SiS-Builder: A Sign Synthesis Support Tool

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Abstract

SiS-Builder is a web based tool, developed in the framework of the DICTA-SIGN project in order to cover for the need of creating sign language (SL) lexical resources, adequate for sign synthesis performed by a signing avatar (virtual signer). The tool's initial function was to automatically generate SiGML transcriptions of HamNoSys strings, as well as the relevant transcription files, by providing the HamNoSys characters of a sign. SiS-Builder provides an environment, which is accessible by everyone and allows interaction without requiring any special installations on the client side. The tool enables users to create or review HamNoSys notations and SiGML scripts of sign lemmas on line, switch between SiGML data and HamNoSys notations by selecting the wished function, review already created lemmas and proofread avatar performance, also viewing the video of the performed sign. It makes then possible to experiment with the results of synthesis of lexicon items, by either consulting the HamNoSys sequence, for those familiar with the HamNoSys syntax, or animating the results through the avatar with the use of the SiGML script.

1. Introduction

SiS-Builder is an online tool initially developed to serve needs of the DICTA-SIGN project, in relation to creation of SL lexical resources and research work on synthesis and animation. The most prominent need that led to its design and implementation was the requirement to generate SiGML transcriptions of HamNoSys strings in order to feed the sign synthesis avatar of the University of East Anglia (UEA) (http://vh.cmp.uea.ac.uk) (Elliot et al., 2000; Elliot et al., 2004a). In the course of its implementation, SiS-Builder was enriched with a number of functionalities that provide a complete environment for creating, editing, maintaining and testing lexical resources of sign languages, appropriately annotated for sign synthesis and animation. In the rest of the paper the components and functionalities of the tool will be separately presented. The tool is based on open source internet technologies to allow for easy access and platform compatibility, mostly exploiting "php" and "java script", and is accessible through the following URL: http://speech.ilsp.gr/sl/.

2. A Sign Synthesis support tool

Sign synthesis and animation have been accused in the past for lacking the naturalness of human signing, equally due to avatar motion performance and complete absence of the non-manual articulation elements from synthetic signing (Karpouzis et al., 2007). Research on sign synthesis is currently experimenting with ways to overcome these weaknesses by improving performance of manual articulation and also by implementing non-manual features (Elliot et al., 2004b). However, the demand for properly coded lexical data to support sign synthesis is increasing, the latter being a time consuming procedure, performed only by human coders (Elliot et al., 2008; Fotinea et al., 2008). SiS-Builder is a tool developed to facilitate creation of lexical resources for sign synthesis, enabling multiple users to create and test their own data sets. As such, the tool is Internet based, free to be accessed by anyone, with no special installation requirements on the client side. It provides a GUI, via which users can automatically create SiGML scripts to be used by the UEA avatar animation engine, either by entering HamNoSys strings (Prillwitz et al., 1989; Hanke, 2004) of signs already stored in a properly coded lexical database, or by creating HamNoSys annotated lemmas online, using the relevant SiS-Builder function (Figure 1). Once the HamNoSys coded data are provided, automatic conversion of the characters and creation of the corresponding SiGML script takes place. The so created script can be stored upon demand on the SiS-Builder server and be ready for future use.

Editing is also possible on already stored SiGML scripts, which allows for immediate presentation of the modified resource by the avatar. In order to store the new lexical item, however, it is obligatory to provide the relevant HamNoSys descriptions which in turn will be converted and stored as a SiGML script.

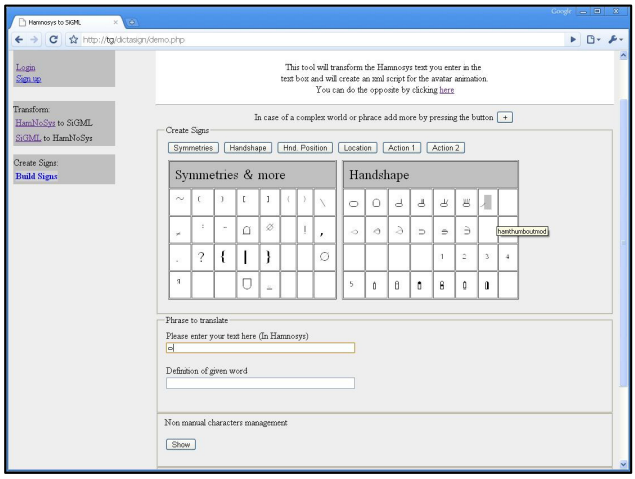

Figure 1: Creating HamNoSys notations online

3. Converting HamNoSys to SiGML

Currently, users may animate a simple sign or a sign phrase consisting of up to four lexical items. To do this, the user has to enter the relevant HamNoSys notations in the field labeled as "*Please, enter you text here*" (Figure 2) in the GUI. After having entered the HamNoSys annotated string in the proper field, the user may add the non manual characters of the sign she/he is dealing with,

