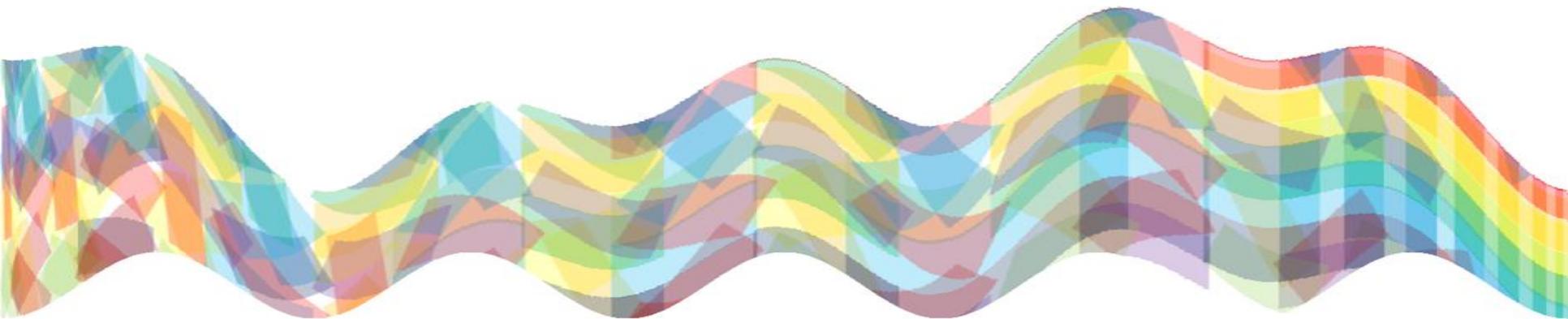


SignWriting Oriented Resources for Deafs

Implementation into the SWORD project of observations arising from  
**the process of users' appropriating  
and adapting SignWriting**

Claudia S. Bianchini<sup>1</sup>, Fabrizio Borgia<sup>2-3</sup>





SignWriting Oriented Resources for Deafs

## Introducing SWord Project

Claudia S. Bianchini<sup>1</sup>, Fabrizio Borgia<sup>2-3</sup>,  
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# we are ...



**Fabrizio Borgia**, PhD (Informatics) candidate

- 2010: MS thesis on the development of a SW editor (SWift)
- 2011-today: PhD dissertation for the digital implementation of SW (SWift, OGR...) in the framework of the project “SWord”

**dr Claudia S. Bianchini**, associate professor of SL linguistics

- 2007-2012: PhD dissertation with Elena Pizzuto’s supervision; the metalinguistic considerations of deaf people using and appropriating SW become the main focus of her research
- 2013-today: tenured at Poitiers as a LS scholar, continues her research on the systems for the graphical representation of SLs, while also providing linguistic advice in the SWord project



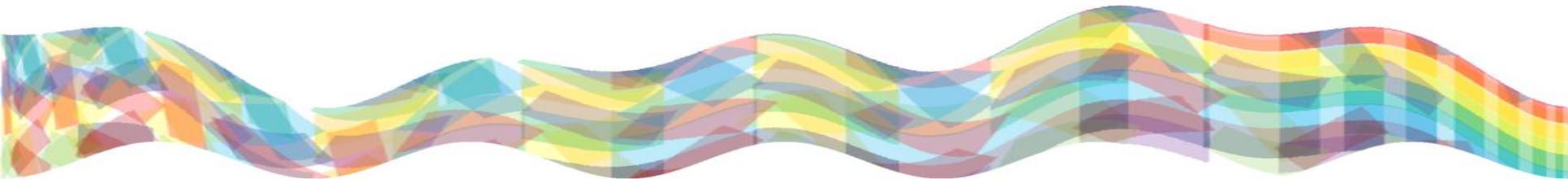
**dr Maria de Marsico**, assistant professor of Informatics

- 2009: participates in the project “VISEL” (together with E. Pizzuto) as head of the research team “Pictorial Computing Lab” (in charge, among other tasks, of the IT part of the project)
- 2010: suggests a SW topic for Fabrizio Borgia’s experimental thesis
- 2011-today: is major professor of Fabrizio’s PhD course and supervises the team of researchers working for the SWord project



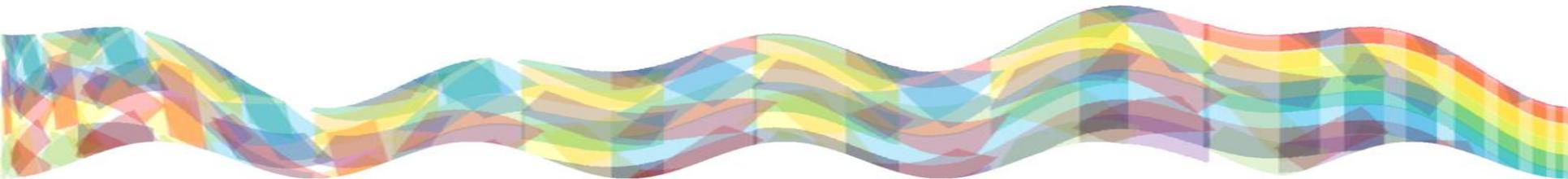
# Italy and SignWriting

- the '90s: Elena wonders about the feasibility of understanding the LIS without a suitable system for its representation... the forerunners of the team probe various systems, e.g. the Stokoe's notation and SignFont
- 2000: Valerie and Elena talk for the first time, by phone
  - Paolo and Barbara learn SW by themselves
    - thereafter, they teach it to other deafs, and to hearing people too
  - a first paper on SW (Pizzuto, Rossini, Sutton)
  - the team "Written-LIS laboratory" (LLISS) is born in Rome, at the "SignLanguage Lab" of the ISTC-CNR
    - 6 deaf, 3 hearing people: SL is the sole working language
- 2009: in the framework of the VISEL project, researchers of linguistics and informatics begin to collaborate, posing the bases for establishing the SWord project



