X Sign Language (xSL) Forum: Considering Deafness as a Language Rather Than an Impairment

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***Abstract*—In this paper, we describe a video based, text free, online forum called xSL Forum. The aim of this work is to provide a tool for signing deaf people, allowing them to communicate using sign language(s). In contrast to the widely used, real time, video chat system, xSL Forum does not require people to be present at the same moment, facing their webcam, in order to communicate. Beyond a digital library, xSL Forum can be used as an asynchronous communication tool and thus, can be useful for variety of other applications such as entertainment, education, or administration.**

Keywords-Deaf; Internet forum; online; video; communication; interaction; sign language.

I. INTRODUCTION

Hearing loss, as a disability, is often misunderstood by the hearing world. It is often an "invisible" disability: a hearing aid may be the only visible indication. Furthermore, many hearing people do not realize that deaf people often have difficulty learning spoken and written languages, as the ability to listen to the sounds of a language is an important part of learning how to read and write. Indeed, in France, for example, an estimated 80% of deaf people are illiterate [1].

In our daily lives, communication, when it is not oral, is mainly based on the written modality: newspapers, public displays, and television. All of which require the ability of reading (Figure 1). The captioning of movies, television shows and news broadcasts is an important advance, but is not useful for all deaf people. Professional environments have the same characteristics, nor is the World Wide Web an exception to this rule: text dominates on the internet and people cannot reasonably be expected to navigate it efficiently without mastering a written language.

A useful means of increasing the accessibility of textual content for deaf people is to propose a signed alternative in the form of a video. As far as we know, this solution is neither automatic nor systematic. If, technically, this is quite achievable, we still find very few sites that deploy this solution. Where it does existing, it is mostly found on specialized sites, initially intended for deaf people. The main obstacle to this alternative modality is the production cost.

So much so that even the dedicated websites or the sites which include deaf people in their audience offer this signed alternative only for their menu options, and switch to text mode (read and/or write) for all or part of their content, including dynamic content (Figure 2). When not in a native sign language form, the contents of the site are translated into a sign language according to the capacity of the structure and the constraints of the production schedule and budget.

Traditionally, websites have these common characteristics: (1) a high dynamicity of contents, and (2) an extensive use of text, which poses a problem for its appropriation by deaf users. These characteristics are also shared by online forums.

This paper is organized as follows: Section II presents motivations behind this work. Section III presents related work. Section IV describes the x Sign Language (xSL) Forum, including the software and hardware architecture, the modes of navigation and interaction, and the evaluations. Section V provides an outlook for future work. Section VI summarizes and concludes our paper.

II. MOTIVATIONS

The online forum has become a major communication tool in the landscape of the modern World Wide Web. It offers many advantages; such as allowing the participation of a wide community in a single conversation, whether for sharing information or seeking a solution; communicating through a forum allows people to instantly broadcast to all users.

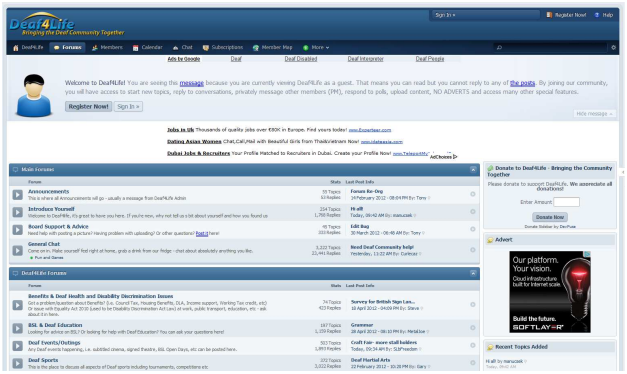

Figure 1. Example of a general forum intended for the deaf community [2]

Asynchronous communication dispenses with the need to be available simultaneously in order to communicate, by passing the constraints of time zone difference in communications between international communities. Finally, the online forum is, by virtue of the persistence of its contents, a perennial source of data.

Although the model of the online forum has proved its value and purely textual access, it is still very difficult to deaf users to benefit from it.