by first selecting from the "*Non manual characters*" section the "*check*" buttons she/he needs, and then choosing the "*show*" button in the "*Non Manual Characters Management*". The user may choose the non-manual features she/he needs to describe a sign, from an (almost) exhaustive list of non-manual characters, been implemented by UEA. To achieve a performance as close to natural as possible, the user may choose a variety of features, such as combined movements for the head like tilt left and swing right. The user may apply the same procedure for more than one sign until she/he proceeds to the final step, which is creation of the relevant SiGML script. An indicative part of the implemented non-manual features, is shown in Figure 3.

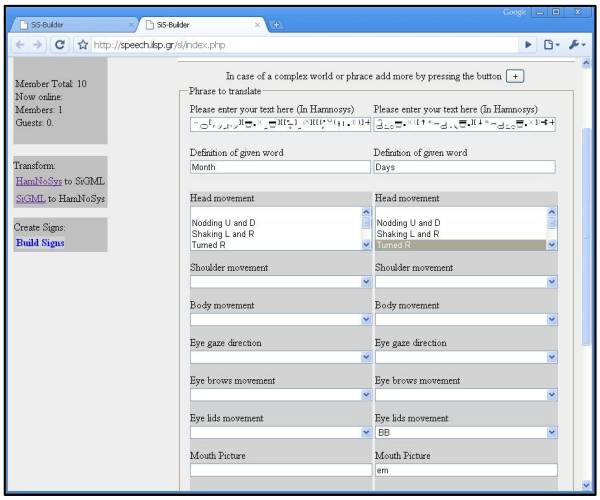

Figure 2: Converting HamNoSys to SiGML

```
sigmlnonmanual.dtd

<!ENTITY % nose_abbrev
    "WR | TW | WI"
>

<!ENTITY % nose
    "%nose_abbrev;          |
     WR_wrinkled_nose       |
     TW_twitching_nose      |
     WI_widened_nostrils
    "
>

<!ENTITY % mouth_gesture_abbrev
    " DO1 | DO2 | DO3 | DO4 | DO5 | DO6 | DO7 | DO8 | DO9
    | JO1 | JO2 | JO3 | JO4
    | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO8 | LO9 | L10
    | L11 | L12 | L13 | L14 | L15 | L16 | L17 | L18 | L19 | L20
    | L21 | L22 | L23 | L24 | L25 | L26 | L27 | L28 | L29 | L30
    | L31 | L32 | L33 | L34 | L35
    | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | CO7 | CO8 | CO9 | C10
    | C11 | C12 | C13
    | TO1 | TO2 | TO3 | TO4 | TO5 | TO6 | TO7 | TO8 | TO9 | T10
    | T11 | T12 | T13 | T14 | T15 | T16 | T17"
>
```

Figure 3: Part of the implemented non-manual entities

4. Converting SiGML back to HamNoSys

If wished, SiS-Builder provides for the option to convert a SiGML script back to the corresponding HamNoSys notation. The results of this transformation are depicted in Figure 4. As already mentioned, HamNoSys strings are visualised either by converting data in SiGML format or by selecting a validated lexical item from a list.

5. Repository of sign resources

Registered users of the SiS-Builder environment have access to the signing resources (signs, concepts and phrases) repository incorporated in the environment.