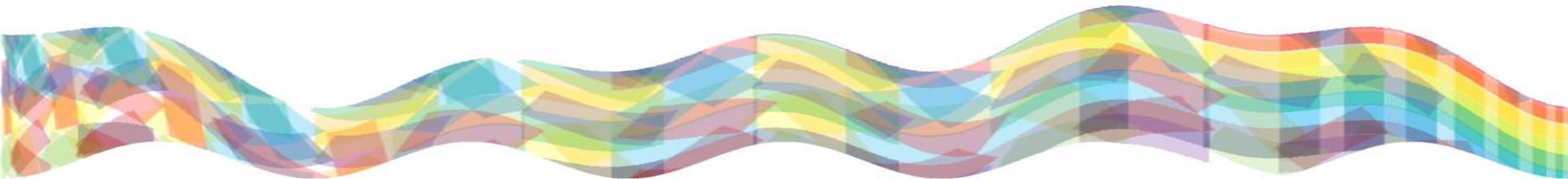
# what is the SWord project

- SWord: SignWriting Oriented Resources for Deafs
  - established thru the collaboration of linguistics and informatics researchers
  - R&D of digital systems, aimed at making SW more accessible
    - to deaf users, eager of writing in their own language
    - to researchers, resolved to transcribe SLs
  - based on the Elena Antinoro Pizzuto's idea of "deaf-centering"
    - i.e., making research with, not on the deaf people



# the SignWriting Symposium 2014

- during this webinar, you'll see 3 presentations of our project:
  - [[Research/01](#)] “Implementation into the SWord project of observations arising from the process of users' appropriating and adapting SignWriting”
  - [[Software/04](#)] “SWift, a user-centered digital editor for SignWriting within SWord project”
  - [[Software/33](#)] “A proposal for the recognition of handwritten SignWriting for SWord project”

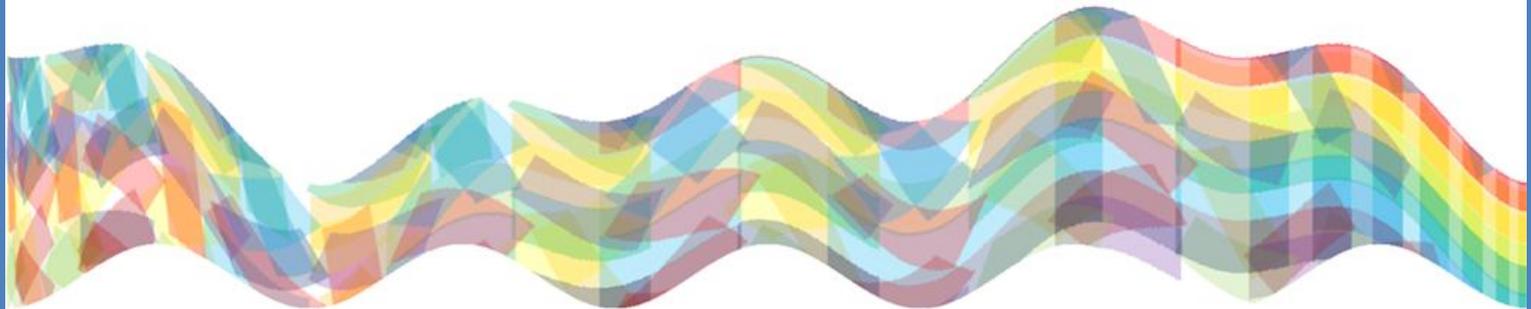




SignWriting Oriented Resources for Deafs

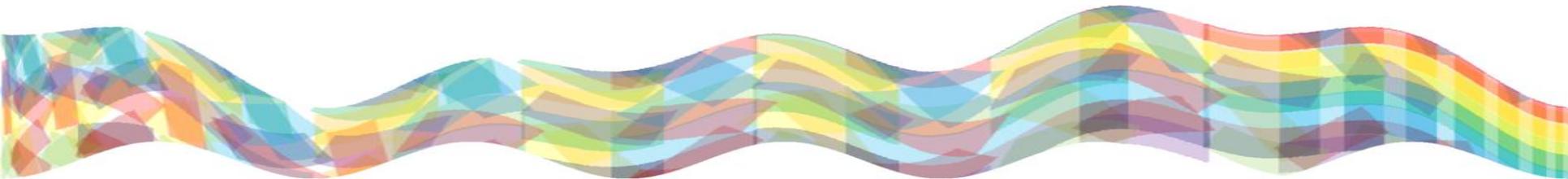
Implementation into the SWORD project of observations arising from  
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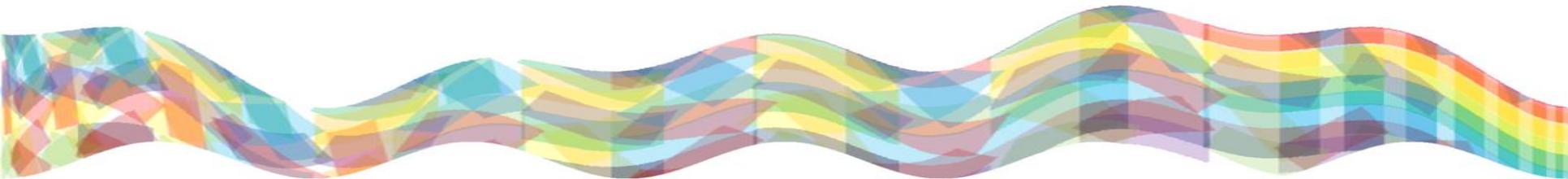
# examining SignWriting

- two main approaches for analysis:
  - “*in vitro*”
    - systematic analysis of the intrinsic characteristics of SW, regardless of its actual use
  - “*in vivo*”
    - observation and analysis of SW utilization by LLISS people
    - observation and analysis of questions posted in the SW-List