We decided to design a tool that will give access to deaf people to such an online forum, without the difficulties posed by their lack of knowledge of written languages.

III. RELATED WORK

Over the previous decade, the technology sector has proposed ideas towards facilitating communication between deaf and hearing people.

Video chat systems, such as the free software ooVoo, Skype or Live Messenger, allow signing deaf users to communicate remotely, one-to-one or one-to-many, using their webcams. This system compensates for phone use in oral synchronous mode but has the same weaknesses, namely: (1) the need for the participants to be available at the same time; (2) the need to own the equipment, i.e., a computer equipped with a webcam; and (3) a lack of a permanent record of the information exchanged during the communication.

From this starting point, many research projects studied how real-time video systems may be implemented, evaluated them in different contexts and looked at how it such a system could become a useful tool for deaf people.

The Mak-Messenger project [4] has been deployed in the field of education to help deaf students learn sign language. This application allows for the broadcasting of messages in the form of signs between users using an interface similar to a conventional chat. This technology can be used to address the educational needs of deaf people.

The Mobile American Sign Language (ASL) project [5] studied the limits of wireless video communications using mobile phones. This was done to assess the extent of the constraints imposed by mobile devices in terms of size and video quality.

The Learning Management System (LMS) [6] uses video in Greek Sign Language to translate any text in a learning environment. This system is designed specifically for deaf people who want to improve the mastery of a language. It offers a bilingual interface (video and text) and a real-time video chat system.

All of these projects use video for synchronous communication (in real time) between users and do not allow any communication in delayed time.

Researchers at the University of Washington created a project for enabling American Sign Language to flourish in Science, Technology, Engineering, and Management (ASL-STEM forum) [7]. This project provides a space for exchange, for the deaf to refine their comprehension of concepts used in science courses at university and provide a translation into American SL.

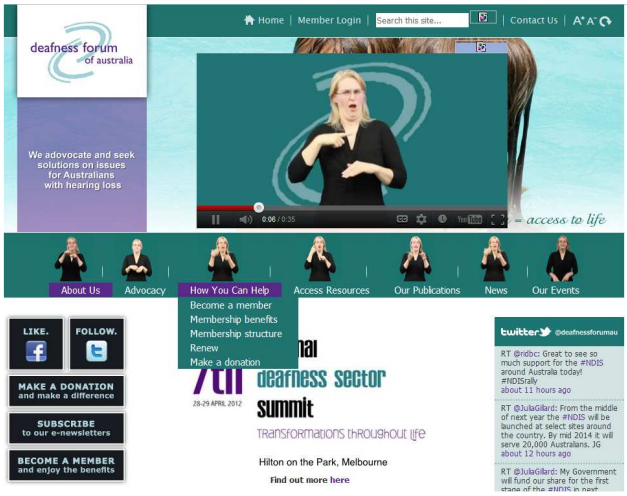

Figure 2. Example of a website with alternative videos [3]

This forum offers a mixed interface, text, and video; which is consistent with the context of use (higher education).

The ASL STEM Forum is primarily intended for the use of tertiary level students, which implies that the users' mastery of reading and writing is high.

This is the only project that includes asynchronous video communication between users. However, it is not designed to be general purpose, nor is it adaptable to another field of interest, like gardening or sports. Moreover, it is designed for a group that has already mastered a written language and wants to discuss the relationship between that and a sign language.

xSL Forum is designed to fill this gap, allowing signing users to discuss a wide range of topics in their native language (sign language), without the need to engage in reading or writing.

IV. XSL FORUM

The main motivation of this work is to offer the whole signing community a communication tool that is usable, accessible, efficient, and up-to-date; one that provides the same easy-of-use and functionality as text-based, online forums. All its content has to be accessible for signing people, especially if they do not know a written language.

"xSL" stands for "x Sign Language". The "x" means that the tool is not linked to a particular SL (Sign Language). It can be used with French SL (FSL), American SL (ASL), British SL (BSL), etc. Thus, all signing people, without any consideration for nationality or location, can use it without any modification for its functionalities.

