SIGN LANGUAGE LINKS IN WEB CONTENT

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INTRODUCTION

Sign languages are complete natural languages with their own grammatical structures [1]. They are not a translation of spoken or textual languages. These languages are the basis for Deaf culture.

On the World Wide Web (WWW), the presence of sign languages is very limited because of the dominance of text-based web development technologies. There is a lack of tools available to create webpages that do not contain text. It is thus difficult for Deaf sign language users to have a web presence in their native language and forces them to work in a second, less expressive language, text. The lack of sign language content on-line also means that Deaf culture has unequal representation in a space that is claimed to be one of the great equalizers of culture and language [2].

Currently, the World Wide Web allows web pages to be produced in any language in written form. Many Deaf people, however, use a visual-spatial language with no written equivalent (e.g. American Sign Language, Langue des Signes Quebecois). Vocabulary and grammar is expressed using hand gestures, facial gestures and body movements.

Some websites do provide sign language content [3-6] but many of them are often dictionaries or text-based information sites rather containing signed web content. In addition, even if there is signed web content such as in [3, 4], sites still use a static textual language for navigate elements and hyperlinks. Signers must then constantly switch between their normal language of communication, sign language, and a second language in text form in order to access the information. While this may assist people in developing proficiency in a text-based language, it limits the expression and exposure of Deaf culture online.

On-line sign language dictionary pages generally use 2D static drawings of the signs or mini movies of dynamic signs [5, 6]. The most common signs that are illustrated are the characters of manual alphabets that when put together constitutes "finger spelling". Finger spelling is an important part of sign language; it is used for names, places and emphasizing words. However, finger spelling complete sentences is awkward and often an inappropriate way of translating between sign languages and spoken or written languages (similar to speaking letters that spell words in sentences).

There is continuing research into generating computer graphics to simulate the body movements of people, creating virtual signing humans or avatars. However, it is a highly complex process to generate virtual humans. To simplify the process of implementing automated signs, Godenschweger et al. [7] designed and implemented a system to generate sign language from simple 3D models and present signs as line drawings. The animated signs are built from a set of static gestures which act as key frames. In this way, they were able to create a wider range of signs. However, with this method it is still necessary to switch to a textual language in order to navigate the web. Another problem is the complexity of the programs and tools required to produce web content; they would not allow novice users to produce personal content to be placed on the web.

In this paper, we will present a system, called SignLink Studio, that allows sign language to be implemented online as video content. Linking mechanisms for hyperlinking functions are implemented within sign language videos and web designers can create sign language webpages without the need for text. We also present the pilot results of a usability study of SignLink Studio with Deaf web designers.

SIGNLINK STUDIO

SignLink Studio has been designed to allow the creation of sign language webpages. The use of text is no longer necessary as the pages are created with video-embedded link mechanisms.

To create a sign language web page, a video of the sign language content is created by the web author/designer. Hyperlinks based on moving gestural signs in the main video are inserted in that

video so that users can browse and navigate between pages without the need for text. Exporting the set of linked sign language videos from SignLink Studio forms the sign language web page or site html and JavaScript that can be easily uploaded to a hosting webserver.

To evaluate the usability of SignLink Studio, we carried out a study with Deaf web designers to assess their ability to create sign language web pages with the tool.

Method

Six deaf ASL speaking youth (age range 18-30) participated in a study to evaluate the usability and functionality of the SignLink Studio. Five of the six participants were community college students and one was a university level student. All of the participants used the Internet daily. Four participants were familiar or very familiar with using a video player on their computer. Two of the participants never used a video player or did not know what it was. Three of the participants rated their English proficiency as advanced, one as around a grade 11 level and two rated their English proficiency below the grade four level. Three of the participants rated the difficulty of the text information on websites as just right, one as difficult and two as very difficult. Two of the participants rated tabs as their most preferred navigation style and four rated buttons such as next and previous as their preferred style. Other styles, such as table of contents and hyperlinks also were rated high.

The study tasks consisted of using SignLink Studio to create signlinks with a test video that detailed one person's trip through the eastern United States. To begin, participants were shown a video tutorial and then provided with hands-on demonstrations of how to insert signlinks into the video and export the associated webpages. As reinforcement training, they were allowed to explore the functionality of the editing interface. Participants were then asked to create two new signlinks within that video and export that page. Participants spent approximately 1 hour performing all the study tasks.