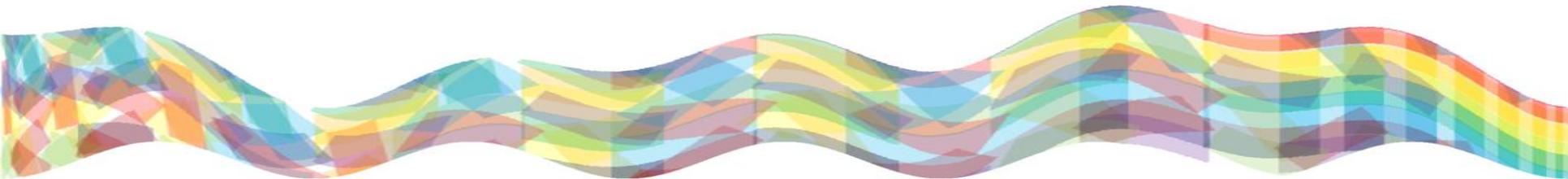
# LLISS, SW-List & recurrent problems in SW

- a rapid scan of the SW-List suffices to realize that, notwithstanding its relative simplicity, SW presents some consistent trouble
  - a similar finding arises from observing LLISS activities
- why do recurrent problems exist? how may it be possible to solve them?



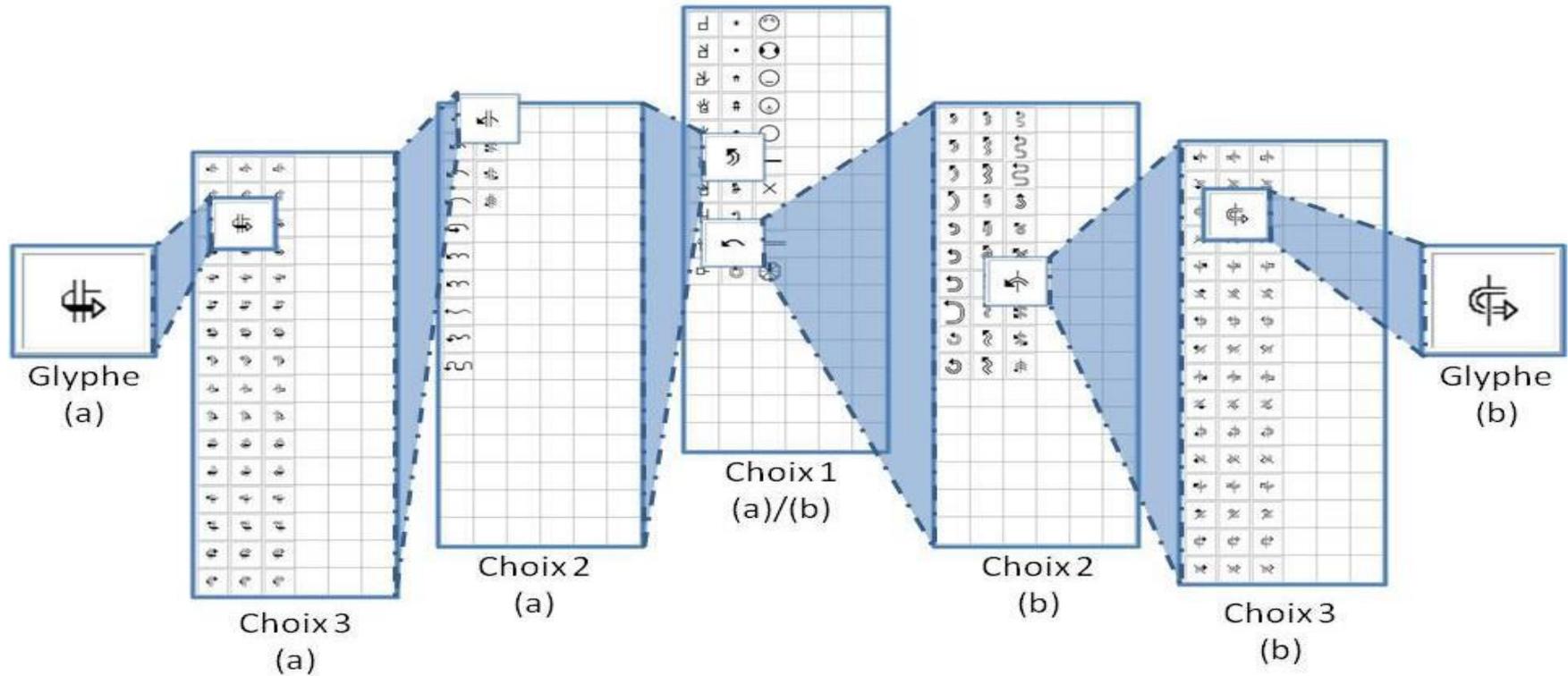
# SignWriting and its consistent troubles

- new users often learn SW by themselves, relying on:
    - the SW manual (theory)
    - SignPuddle (practice)
- } based on ISWA
- the amount of glyphs present in ISWA has increased over time
    - notwithstanding the efforts to keep the whole system coherent, the “history” of SW evolution has left its mark with every succeeding version of SS/IMWA/ISWA
    - nor the manual nor SignPuddle explicit all the rules for glyph transformation