Most computer applications nowadays are localized: they benefit from translation and some possible adjustments depending on the culture and the language mastered by potential users in a particular part of the world.

Our approach is to consider developing an application originally designed for signing people.

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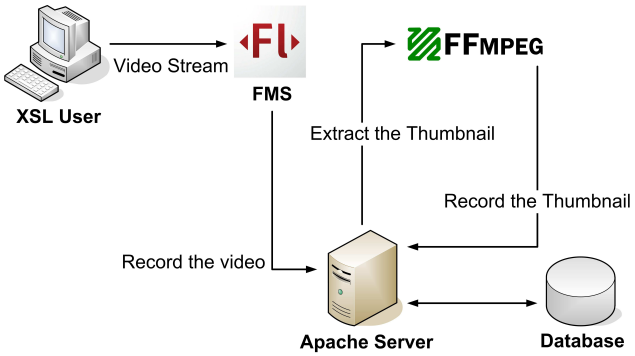

Figure 3. Recording a video (posting a message)

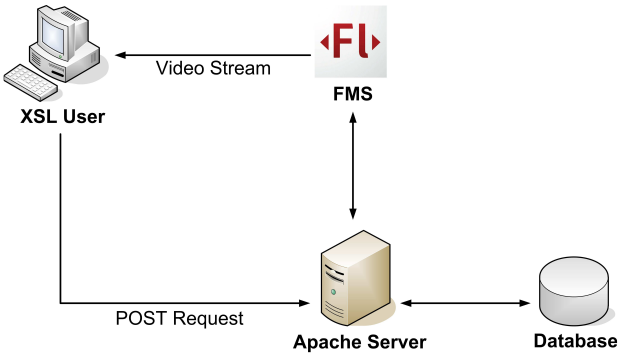

Figure 4. Playing a video (reading a message)

No written text is presented on the pages of the forum and we do not ask the user to enter any kind of text when using the xSL forum.

Forum access is possible even if the signing person does not know how to read or write. Knowledge of sign language (French or otherwise) is the only requirement to use this tool.

The xSL forum is an asynchronous tool. Users simply record a message in video form (a question, for example), and then come back later to see the answer(s). Beyond the constraints mentioned earlier, this feature can become a major advantage in certain contexts, e.g., to compensate for a large time difference between two interlocutors (a French one and a Japanese one).

xSL Forum can also be seen as a digital library with a capacity for long-term memory. Therefore, we can consider its use in specific contexts, such as: education (online courses), or administration (explanation of procedures, individual experiences, frequently asked questions, etc.).

A. Software and Hardware Architecture

The hardware architecture is standard for the World Wide Web landscape. It is a server (64bits PC with an Intel Xeon, 2GB of RAM and a 500 GB hard drive), on which are installed: an Apache server with PHP and a MySQL database (Figures 3 and 4). The software architecture consists of three principal parts:

- Flash Media Server
  The video streams are operated by a software component installed on the server side, Adobe Flash Media Server (FMS) [8]. This software supports streaming and recording video streams within web pages on the forum. On the client side, a small module coded in Flash Action Script 3 ensures the communication with FMS. Although Flash is not free and make us dependant on Adobe, we chose to use this technology to the extent that, at the time of development, it was the only solution available that allowed us to test the client behavior, independently of the browser used. Furthermore, many websites are using this technology and many users have already installed the Flash plug-in on their browser. It is a form of standardization in the management of video streams.
  FMS is not free in its standard version, but a free version for developers is available. It is merely limited in number of simultaneous connections from clients. Although the inclusion of FMS in the global architecture was quite complex, this choice allows the administrator/owner of the forum to keep a hand on the video content, in order to manage, for instance, privacy and restricted access to it. It seems that this would not have been fully achievable if we had decided to use another technology such as the YouTube API.

- Flux BB
  The software architecture of the website is derived from FluxBB [9]. It is an open source forum (GNU) developed in PHP, that we modified and added to. Common features have been preserved but all interfaces (GUIs) have been adapted to the specificities of video. The text input interface used for posting messages was replaced by a video recording interface (Figure 5).