Data were collected using the Gestural Talk Aloud Protocol [8] with simultaneous verbal translation, note taking and pre/post study questionnaires. The analysis of the detailed video data is reported in this paper. Data from notes and pre/post questionnaires were reported in [9].

Thematic outcome measures for the video data were derived by two independent reviewers and then focused into seven measures (see Table 1).

Positive, negative, confusion and interruption descriptors were used. Positive was indicated by any positive comments about existing features and when the participant was able to successfully complete a task. Negative was indicated by any negative comments about existing features and comments about additional features that should be present. Confusion occurred when questions about existing features arose and when the participant was unsure of how to perform a task. An interruption was used to record when the facilitator needed to help

Table 1: Video analysis measures

	Measure		Definition
1	Signing Avatar		Positive and negative comments and events concerning the use of a signing avatar for the introductory signing avatar.
2	Technical		Positive and negative comments and events about the computer (mouse, keyboard, speed) or any other technical component of the experimental setup.
3	Ease of Learning		Positive and negative comments and events about how easy it is to learn to use SignLink Studio.
4	Functional	SignLink Studio	Positive and negative comments and events about appearance, location, and meaning of the available functions, including the labelling, buttons, colours and shapes used in SignLink Studio (not including comments made about the three parts of the signlink). Also mentioning additional functions that would be helpful. Confusion with functionality of SignLink Studio and with the task. Interruption by facilitator in order to complete a task.
		Signlink: URL	Positive and negative comments and events made about the appearance, location and meaning of the available functions on the screen to add the URL to the signlink. Including comments about the availability of optional text label for the URL. Confusion and interruption as above.
		Signlink: Timing	Positive and negative comments and events made about the appearance, location and meaning of the available functions on the screen to set the timing for the signlink. Confusion and interruption as above.
		Signlink: Thumbnail image	Positive and negative comments and events made about the appearance, location and meaning of the available functions on the screen to choose the signlink thumbnail image. Confusion and interruption as above.

the participant complete steps in the study task.

All four descriptors were used for the SignLink Studio measure and for the three Signlink measures (called functional measures). Only positive and negative were used for the remaining measures.

To determine the inter-rater reliability of the thematic analysis, two evaluators were instructed on the video analysis procedure and trained in the coding categories and their respective definitions. The single measures Intra Class Correlation (ICC) for all categories was 0.64 or better. All subsequent analyses were carried out by a single evaluator.

RESULTS AND DISCUSSION OF EVALUATION

A Kruskal-Wallis test was carried out between functional measures for all descriptors: positive, negative, confusion, and interruption. Significance was found for positive and confusion as seen in Table 2. No significance was found for the negative and interruption descriptors.

Figure 1 shows the mean number of events recorded for each descriptor for the categories, SignLink Studio (SL Studio), URL, Timing and Thumbnail image.

Table 2: Statistical values of descriptors for all functional measures.

	H	df	N	p	mean	SD
Positive descriptor	14.20	3	22	0.003	4.18	3.71
Confusion descriptor	14.00	3	20	0.003	3.65	4.10
Negative descriptor	4.73	2	10	0.094	3.20	2.86
Interruption descriptor	5.55	3	18	0.136	3.00	2.40

There were more positive events for all of the functional measures than for any other descriptor (92 positive events of 251 total events) and the fewest events occurred for the negative descriptor (32 events of 251). The majority of positive events occurred for the functional measure, SignLink Studio (mean=9.17 and SD=3.37) and the fewest positive events occurred for Signlink URL (mean=1.67, SD=0.82). This indicates that participants seemed to like the functionality in SignLink Studio and understand the purpose of the various authoring elements. Example comments from the data tapes include “that is good” and “I understand how to do that". By the end of each study, all participants were able to successfully create a signlink, save a SignLink Studio project, and export a web page, indicating that the software will most likely be accepted by the community.