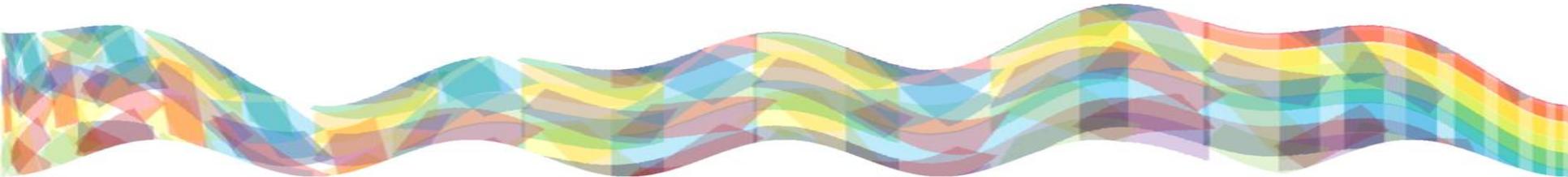


# e.g.: glyph organization in SignPuddle

- in SignPuddle, selecting two very similar glyphs follows very different paths



- the rules for glyph transformation are not explicit

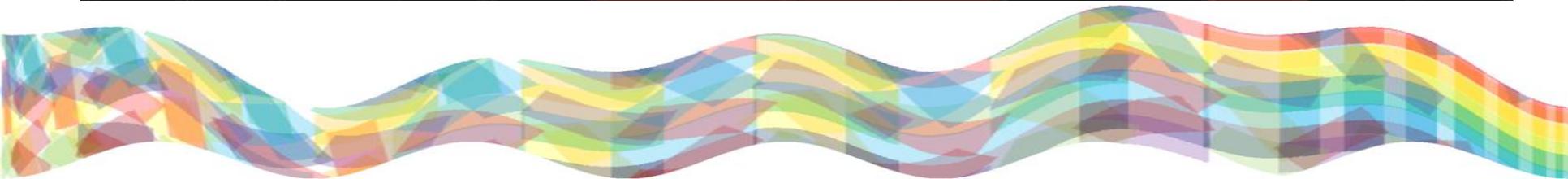




# e.g.: glyph organization in ISWA2008

- furthermore, there are many “holes” in the classification
  - e.g.: movements possible only on one single plane, and not on others

$P_V$													
$P_H$													
$P_S \updownarrow$													
$P_S \leftrightarrow$													



# our proposal: a reclassification

- re-arranging SW to explicit all the functional and graphic rules securing the glyph production
- removing irregularities (“exceptions”)
  - still, without messing with Sutton&Co’s foundations

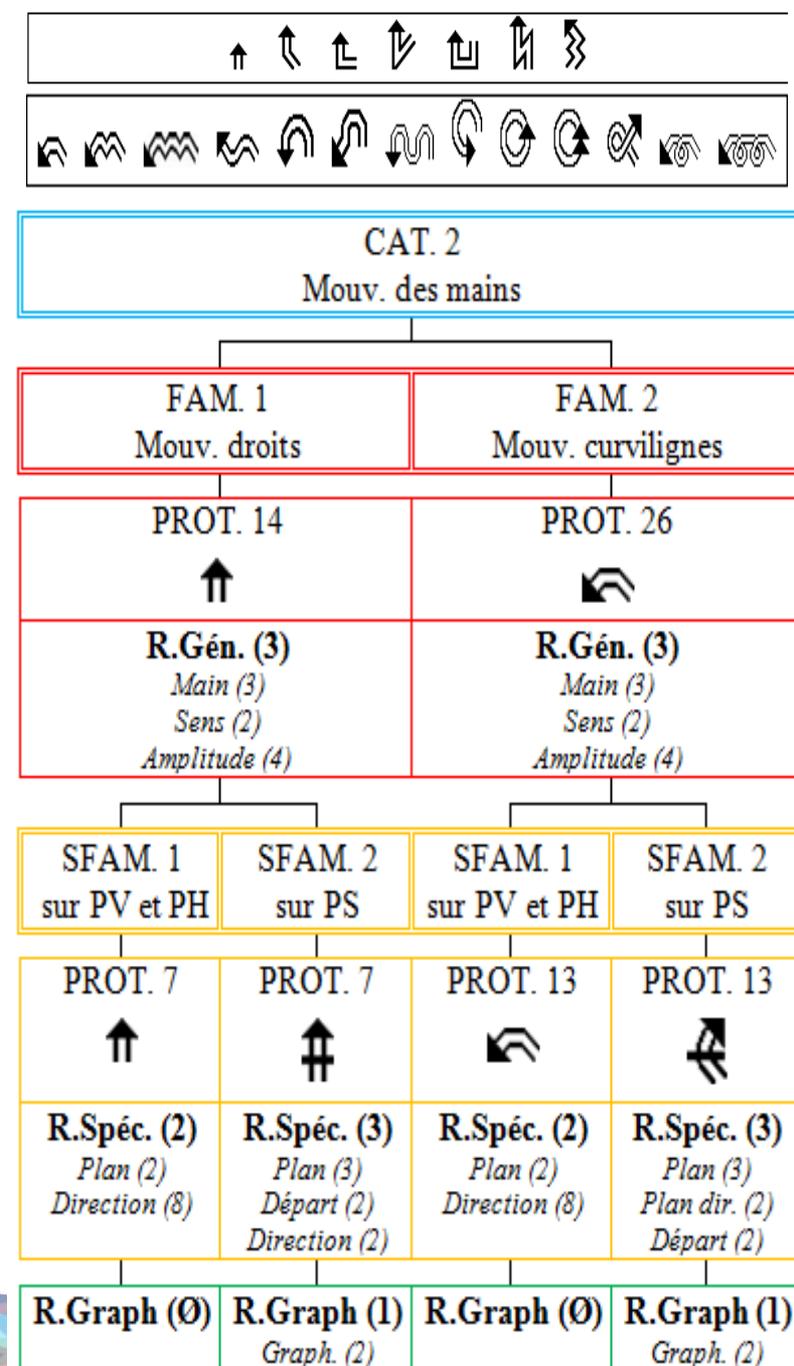
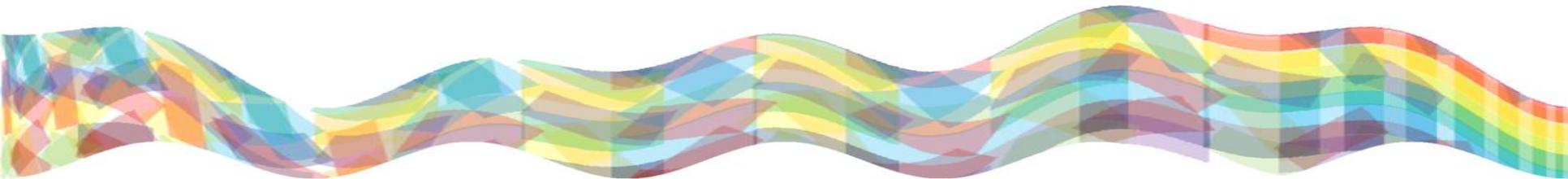