- FFmpeg
  This is a library for manipulating video [10], which offers, for example, the ability to convert videos from one format to another. We use FFmpeg to dynamically extract images from videos that are posted on the forum. These images are used as thumbnails, which will be displayed as visual tips to recognize the messages of different users. We decided to extract the 10th picture of a movie and use it as a thumbnail to avoid the issues encountered if an earlier picture was chosen (blank or black ones, due to the streaming process).

B. Navigation and Interaction

One of the challenges of this development task was to find solutions for keeping interaction fluid, including exploration of the site contents and ease the manipulation and playback of videos. Interaction is exclusively via the mouse; the keyboard is never required. This feature will make its use on mobile platforms much less restrictive (no need of any keyboard) and more appropriate.

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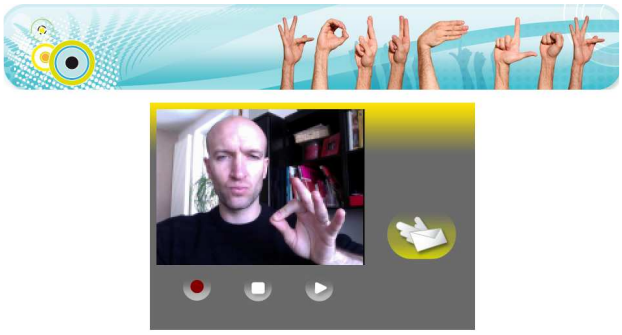

Figure 5. Video record interface

The hierarchy of the xSL Forum consists of three levels: categories, discussions and messages. The home page shows the categories hosted within the xSL Forum. By clicking on the thumbnail of one of these categories, users can access the various discussions (Figure 6). Similarly, by clicking on a thumbnail for a discussion, users can view the various messages exchanged in this discussion (Figure 7).

The pages on xSL forum are designed in such a way as to preserve simplicity while being visually pleasing and intuitive at the same time. Several design choices were implemented to meet these criteria.

First, we systematically combine two images to describe a given piece of content. For example, on a category page (Figure 6), the "category" tab in the top-left consists of an icon and a thumbnail, which reflects the title of the category. This combination allows us to offer two formats, one static and one dynamic, to take into account varying levels of navigation expertise. When users mouse over the thumbnail, the corresponding explanation video is played.

We also implemented a color code to complete the specificity of each level of the hierarchy of the forum: categories are green, topics are orange, and discussion messages are yellow. This encoding can also be retrieved via the tabs presented in the top left of the interface, which effectively completes the double (icon/thumbnail) presentation described above. These tabs allow the user to locate him/her-self through the existing topics and categories.