Confusion was recorded in all functional measures with SignLink Studio having the greatest number (mean=7.00, SD=6.45) and Signlink URL having the fewest (mean=1.33, SD=0.96). There were two types of confusion measured, confusion with the interface and confusion with the experimental task, the majority of the confusion occurred with the interface. Confusion with the interface was generally focused on the location and labeling of buttons, especially as they relate to the signlink. Confusion ranged greatly between individuals, 20 events were recorded for one specific individual while the remaining five recorded between one and five events for all functional measures. We recommend that the buttons for the signlinks be changed so that they are more prominent, using either size of location.

Although there was no significance found for the negative descriptor, there was a noteworthy trend where the SignLink Studio measure seems to have more negative comments. Almost all of the negative events (27 of 32 events) were recorded in the SignLink Studio measure. No negative events were recorded in the Signlink URL measure, and only one participant recorded negative events in the Signlink Timing measure. The negative events tended to be related to the colour and location of the buttons (i.e. “[the stop button] should be red, not blue, everybody knows red is for stop”).

Interruptions were greatest for SignLink Studio measure (mean=5.00, SD=3.67) and the fewest for Signlink URL (mean=1.75, SD=0.96). Interruptions were necessary when the participant could not

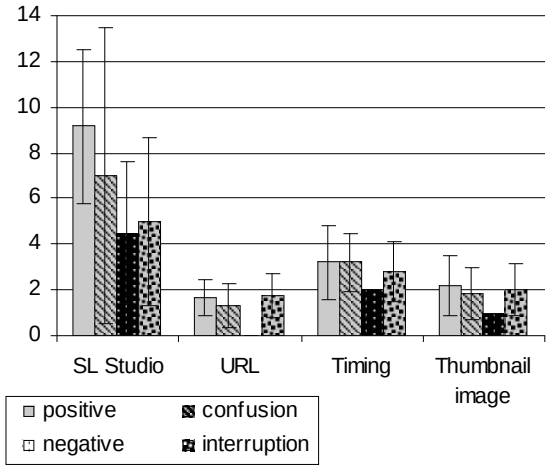

Figure 1: Mean number events

complete a step in the task and asked for clarification about the task itself or the interface. It does not seem that there was any part of the program that was more difficult to understand and use than the rest.

The SignLink URL task was a simple and short duration task involving entering a web URL for the assigned link. As a result, this measure had the fewest events for all descriptors (21 of 251 events). Participants seem to understand that a URL was required for linking as part of a standard web design process.

The SignLink Studio functional measure had the most events overall (149 of 251 events). This was not surprising as this measure encapsulated most of the software functionality (accept for the three steps in customizing a signlink). In this measure most of the comments and marked events were positive (55 positive events of 149 events) and fewest for the negative descriptor (27 of 149 events).

A Mann-Whitney statistic was also carried out between the positive and negative events for the other measures. No significant difference was found.

There seems to be a negative trend for the Signing Avatar measure with a mean of 3.67 events (SD=2.31) while the mean for the positive events was 2.50 (SD=0.71). The response to the signing avatar seemed consistently negative. Example comments included, “the signing avatar is too fast”. Even though there were also comments that the signing avatar was “cool” and “neat”, statements such as “I don’t understand what he is signing”, “when I get use to [the avatar] it might be better, but I thought the delivery was too fast” and “the human signer is better than the avatar” were more frequent.

The Ease of Learning measure seemed to be slightly more positive with a positive mean of 2.40 (SD=1.95) and a negative mean of 2.00 (SD=1.00). Comments relating to this measure included, “It is the most fun I have had since coming to RIT”, “with a little practice it will be a real cool tool”, “having a ball, it is not that hard”, and “can learn from demonstration.”

The Technical measure contained only negative events, with a mean of 4.75 (SD=3.10). Most of the events were due to the program crashing or other problems with the software performance (e.g. the video did not display/play as needed). While prototype software can be unreliable, it is important to gauge the response of the user to the interface and functionality at early development/prototype stages.

CONCLUSION

In this paper we have given a preliminary analysis of the video data from the SignLink Studio study. The overall response to SignLink Studio seems positive although some of the interface elements such as the video control buttons caused confusion. The use of the signing avatar, at this point, is not well received; the use of a human signer is still the most acceptable form. The software needs to be made more robust in order to prevent the technical problems experienced.

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