Fig. 210 – Catégorie 2 « Mouvements des mains »

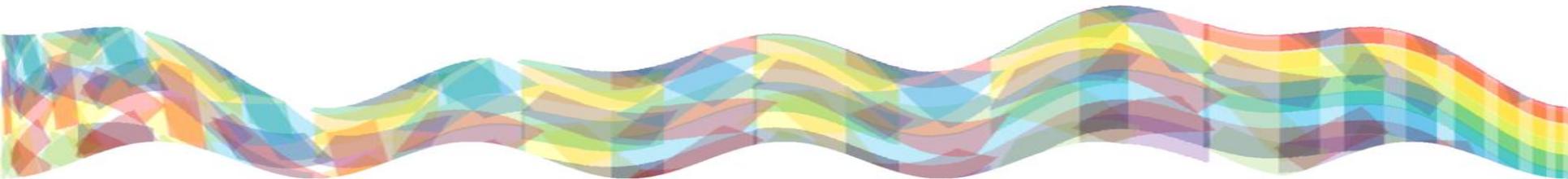
# advantages of the reclassification

- thanks to the reclassification,
  - all the rules for using each glyph are 100% explicit (clarity) and without exceptions (coherence)
    - following these rules, the set of glyphs may be completed maintaining a systemic coherence
    - the parameters of each trait may be investigated, even when glyphs do not belong to the same category
      - great usefulness in linguistics



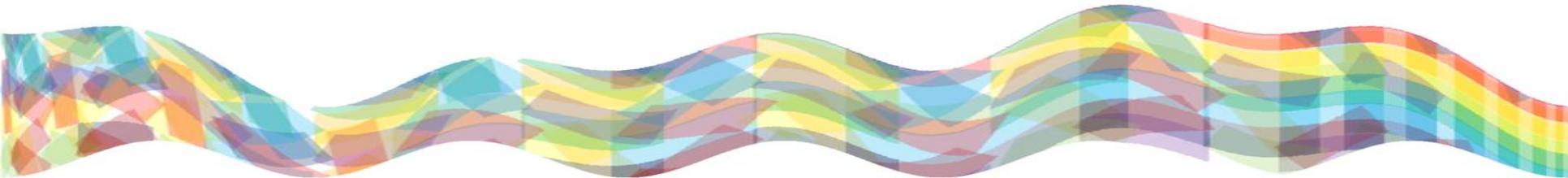
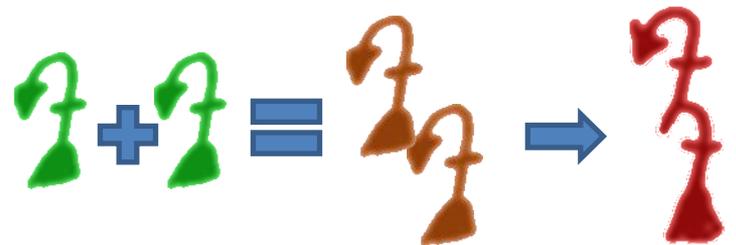
# reasons from “in vivo” observations on why new glyphs are added

- at LLISS, deaf people prefer hand-writing
  - failing to find specific glyphs, they invent new ones (“*ad hoc*” glyphs)
    - that’s a true process of adaptation and appropriation of SW
      - but composition rules are quite strict
        - almost the same as those pointed out in the reclassification



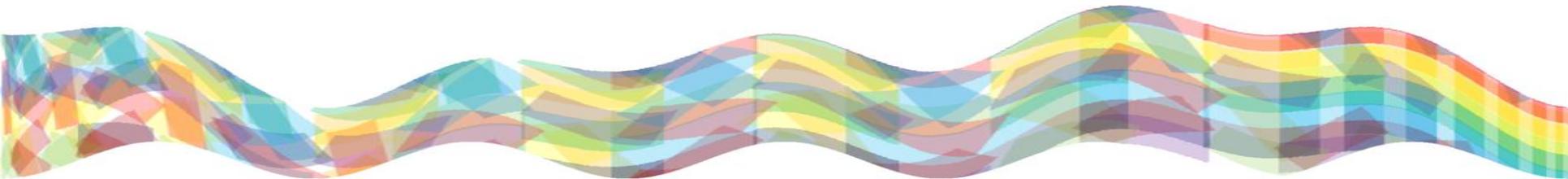
# defining the *ad hoc* glyphs

- an *ad hoc* glyph should:
  - fill a (alleged) void in SW
  - sprout from the union or meaning modification of existent glyphs
  - be coherent with the system
  - be easy to understand
  - aspire to be duly included in the official SW



