SL), which, like many vocal languages have not developed an own writing system. SW is composed of a complex set of symbols (called glyphs) that allows encoding each component of the sign and is organized into a classification called ISWA (International SW Alphabet), where each glyph is identified by a unique numeric code (CNU). This paper examines the changes of SW through the years, changes that have affected the number of glyphs, their graphics, and the general organization of the classification; the analysis of the dynamics of SW modifications (that are both "top-bottom" and "bottom-top") allows to hypothesize how SW may evolve in the future.

Keywords: Deaf people, Sign language, SL representation, SL writing, SignWriting

I. REPRESENTATION OF SIGNED LANGUAGES (SL)

Sign Languages (SL) are visual-gestural languages used by most deaf people [01] [02] to communicate with each other. Like the majority of the vocal languages (VL) in the world, SL have an exclusively oral tradition [03] [04] [05] but, unlike the VL, they cannot be represented using systems inspired by pre-existing writing system [02] (e.g., the International Phonetic Alphabet) because of their not audio-phonatory nature.

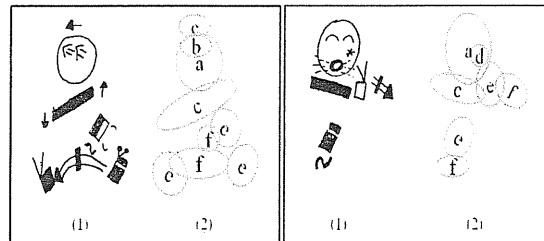
Over the years, numerous systems to represent the SL have been developed by researchers and educators, including the most used in the scientific community, the Stokoe Notation (SN; [06]) and the Hamburg Notation System (HamNoSys; [07]), the latter issued from the first. These systems are based on a set of symbols that represent the four "core" parameters of the SL (or at least those considered appropriate by Stokoe and his colleagues – see [06] and [08]): a) handshape b) location c) movement; d) palm orientation. The representation of the body postures and facial expressions, and the use of the gaze, although essential to convey the meaning of signs [09] [10], is seldom taken into account.

This approach, focused almost exclusively on the manual components of the sign, prevents the SN and HamNoSys (but also to all other derivative systems) to adequately represent the speech signed and specific features of the SL (for more details, see [05] and [11]). By providing only a partial description (and without some basic elements to convey the meaning),

such systems are difficult to read, making them unsuitable as a writing system for SL.

II. SIGNWRITING

SignWriting (SW), designed in 1974 by Sutton [12], is a system created to represent the SL based on a set of glyphs (i.e., symbols) that allow to represent each component, manual and not, of the SL (Fig. 1).



Legend: (a) facial expression: (b) gaze: (c) body and head position: (d) contact: (e) handshape: (f) hand and arm movement

Figure 1. (1) sketches in SW composed of many glyphs placed in the drawing similarly than in the "sign space", (2) identification of the glyphs (see circles) and the components represented.

Glyphs transmit iconically the shape of the element to indicate that range and arranged in a two-dimensional sketch which is the transposition of the space in which it develops the sign (called signing space), thus providing information on the spatial relationship that binds the different elements (for a description of the system, see [05]).

Numerous studies conducted on Italian Sign Language (LIS) by the ISTC-CNR-SLDS group have demonstrated the benefits of using SW as an instrument for transcription of the SL as well

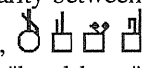
as a way for writing (e.g., [05] [11] [13]). In particular, these studies have emphasized how the iconicity of SW, the particular arrangement of the two-dimensional glyphs and the ability to represent all the components of the sign are well adapted to a multilinear language (which therefore conveys meaning through a multitude of articulators used simultaneously), a language that has the "iconicity as an organizing principle" [14] and in which the use of space and of gaze is fundamental for the creation of syntactic relations.






III. EVOLUTION OF SIGNWRITING





Since 1974, when it was created, SW is a constantly evolving system: this paper will focus on changes between 1995 (the date of its first computerization) and 2010 (year of release of the latest official version of SW), period during which 6 versions have been released: SSS1995 (Sutton Symbol Set), SSS1999, SSS2002, IMWA2004 (International Movement Writing Alphabet), ISWA2008 (International SignWriting Alphabet) and finally ISWA2010. In the following of this article, ISWA2008 will be used as reference version.