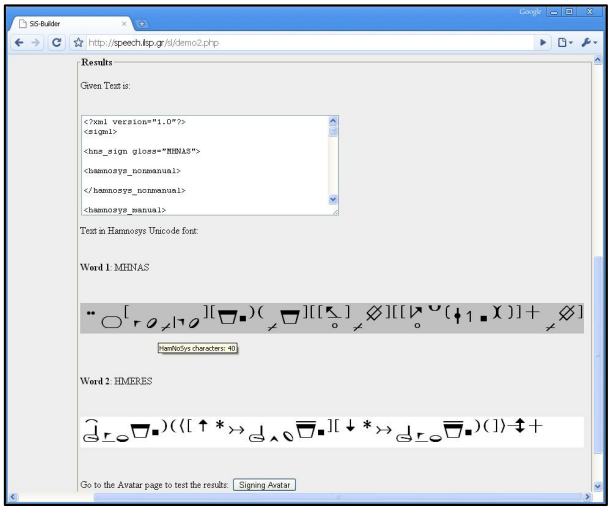

Figure 4: Converting SiGML back to HamNoSys

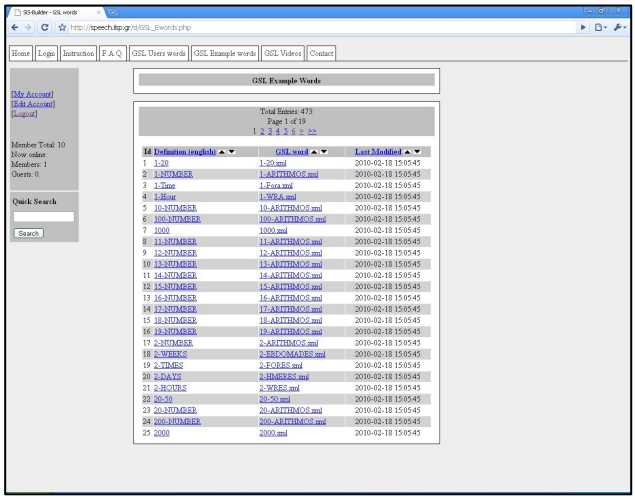

Figure 5: Repository of signs

Users can go through the available list of signs or search for the lexical resource they are interested in, by exploiting the "*Quick-Search*" function, visualised on the left hand side menu of the screen. Figure 5 depicts an instantiation of the GSL repository of lexical resources.

5.1 Users' repository

Registered users of the SiS-Builder environment, are provided with their own repository space. This facility allows users to store, experiment with and modify the lexical resources they have previously created, until they achieve satisfactory descriptions for synthesis, corresponding to appropriate animation performance.

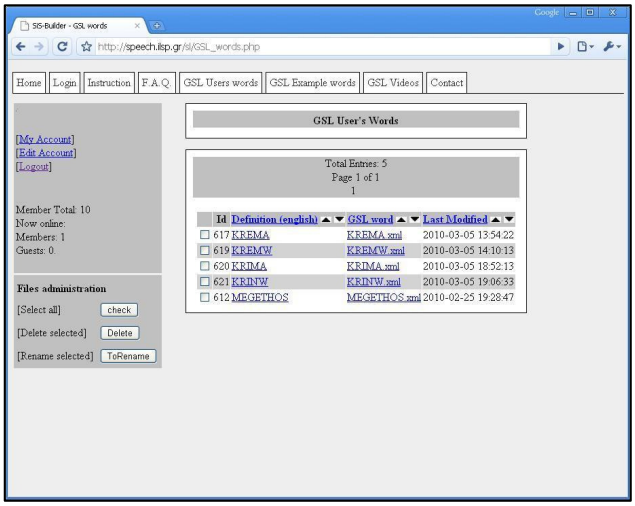

Figure 6: User's repository

Figure 6 depicts a specific user's repository, where modifications of lexical resources may be performed.

5.2 Video repository

In order to facilitate users to create lexical resources for avatar animation or to make it possible to compare natural signing resources, with the avatar's SL performance, a video repository is offered to registered users, containing authentic signing data.

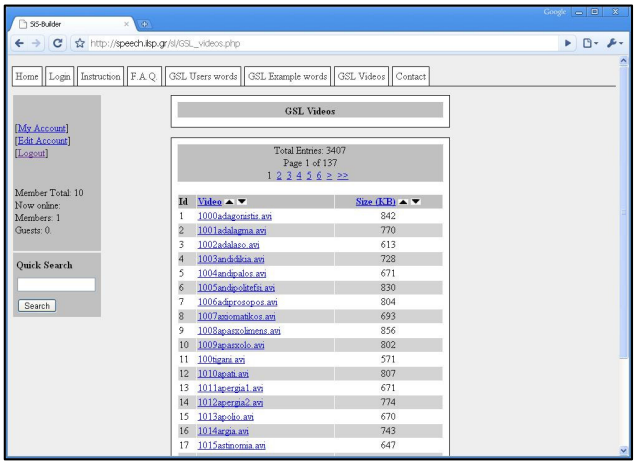

Figure 7: GSL videos repository

To demonstrate the comparison utility of the specific functionality, Figure 8 depicts an instantiation of video presentation of a specific lexical item (the GSL sign for "wild" in this example), while Figure 9 instantiates the same lexical item when visualised by the UEA avatar.
Search in the video repository is possible either by means of the English form of a lexical item, its Greek form or the name of the corresponding video file. A partial search query is also possible. Users can search for example the item "lawyer" by typing either "lawyer" or "law" or the name of the corresponding video file, if this is known to them, i.e. typing "1061law.avi" or "δικ" or "δικηγόρος", if they make the same query in Greek. Search results are then presented to the user in a similar way, as the list shown in Figure 8.