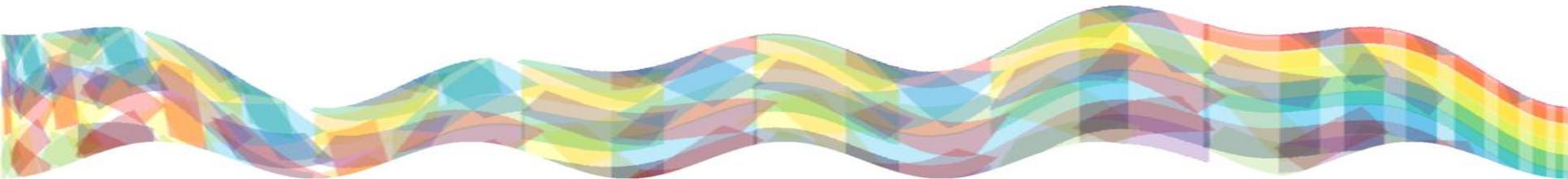
# utilizing the *ad hoc* glyphs

- during script production, deaf experts have contrasting attitudes toward *ad hoc* glyphs
  - creativity and productivity vs. rigors and command
- BUT:
  - everybody uses *ad hoc* glyphs, often without realizing it
- during script scanning, readers are not even aware of the presence of an *ad hoc* glyph
  - truly *ad hoc* glyphs are well integrated in the system and therefore they do not appear as aliens



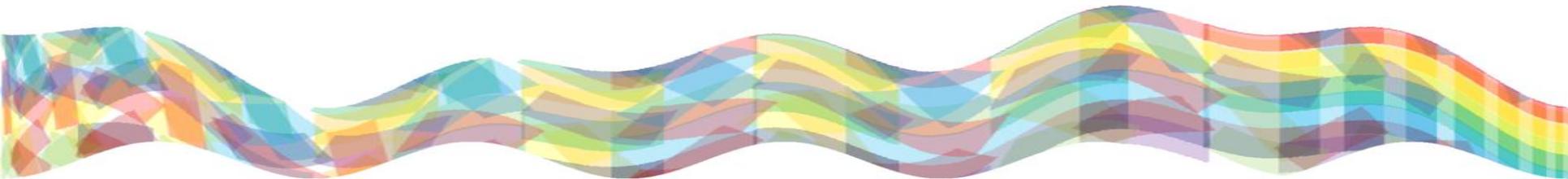
# conclusions

- deaf people at LLISS acquired SW fast and easily
  - some recurrent problems may be solved merely expressing all the rules
    - this requires a thorough reclassification of the whole system, yet without straining its intrinsic nature
    - such a systemic reclassification has been carried out and implemented “on the drawing board”, but every user does it in his own head; thus, the research “just” revealed a concealed phenomenon



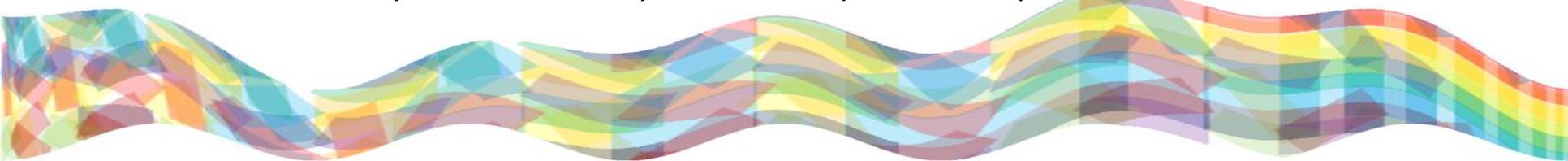
# conclusions

- SW is still a “young” system
  - it has not settled yet
    - SW has been not “imposed on” but “adopted by” the deaf
      - that’s the reason it is the only system suited for writing SLs
- observing the way of using it by the deaf people is of major interest for linguistics researchers, whether studying SLs or analyzing graphical systems



# acknowledgments

- to the graduating students of the Master in Informatics at the University of Rome I “Sapienza”, who contributed in implementing parts of OGR:
  - D. Della Valle, L. Franciosi, L. Fochetti, N. Pllaha, M. Rotiroti
- to the members of the “Sign Language Laboratory” (now “Sign Languages and Deaf Studies”) of the ISTC-CNR of Rome, who originated data and metalinguistic speculations exploited by C.S. Bianchini for her PhD dissertation, which is the core of this presentation:
  - E. Antinoro Pizzuto, A. Di Renzo, G. Gianfreda, L. Lamano, T. Luciola, B. Pennacchi, G. Petitta, P. Rossini, V. Volterra
- to the professors and researchers, who closely followed the progress of our work:
  - D. Boutet, M. Castelli, C. Cuxac, P. Dalle, A. Perri



# abstract

Since the early years of the 2000s, SW has been used as a transcription and writing system for Italian Sign Language (LIS) by the "Written-LIS laboratory" (LLISS) at the ISTC-CNR in Rome. Between 2007 and 2012, during the preparation of her doctoral thesis, Bianchini [1] observed the modalities of using SW at LLISS and analyzed the ways by which its deaf and hearing members made the system their own.

It is worth mentioning that the LLISS people were self-taught in SW, on the basis of the 1995 manual and of the 2004 version of SignPuddle. Despite a very good knowledge of SW, we noted recurring problems in its use, and tried to understand the reasons. We thus realized that many difficulties arose because of the lack of strict coherence in the organization of SW (see Note 1) that was evident both in the manual and in the 2006 SignPuddle server in use in the lab. One example is the movements of the hands in which: (1) all changes in a BaseSymbol do not describe the same trajectory; and (2) it is not possible to realize the same trajectories on every level (Figure 1). Therefore, we decided to carry out a complete reorganization of SW while totally respecting the work of Sutton and her team (I.e., no "original" glyph has been deleted), but suggesting additions so as to increase the coherence of the system (see Figure 1) [2]. This idea originated observing the written productions of LLISS people, where many glyphs were created "ad hoc" to represent movements, configurations, facial expressions and other signing elements not already provided in the different versions of SW.

This reclassification required a new numbering system for the glyphs, which also involves the advantage, for the linguists, to easily extract the different glyph features (e.g., a query may extract all, and only, the movement from right to left of the right hand in the horizontal plane).