1. Sutton's classification


The glyphs in each version of SW are arranged within a consistent classification from the organizational point of view as well as from the graphic one.

On the first aspect, SW is organized (at least from 2002, see following § III.2) in prototyping Base Symbols (BSY), divided into categories (CAT) and Groups (GR) on the basis of similarity between the elements described¹: for example,  glyphs will all belong to the CAT01 "handshape" and GR02 "index and middle fingers." The graphics of the BSY undergo changes allowing the prototypes to become actual glyphs.

From this point of view, the configurations are very consistent; for example for the BSY : the right hand  will be specular to the left ; the color of the palm (here represented by the circle) will be white if the palm is visible , black for the back  and black and white for the

side ; if the hand is disposed on the vertical plan  fingers will be joined to the circle, if it is in the horizontal plan  will be slightly detached, and finally, the orientation of the glyph will change depending on the orientation of the hand  on the plan where it is placed. Every single BSY representing a configuration may thus be declined in 96 possible positions (see also Fig. 6).

For the movement too, some characteristics will be in common to all the glyphs: for example the movements on the vertical plan are always represented by double-shaft arrows  and the horizontal ones by single-shaft arrows ; the arrows with a black tip represent the movement of the right hand , the white tip is for the left hand  and the "blank" one is for both hands moving at the same time ; or the "rule of the road" is respected also in curved movements, i.e. that what is closer is represented with a thicker line, and therefore  describes a movement

that goes from near to far and  one that goes from far to near. Other elements, however, do not have the same consistent application, such as the number of possible orientations, or the ability to express a certain path of movement on different plans.

The organization of the Sutton's classification can thus be summarized in a diagram (Fig. 2): each BSY is placed in a CAT and a GR and can be declined in accordance with a set of rules that may have different applications depending on the BSY.

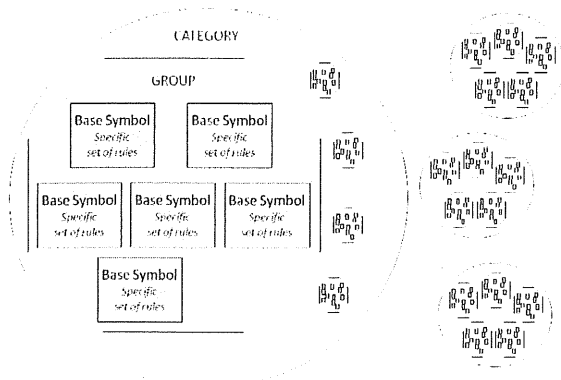


Figure 2. Organization of Sutton's classification

At each new version, SW continues to change in organization and graphics, as it will be shown below.

¹ A detailed analysis of the criteria of subdivision, which are not always consistent is presented in [05]; many of these inconsistencies are a direct consequence of the evolution of SW.

2. Alterations of the UNC

From the formal point of view, the evolution of SW is visible in the change of names of the set of glyphs, but also by the modifying of the Unique Numerical Code (UNC), the code used to identify individual glyphs within the classification (Tab. 1).

Version	SSS1995	SSS1999	SSS2002
Glyph			
UNC	s182-0-0	s204-1-1-1	09-01-001-01-01-01
Version	IMWA2004	ISWA2008	ISWA2010
Glyph			
UNC	08-01-001-01-01-02	05-01-001-01-02-01	03-01-001-01-02-01

Table 1. UNC attributed to a single glyph from 1995 to present

In versions SSS1995 and SSS1999, the CNU is composed of two parts: a number "S000" that identifies the BSY, (without the division into groups and categories) and three numbers that identify the graphical rules for editing the BSY. Since 2002, UNC has become a code consisting of 6 numbers: the first two (CAT and GR) identify the type of glyph; the following two (BSY and variation - VAR) define the prototype graph element described; the last two "decline" the graphical glyph (fill - FILL - and rotation - ROT). This is the version presented in § III.1, and can be summarized as in Fig. 3.

01 - 01 - 001 - 01 - 01 - 01

CATEGORY (Cat) GROUP (Gr) BASE SYMBOL (BSy) VARIATION (Var) FILL (Fill) ROTATION (Rot)

Figure 3. The Unique Numerical Code (UNC) used from 2002 to present

Changes at UNC are not only formal. With each new version, Sutton adds new glyphs, rethinks the way to classify them, and this results in substantial changes at UNC. Sutton must in fact decide, each time, whether to keep the consistency of the classification, keeping together glyphs that encode similar elements, or to maintain the UNC.