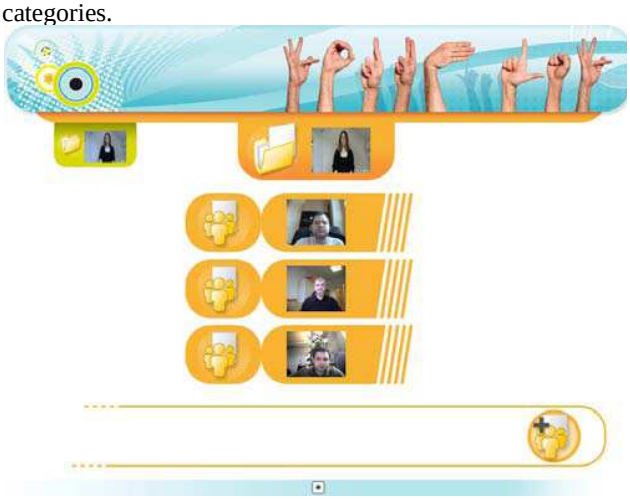

Figure 6. Different discussions in a category

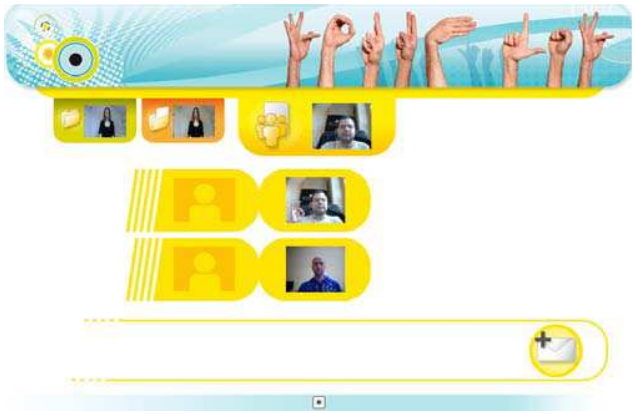

Figure 7. A particular discussion

- Playing videos (reading messages)
  A video (from a topic or a message) is played, when the cursor is placed over its thumbnail. To achieve this, our tool calls a script that executes a JavaScript code into a PHP file, using AJAX asynchronous mechanisms. This code implements a PHP/Flash playback that connects with the FMS to obtain the requested video and broadcast it (Figure 4).
  The requested video then appears next to the thumbnail in a window size of 200×160 pixels (Figure 8). This size was considered the most efficient as a result of an experiment to evaluate different sizes of videos on a web page by deaf signing users. The study was conducted with seven deaf users. They were asked to access a webpage with a 15" laptop and choose which sizes of video frames should be considered wide enough to understand the signed message.
  The available sizes ranged from 75×60 to 200×160 pixels (Figure 9). The comprehension of the message was good or acceptable on the three widest video frames, ranging from 125×100 to 200×160 pixels. However, all users reported that the widest one (200×160 pixels) was the most comfortable. If the user moves the cursor off the thumbnail, the video will stop and the window of the player will disappear (Figure 10).

Figure 8. Cursor over a thumbnail: the video appears (played)

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Figure 9. Different sizes of videos were used to evaluate the understanding and comfort of viewing.

Figure 10. Cursor out of thumbnails

- Recording videos (posting messages)
  Our current version allows users to create threads or leave messages, while the administrator controls the creation of new categories. If a user wishes to create a discussion or leave a message, he/she has to click on the icon on the bottom right of the screen (Figures 6 and 7). A new screen appears that implements a video recording interface (made with Flash Action Script 3) (Figure 5), that includes four features: record, stop, play, and validate. The recorder can record Flash videos using the webcam of the user's computer, in conjunction with the FMS server-side module. Once the video is validated, a PHP script is called. FFmpeg will extract a thumbnail, and then the server saves the extracted image and video to the database (Figure 3).

C. *Evaluations*

Beyond the experiments outlined above, we offered the use of the xSL forum to several deaf people.

Our first observation was that this type of tool (an online discussion forum) is not very well known by among the deaf community. This is consistent with our discussion in the introduction, where we assessed the typical form of online (textual) forums as having a low level of accessibility for this population. Therefore, their use and operation remain unclear.

However, after explaining the operation and purposes, all those contacted expressed great enthusiasm, and considered the many contexts of use of the xSL Forum, its use in the educational context was the most frequently mentioned.

We are about to start a formal evaluation of the xSL Forum. The aim is to evaluate the human-computer interfaces and ergonomics of the navigation and interaction. For this, we are preparing an experiment that consists of showing part of a movie to a set of deaf people and allowing them to discuss it remotely using the xSL Forum. We will prepare a variety of topics for this purpose. After a period of time has passed, questionnaires will be given to the users in order to elicit their feelings, criticisms, and suggestions regarding the tool.

V. FUTURE WORK

A new version of the xSL forum is under development. We are working on the following improvements:

Users should be able to access their account securely, so we are looking into authentication tools based on face recognition, such as [11]. The integration of these tools will help us meet our initial constraints, i.e. not to have to handle text.

We are also replacing FMS with the RED5 media server [12], a royalty free audio/video streaming engine. We are also considering the integration of video using HTML5 on the client side, but its implementation in the browser is still limited. This will provide a free forum independent from proprietary technologies; the ultimate being to provide a tool that is open source and royalty free.

We are trying to integrate help videos with interactive icons, to be read in the same way throughout the forum (with the mouse over action).