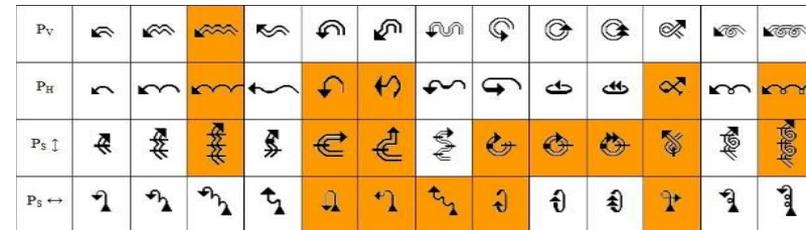
This work, however, was not an end in itself: in fact, all the deaf people we worked with prefer to hand-write SW, considering the use of SignPuddle too slow; therefore, as part of the project SWord (SW Oriented Resources for the Deaf) implemented by the Informatics Dept of University of Rome I "Sapienza", and in particular of the Borgia's doctoral dissertation, a new software was created, which allows to quickly digitally-write SW. This software, called SWift (SW improved fast transcriber) [3], is based on said reclassification and will be presented in detail in the paper by Bianchini, Borgia & De Marsico.

[1] C.S. Bianchini. 2012. Analyse métalinguistique de l'émergence d'un système d'écriture des Langues des Signes: SignWriting et son application à la Langue des Signes Italienne (LIS). Ph.D. thesis, Université de Paris 8 - Università degli Studi di Perugia.

[2] C.S. Bianchini, F. Borgia. 2012. Writing Sign Languages: analysis of the evolution of the SignWriting system from 1995 to 2010, and proposals for future developments. Proc. Int. Jubilee Congress of the Technical University of Varna, 6: 118-123.

[3] C.S. Bianchini, F. Borgia, P. Bottoni, M. De Marsico. 2012. SWift: a SignWriting improved fast transcriber. in Proceedings of AVI2012 (Capri, 21-25 May 2012).

**Note 1:** Mostly due to the fact that SW is a system in constant evolution and, as such, is the result of "sedimentation" of several successive layers (see for more details Bianchini & Borgia, 2012).



**Figure 1** - White boxes: the possible trajectories within the official ISWA2008, by planes; Orange boxes: the trajectories that were added improve the system coherence.

01

Hi everyone. We are very happy to be here today!

Now we will present you the first part of our work on SignWriting, showing you the process by which deaf users are appropriating and adapting SignWriting.

02

However, before that, I shall briefly introduce our group and the SWord Project...

03

So! Who we are...

Fabrizio is a PhD student in computer sciences. He is doing a dissertation on digitalization of SignWriting.

Maria is Fabrizio's main professor. She is a computer science specialist and she coordinated our project.

Claudia, me! I am a linguist, expert in writing systems of SignLanguages, and I have done my PhD on SignWriting.

For more details you can look at our CVs on the SignWriting website

04

We are not the first ones working on SignWriting in Italy, so I will tell you how SignWriting reached Italy.

In the '90s Elena Pizzuto, who was a great SignLanguages linguist, began a reflection about the fact that, if you really want to discover how SignLanguages works, you need to represent it! She started investigating notation systems for SignLanguages but she did not find any suitable one.

In 2000, she finally discovered SignWriting and she called Valerie on the phone.

After this first contact, 2 Italian deafs, working with Elena, decided to learn SignWriting by themselves... this is the beginning of SignWriting in Italy!

The SignWriting working group grew and in 2007 there were 3 hearing people (I was one of them) and 6 deafs working with SignWriting! Because everyone knew SignLanguage, SignLanguage was the only language used during working hours... during meetings as well as coffee breaks.

In 2009, Elena started the VISEL project, in which Maria was involved. This was the first step of our SWord project.

05

But what is the SWord project? S.W.O.R.D. means SignWriting Oriented Resources for the Deafs.

It is a collaboration between experts of computer science and linguistics to develop a series of digital systems. It will allow SignWriting to become more accessible to deaf users but to researchers in SignLanguages linguistics too.

The philosophy of the project is based on Elena's idea of "deaf-centered research", which means that we need to do research WITH the deafs and not ON the deafs.

06

During this Symposium, you will see us 3 times, speaking about 3 parts of our project: now I'll show you the linguistics research frame, then Fabrizio and Maria will present you our two software: first SWift, a digital editor for SignWriting, then OGR, a hand-writing recognition and digitalization software.

07

Ok, lets begin with the main topic of our presentation.

08

In our analysis we decided to have 2 different approaches.

The first one is an "in vitro" analysis: we consider SignWriting in its fundamental structure, regardless of its actual use.

The second one is an "in vivo" analysis: we consider the way by which deaf and hearing individuals use SignWriting. For this purpose, we observed Elena's collaborators for 5 years and we had also a look at the SignWriting List.

09

You all know the SignWriting List, better than the specific issues highlighted at the Rome's lab, so let us speak about the List.

If you observe the mails, very often, people ask "how can I write this down? I do not understand the way this is used! Is there a difference between this and that?". We observe the same in our lab.

So our main question is why are there recurrent problems, even if SignWriting is quite easy to use? Is there a way to solve them once for all?

10

The first thing to say is that, in our experiment, SignWriting learners don't have an "official SignWriting teacher", they learn by themselves, alone or in groups, using the SignWriting manual for theory and the SignPuddle to practice.

The second thing is that the amount of glyphs used in SignWriting has increased over time and this has left some traces in the ISWA organization.

Third, neither the Manual nor SignPuddle give explicit rules. Let me clarify: rules are explained in the Manual and are used in SignPuddle, but there are rules that are very similar and they are not put in relation in the Manual, so a new user does not see that it is exactly the same rule.

Let us see some examples...

11

I am using SignPuddle and I am searching for an arm rotation on the vertical plan, and another on the horizontal plan... To reach them, I have to follow very different paths; so, if I'm using SignPuddle, I may not see the relationship between these two glyphs: they are similar and follow almost the same rules... but they are too far away in the "tree of choices".