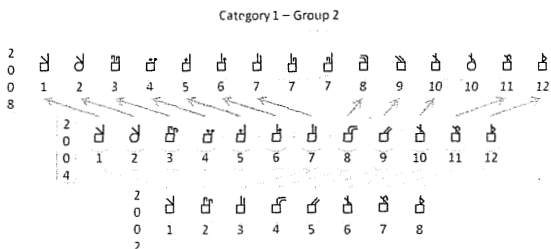


Figure 4. Displacement of prototypes from 2002 to 2008 within the CAT01 - GR01

Fig. 4 shows how the UNC of 8 different BSY has been maintained, or changed, between 2002 and 2008.

In 2004, Sutton added several new BSY including that she chose to insert between and , so as to maintain the coherence, given their bending similarity. In 2008, however, for the addition of and , Sutton decided not to change the UNC, entering the new glyphs as VAR02 and VAR03 of BSY07. This choice allows her to avoid dealing with the problems of conversion (change the UNC implies having to convert any text to the new standard in SW product with a previous version), but causes a loss of consistency in the classification, since similar variations of BSY (it is in both cases a bending of the fingers) are sometimes considered as BSY different and other times as VAR of the same BSY.

3. Alterations of the amount of glyphs

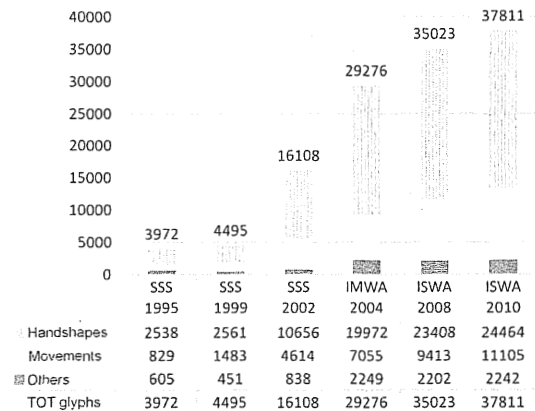


Figure 5. Variations of the number of glyphs needed to represent configurations, movements, or else

The BSY additions made by Sutton involve a steady increase of the glyphs for each version, as can be seen from the graph in Fig. 5.

Between 1995 and 2010, the number of glyphs has grown approximately 10 times, and this increase has been concentrated mainly in categories relating to handshapes and movements of the upper limbs.

The tendency of SW to be a system based on detailed graphic rules may justify some of these changes. For example, between 2002 and 2004, Sutton decided to switch from one representation identical for left and right hand to a separation between the two graphics options, and also to change from a rotation of 180° with only 4 possible orientations to a 360° orientation

with 8 possible orientations (Fig. 6). These two changes increase the number of possible variations of a prototype from 24 to the current 96, resulting in a 4-fold increase in the number of glyphs linked to handshapes. Similarly, the addition of a new handshape determines an increase of 96 glyphs within the system and Sutton added 97 new prototypes (i.e. 9312 new glyphs) in the transition between IMWA2004 and ISWA2008.

BSy	Right hand			Left hand		
	Palm	Side	Back	Palm	Side	Back
Vertical plan						
Horizontal plan						

Figure 6. Realizations of a BSy; on gray background, the choices added in the IMWA2004.

As already seen in Fig. 4, each change of version generates changes in the position of the glyph within the system of Sutton. Continuing to examine the configurations, for example, it appears clear how the addition of new prototypes has led Sutton to an unavoidable choice: to maintain the UNC or to keep the consistency in the arrangement of glyphs within the system.

Other types of modifications may occur and involve substantial increases: e.g., the addition of a plan where the trajectory of a movement is realized, or the amplitude for a movement, etc. Each of these changes requires to represent many glyphs, in order to fully decline the BSy being added or which underwent a change.

Each modification tends to improve the ability of SW to represent every component of the LS. However, the amplitude of the system, mainly organized on the basis of rules with plenty of exceptions (as is the case for the classification of Sutton), often leads to the emergence of new inconsistencies that need to be corrected in later versions.

4. Alterations to the glyphs graphics

Some changes of SW do not increase in the number of glyphs nor entail modifications in the UNC: they are replacements of glyphs to make more consistent the graphical solutions of SW.