Video playback will also be improved by providing a "full screen" mode with control buttons (pause, play, timeline). These controls do not exist in the current version and yet they are indispensable, especially in the case of long videos.

We are planning to evaluate this tool with deaf communities. We also intend to test it with people who practice Cued Speech, as it can be used in the same way as sign language in the xSL Forum.

We are also planning to develop and deploy a version of the website for mobile platforms (phones and tablets). A specific application, IOS and Android, will ideally complete the whole set. These kinds of platforms suffers from the need for a real or virtual keyboard. When the keyboard is a physical one, it makes the device bigger; and when it is virtual, it poses serious constraints and ergonomics issues for the user. The xSL Forum is a great laboratory for experimenting with non-verbal interaction, based on visual cues, images, videos and gesture recognition. Initially linked to the deafness context, all the experiments and results could be tested and applied in a more general context, i.e. toward all users (hearing or deaf).

Another important discussion has been raised: the way search engines deal with video indexation and the use case offered by the xSL Forum.

Finally, the aim of this project is for the xSL Forum to be used to bring together different communities, including deaf, hearing-impaired, and hearing people. We, therefore, wish to collaborate with teams working on issues of recognition and automatic translation from sign language into written language and vice versa. This kind of collaboration would lead to a true bilingual access to xSL Forum and total accessibility.

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VI. CONCLUSION

As far as we are aware, an online forum using videos as its main modality of communication for signing people -deaf or hearing- did not exist before the xSL Forum. It allows users to simply exchange experiences and knowledge in various fields, according to previously unexploited temporalities in video mode (asynchronous communication and message archiving).

Beyond the important contribution to the deaf community, xSL Forum allows us to devise and propose non-textual interactions for situations in which text is not or is no longer be available. This forum can be used in contexts in which the modality or text is not very usable (mobile devices, embedded, no keyboard, etc.).

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REFERENCES

[1] D. Gillot, “The rights of deafs”, rapport to the French Prime Minister, 1998 (in French). See http://clas-lyon.fr/spin.php?article116 [retrieved: January, 2015].

[2] Deaf4Life forum: http://deaf4life.co.uk/ [retrieved: January, 2015].

[3] Deafness forum of Australia: http://deafnessforum.org.au/ [retrieved: January, 2015].

[4] J. Ohene-Djan, R. Zimmer, J. Bassett-Corss, A. Mould, and B. Cosh, “Mak-Messenger and Finger-Chat, Communications Technonlogies to Assist in the Teaching of Signed Languages to the Deaf and Hearing”, Proc. of the IEEE International Conference on Advanced Learning Technologies, 2004, pp. 744-746, doi:10.1109/ICALT.2004.1357643.

[5] A. Cavender, R. E. Ladner, and E. A. Riskin, “MobileASL : Intelligibility of sign language video as constrained by mobile phone technology”, Proc. of the 8th International ACM SIGACCESS Conference on Computers and Accessibility (Assets ‘06), 2006, pp. 71-78, doi:10.1145/1168987.1169001.

[6] A. S. Drigas, J. Vrettaros, and D. Kouremenos, “An e-learning management system for the deaf people”, Proc. of the 4th WSEAS International Conference on Artificial Intelligence, Knowledge Engineering Data Bases (AIKED ‘05), 2005, pp. 28:1-28:5.

[7] A. C. Cavender, D. S. Otero, J. P. Bigham, and R. E. Ladner, “Asl-stem forum: enabling sign language to grow through online collaboration”, Proc. of the SIGCHI Conference on Human Factors in Computing Systems (CHI ‘10), 2010, pp. 2075-2078, doi:10.1145/1753326.1753642.

[8] Flash Media Server: http://www.adobe.com/products/flash-media-server-family.html [retrieved: January, 2015].

[9] Flux BB: http://fluxbb.org/ [retrieved: January, 2015].

[10] FFmpeg: http://ffmpeg.org/ [retrieved: January, 2015].

[11] Pam Face Authentication: https://code.google.com/p/pam-face-authentication/ [retrieved: January, 2015].

[12] RED5 Media Server: http://red5.org/ [retrieved: January, 2015].

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