12

Another example, I download the zip-file with ISWA and I start looking at it. I see, here to, that glyphs are divided by plan, so I can't see easily that there are "arm rotations" on 3 different plans and that they share similar rules. Moreover, in the same BaseSymbol we can find the hand or wrist movement, but not always.

The Manual is more "user-friendly" but also shows remnants of the ISWA organization.

In fact, in our experience, it should be easier:

- to understand all the movements for the hand, wrist, etc.;
- than to understand the straight movements, the circular movements, etc... regardless of the part of the body.

13

If we try to organize the ISWA by looking both at the plans and at the body part, we can obtain a good view of what SignWriting can really code.

Look at the white cells of our chart. When doing our schematization, we found that in ISWA2008, there are a lot of holes... Therefore, you could write 1 or 2 "boing" in all the plans, but you may do it thrice only in the sagittal plan (left-right). So that, for years, our deaf colleagues told us it was impossible to write down the sign "shelf" in LIS!

We decided to fill the holes, adding the glyphs in the orange cells. They are not very well drawn, but the purpose is to show you that SignWriting allows drawing them, even if they are not present in the official ISWA.

14

Therefore, what have we done, concretely?

We decided to take the ISWA and to “deconstruct” its organization. Then we organized it again!

For this, we followed some easy principles:

- all rules allowing to transform a BaseSymbol into a glyph have to be explicit;
- all rules have to be coherent: we don't want a rule that works with a BaseSymbol but not with another BaseSymbol belonging to the same category as the previous one;
- if something can be done on a plan, it can be done on other plans too;
- if there are two ways to write down exactly the same glyph, we keep both, but we explicitly show that they are “synonyms”;
- in general, if Sutton&Co have created a glyph, we'll try as hard as possible to keep it.

15

Using our reclassification has many advantages.

First of all, and this is the reason why we have done it, 100% of the rules behind BaseSymbols transformations are explicit.

Second, if one wants to add a new handshape or a new movement trajectory, one can do it without changing the ISWA numbers (because we have also rearranged ISWA numbers...).

Last but not least, with our new ISWA you can investigate information on every single glyph. Thus, you can now ask our database to “find me every clockwise hand movement in the vertical plan” and it can find them all, without leaving behind any glyphs. And this is really useful for linguists like me, who wants to investigate on the relationships between different components of signs.

16

Now, if I were you, I would like to ask... “Why do you put new glyphs in your classification... 38 thousand glyphs wasn't enough for you?”

As my deaf colleagues use to handwrite SignWriting, they never have problem to write down a sign... but once I was trying to digitalize a text, and I realized that a lot of glyphs used by my colleagues do not have a perfect match on SignMaker. I decided to call those glyphs “*ad hoc* glyphs” and to analyze them.

I discovered that those new glyphs were very well integrated with SignWriting, because they followed all those rules that are not explicit but are present, and that the users learn because they use SignWriting.

So, when I decided to re-organize SignWriting, I thought it was not a problem to add new glyphs to avoid exception, but only if I could follow the implicit rules that my colleagues had followed to create a new glyph.

17

Let us explicit the rules that my colleagues use to create an “*ad hoc*” glyph. It is worth noting that they do that without thinking about those rules. It was my analysis which enabled us to discover those rules.

The “*ad hoc*” glyphs:

- appear when there is a gap in ISWA or when my colleagues can't manage to find the appropriate glyph (although it may exist);
- are always consistent with SignWriting rules, which means they must be created:
  - by changing the nature or the shape of an existing glyph;
  - by merging 2 existing glyphs;
  - by creating a total new one but always respecting SignWriting rules.
- have to be easy to read for every SignWriting user (the readability is, in our opinion, one of the most important features of SignWriting).

If they obey all those rules, they can aspire to become an official glyph in ISWA.

18

After my first analysis on “*ad hoc*” glyphs, I asked my colleagues what they think about adding new glyphs. For me, the answer of one of my colleague was much unexpected: he said that SignWriting has to stay “pure” and only Valerie has the right to modify it! So I showed him that most of his glyphs were “*ad hoc*” and he was very upset! For others colleagues it was normal to add “*ad hoc*” glyphs, but they did not want me to add them to my classification, because they thought it was a lack of respect for Valerie’s work. I hope I know Val enough to know that she will not be upset with me if I decide to add some glyphs!

19

In conclusion, during the 5 years I worked in Rome, I noticed that SignWriting is very easy and fast to learn for deaf people. However, even if they can learn it fast, some problems are recurrent. So I decided to reclassify the whole SignWriting, to make the rules more explicit, but without changing its intrinsic nature.

Our aim is to make SignWriting easier to learn, by “chewing the work” for users. Every new SignWriting user needs to understand the rules, we just help him by telling them explicitly. Our research has “just” revealed a concealed phenomenon.

20

My last slide is a generic conclusion on SignWriting.

Even if this year is its 40<sup>th</sup> (fortyeth) anniversary, SignWriting is still a young, growing system which needs more users to reach its final status! Moreover, in my opinion, this is the reason why SignWriting is so good to represent SignLanguages. Because it is not a system “imposed” to the deaf by linguists or educators, it’s a system that was born from an hearing person but now grows in the deaf user community. And this is fantastic!

For me, as a linguist, research on SignWriting is more that observing a graphic system... it is almost the first time in the history of linguistics that we can see emerging a new writing system, touching with our hand how the community uses it, how they appropriate and adapt it. That’s really a very important linguistic issue.

21

Last thing! Maria, Fabrizio and I would like to say thank you to all the people who have helped us in our research:

- the graduating students of the Master in Computer Science at Rome’s Sapienza University, who contributed in implementing parts of the SWord project;
- all the deaf and the hearing staff of Elena’s lab, the “Sign Language and Deaf Studies” lab of ISTC-CNR in Rome; moreover, we wish to dedicate this presentation in loving memory of Elena;
- and our colleagues, PhD directors, etc. who helped us in our research.

22

abstract