An example is the evolution of the BSy representing the circular movement on the vertical plan.

Like most of the glyphs, changes over the years led this BSy to increase the number of its possibilities, from 24 glyphs in 1999 to 192 in 2010. But besides these changes, this BSy also changed its graphic style. In 1995, the circular motion on the vertical plan was represented by , which is not consistent with the graphic choice to represent the movements on the vertical plan with a double-shaft arrow, like for or . In 2004, Sutton decided to add a range of motion, representing by the little-range

movement and by the wide-range one: The second glyph is consistent with the other movements, while the first one is not. Finally in ISWA2008, Sutton harmonized the choice, replacing the pair with , making this movement consistent with the graphic solutions used for straight and curved movements.

Similarly, some BSy representing configurations are modified, so as to make them more uniform compared to the other configurations, or to correct the problems of graphical logic (Fig. 7).

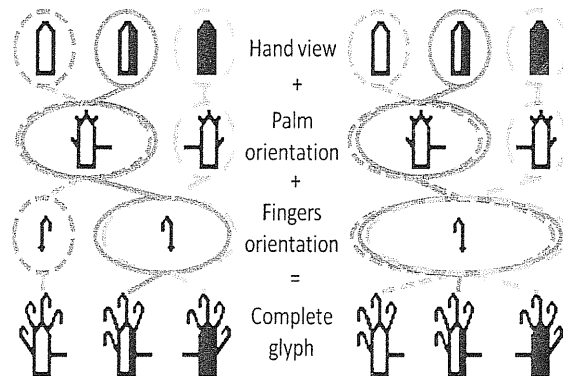


Figure 7. Example of the graphic composition of glyphs, and graphic variations between SW versions (here, from IMWA2004 to ISWA2008)

For example, between 2004 and 2008, many glyphs which represent hands with fingers curved (like , , and) were "flipped": the glyphs became , i.e. while a diversity was kept in representing the palm (the horizontal bar indicates the thumb, which is oriented to the right if the hand is palm or side-viewed, and left if it is back-viewed, like when the hand is put in that position), in the contrary the orientation of fingers was modified, so as to be turned in the same way.

IV. DYNAMICS OF SW EVOLUTION AND FUTURE PERSPECTIVES

All changes SW has undergone, of which this article shows just a few examples, are detectable in the official versions of SW, since they were formalized by Sutton and her team and disseminated to the user community of SW, following a stream that could be defined as "top-bottom" dynamics.

However, each group of users of SW is, in its turn, promoter of these changes. It has been shown in [05] [15] and [16] the way by which SW is adapted to the needs of representation of its users, through the creation of "ad hoc glyphs" [05]. These glyphs are thus so well integrated (from the organizational point of view and organizational chart) in the standard SW that it is often difficult to detect them.

The glyphs created *ad hoc* by the various groups of users can be brought to Sutton *via* several channels, including the website (www.signwriting.org) SW and/or a dedicated mailing list (SW-L@listserv.valenciacollege.edu); thus, there is also a "bottom-top" dynamics in the evolution of SW.

The integration between these two types of dynamics means that Sutton is able to adapt her system of representation according to the needs of its users, making it a system of representation more and more efficient. At the same time, Sutton can, through the various versions of official releases, standardize the glyphs of her system, even on a different basis from those proposed by users. Moreover, her hold over the official version allows her to always control all the possible options for each BSY.

It is therefore envisageable that, at least until these two dynamics resist, the evolution of SW will lead it to represent the different components of the sign, including those that Sutton may not have considered originally, with an increasing range of details. If the flow of information between users' groups and Sutton were to stop, a differentiation of SW at local level would probably develop. It must be taken into account the fact that SW is a system that aims to be an international alphabet for the LS, providing each local group with a multitude of glyphs, of which only a part is needed to encode the targeted LS. One could therefore suppose that, should several groups remain isolated, a rethinking of SW will emerge to limit the number of glyphs in respect to the official version and that, at the same time, more specific references to the own LS will

appear, maybe just for special purposes of those using the system.