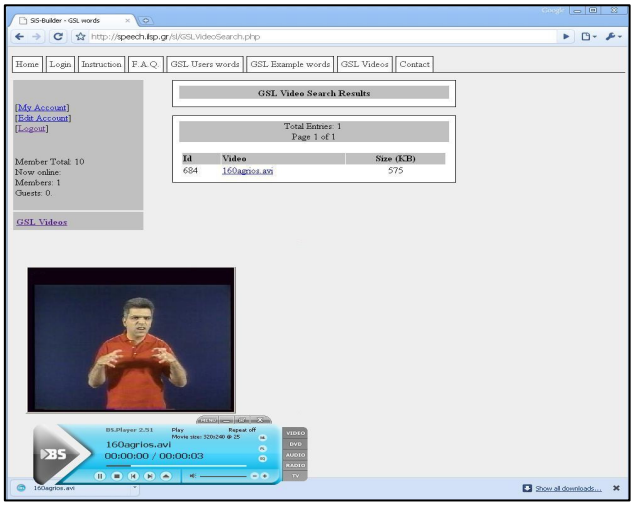

Figure 8: GSL video for the sign "wild"

Lexical resources created in the SiS-Builder environment may feed the UEA signing avatar accessible at: http://vhg.cmp.uea.ac.uk/tech/jas/095z/SPA-framed-gui-win.html. Examples of the signing avatar female model, Anna, are presented in figures 9, 10 and 11 below.
In Figure 9 one can observe the avatar environment, which is designed and developed by UEA. On the left hand side of the screen, the SiGML script created by SiS-Builder, describes the sign for "wild", where avatar performance is directly comparable to natural representation of the same sign in the video of Figure 8.

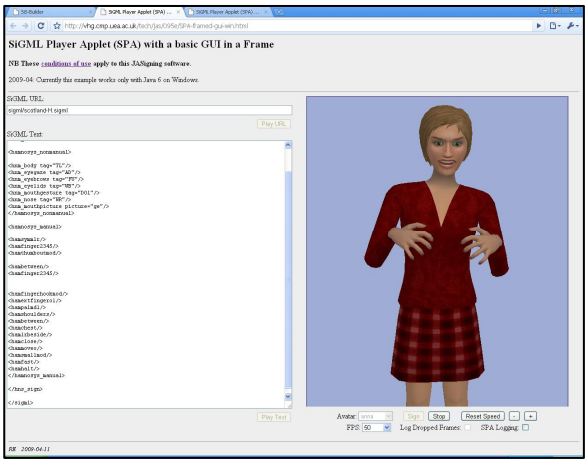

Figure 9: Avatar signing the GSL sign "wild"

Figure 10: Avatar signing (zoom) the GSL sign "cat", demonstrating non manual features implementation

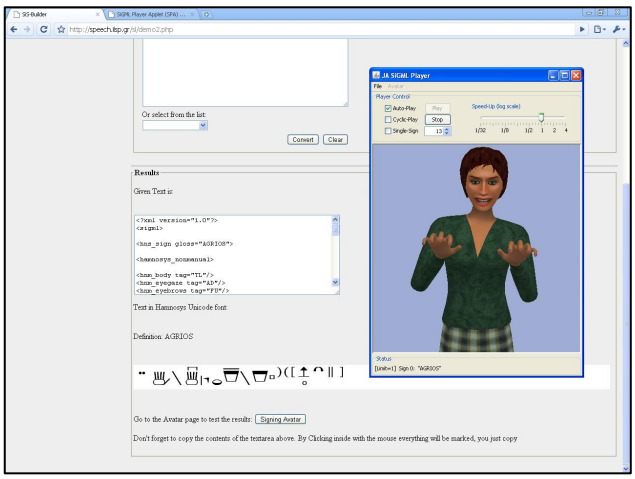

Figure 11: On the background SiS-Builder's results of the GSL lexical resource "wild", while a synonym of the sign represented in Figures 8 and 9 is performed by the UEA avatar

6. Conclusion

SiS-Builder was developed to assist creation of lexical resources appropriately coded for sign synthesis and animation (Efthimiou et al., 2006) in the framework of a specific research task. In this respect, SiS-Builder makes use of the HamNoSys notation system and the SiGML scripting language to speed up lexical resources creation and cover needs for multilingual synthesis. Implementers enriched the initial environment, though, with a number of functionalities which allow for the long term use of the tool by a wide range of users in the scope of creating lexical resources of SLs, fully coded for sign phonology (Kouremenos et al., to appear).

7. Acknowledgements

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