LITERATURE:

- [01]. Russo Cardona T., V. Volterra. 2007. *Le lingue dei segni: storia e semiotica*. Carocci, Roma: 160 p.
- [02]. Garcia B. 2010. *Sourds, surdit , Langue(s) des Signes et  pist mologie des sciences du langage: probl matiques de la scripturisation et mod lisation des bas niveaux en Langue des Signes Fran aise (LSF)*. M moire de HDR, Universit  de Paris 8.
- [03]. Di Renzo A., L. Lamano, T. Lucioli, B. Pennacchi, E. Pizzuto, L. Ponso, P. Rossini. 2006. *Scrivere e trascrivere il discorso segnato: primi risultati di sperimentazioni con il sistema SignWriting*. in: D. Fabbretti, E. Tomasuolo (eds) "Scrittura e sordit ". Carocci, Roma: 159-179.
- [04]. Pizzuto E., P. Rossini, T. Russo. 2006. *Representing signed languages in written form: questions that need to be posed*. Proc. 5th Intl Conf. on Language resources and evaluation (2nd workshop) LREC2006 (Genova 25/05/2006). ELRA Ed.: 1-6.
- [05]. Bianchini C.S. 2012. *Analyse m talinguistique de l' mergence d'un syst me d' criture des Langues des Signes: SignWriting et son application   la Langue des Signes Italienne (LIS)*. PhD dissertation Universit  de Paris 8 / Universit  degli Studi di Perugia (co-tutoring): 674 p.
- [06]. Stokoe W.C. 1960. *Sign language structure: an outline of the visual communication systems of the American deaf*. *Studies in Linguistics*, 8 (occasional papers). [*Reprinted in*: 2005. *Journal of Deaf Studies and Deaf Education*, 10(1): 3-37.]
- [07]. Hanke T. 2009. *HamNoSys: Hamburg Notation System for Sign Languages*. http://www.sign-lang.uni-hamburg.de/dgs-korpus/dj_files/inhalt_pdf/HamNoSys_06en.pdf
- [08]. Stokoe W.C., D. Casterline, C. Croneberg. 1965. *A dictionary of American Sign Language on linguistic principles*. Gallaudet College Press, Washington DC: 346 p. [*Reprinted in*: 1976. Linstock Press].
- [09]. Cuxac C. 2000. *La Langue des Signes Fran aise (LSF): les voies de l'iconicit *. Ophrys, Paris.
- [10]. Pizzuto E., P. Rossini, M.A Sallandre, A. Wilkinson. 2008. *Deixis, anaphora and highly iconic structures: cross linguistic evidence on American (ASL), French (LSF) and Italian (LIS) signed languages*. Proc. 9th Intl Congr. on theoretical issues in sign language research (Florianopolis 09/12/2006). Editora Arara Azul: 140-158.
- [11]. Gianfreda G., G. Petitta, C.S. Bianchini, A. Di Renzo, P. Rossini, T. Lucioli, B. Pennacchi, L. Lamano. 2009. *Dalla modalit  faccia a faccia ad una lingua scritta emergente: nuove prospettive su trascrizione e scrittura della Lingua dei Segni italiana (LIS)*. Atti IX Congr. Internaz. Associazione Italiana di Linguistica Applicata [AItLA] (C. Consani, C. Furiassi, F. Guazzelli, C. Perta eds). Guerra Ed., Perugia: 413-437.

- [12]. Sutton V. 1995. Lessons in SignWriting: textbook & workbook. Deaf Action Committee for Sign Writing, La Jolla (CA).
- [13]. Di Renzo A., G. Petitta, T. Lucioli, C.S. Bianchini, T. Gulli, P. Rossini. 2011. L'Inno di Mameli tradotto in Lingua dei Segni Italiana (LIS): un'analisi linguistica. Collana Pubbl. SLI (Ed. Bulzoni, Roma): in press.
- [14]. Cuxac C. 1993. Iconicité des Langues des Signes. *Faits de Langue*, 1: 47-56.
- [15]. Bianchini C.S., F. Borgia, M. Castelli. 2011. L'appropriation et les modifications du SignWriting (SW) de la part de locuteurs de Langue des Signes Italienne (LIS). *Travaux Linguistiques CerLiCO*: in press.
- [16]. Bianchini C.S. 2012. Rappresentare le Lingue dei Segni con SignWriting: evoluzione di SW sulla base delle esigenze di rappresentazione degli utenti. *in*: P. Fabbri, T. Migliore, A. Perri "Scritture per immagini: tipografie, chirografie, lingue artistiche". Aracne Ed.: in press

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