

## **Title**

Signlinking 2.0

## **Authors**

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## **Abstract**

The first generation of the signlinking technique (version 1.0) demonstrated the potential of bringing sign language to the Web on its own terms. The signlinking technique has now been updated (version 2.0) using Flash, which has greatly enhanced its browser performance, while simultaneously reducing the number of files required for each "signed webpage". In addition, content management functionality, which includes a discussion forum, has been developed to take advantage of the updated method of signlinking videos. The CMS application (SignlinkCMS) can be used in conjunction with Signlink Studio to create and manage signed websites and interactive forums. A pilot study of SignlinkCMS showed that despite the many technical hurdles to overcome, users were very willing to invest the time and effort required to create sign language video messages and that sign language based communication networks are highly desirable. .

## **Introduction**

In 2005, when the Signlink v1.0 technique was introduced video on the Web was in its infancy and the Web was still very textual. Despite the popularity of video sites such as Google Video, YouTube and video logs (vlogs) not much has really changed. For the most part, links are still hyperlinked text or hyperlinked images of text, and not surprisingly, text remains a dominant form of information dissemination.

This works well for most linguistic groups because electronic text encoding systems (e.g., UNICODE) are in place for most of the world's major written languages, resulting in the emergence of the Web as a powerful medium for work, learning, social connection, entertainment and cultural expression. Unfortunately, the text intensive nature of the Web has made it difficult to achieve an authentic Deaf cultural presence because most sign languages do not have widely used written forms (Stokoe, 2005). As a result sign language video is often "plugged-in" to otherwise text-based navigation systems to the detriment of people who experience a written language as a second language or those who desire a purely signed experience for cultural reasons.

The signlinking technique was developed to allow hyperlinks to be inserted into video along with additional page visualization aids. An editor, SignLink Studio (SLS) (formerly "SignEd"), was developed simultaneously to simplify the authoring of the signlinked videos. The most recent version of this editor implements the signlinking technique using Flash.

As a natural extension of the signlinking technique combined with the current direction of web-based social communities towards inclusion of video content, and the demands from the Deaf community, we wanted to explore the possibilities of social networking, vlogging and bulletin board forums in sign language. We expanded the functionality of SLS to support these features and to examine the impact they would have on sign language users. A content management system (CMS) for signlinked content, called SignlinkCMS, has been developed. In this paper a review the signlinking concept is provided along with a description of SignLinkCMS and the results of a pilot study of SignlinkCMS used in conjunction with SLS.

## **Background**

As early as 1978, researchers and individuals had been exploring the use of information and communication technologies (ICT) including asynchronous (e.g., bulletin boards, email) and synchronous (e.g., chat) computer-mediated communication systems by people with disabilities. Electronic bulletin boards and forums are a mechanism in which users have a shared public space in which to make contributions on specific topics (threaded), and retrieve and reply to the contributions of others for information exchange and social interactions at any time and any place (James & Wotring, 1995; Preece, Maloney-Krichmar, & Abras, 2003). Churchill and Nelson (2007) also suggest that the shared and persistent nature of communication on public bulletin boards changes the nature of communication because it is available, persistent and potentially accessible to a wide audience.

Even early studies in 1978 with DeafNet researchers (Wagreich, 1982) suggest that users with disabilities enjoy peer and emotional support, convenience, increased access to information, self-advocacy, an increased ability to independently carry out business and personal transactions and communications and empowerment as a result of using ICT in general, and specifically electronic bulletin boards (James & Wotring, 1995; Ritchie & Blanck, 2003). In a study of 200 web sites by the US Centers for Independent Living, Ritchie & Blanck (2003) found that 27.5% of them provided peer counseling services through ICT, specifically bulletin board and chat facilities.

Ritchie and Blanck (2003) suggest that websites and web resources that are not accessible prevent people with disabilities from taking full advantage of these services and resources. Often, however, accessibility for people with disabilities has left out members of the Deaf community. For example, researchers often cite lack of text equivalents and the use of frames as the most common reasons why websites are inaccessible (Ritchie & Blanck, 2003; Lazar, Dudley-Sponaugle, & Greenidge, 2003; Zeng & Parmanto, 2004). While the Web Content Accessibility Guidelines version 1.0 (W3C, 2003) provide a checklist of the 10 primary elements of web site accessibility, including the provision of text equivalents, there is very little mention of the need to provide sign language accessibility other than in relation to videos or movies. There is little provision for having alternative language content on text-based web pages or communication applications such as bulletin boards or forums on-line.

Rafaeli and LaRose (1993) identified some of the important factors for bulletin boards success. In their study of 126 bulletin boards from a variety of hosting locations in the US, they found that bulletin board success, defined as having longevity, and high contribution levels, adoption rates and regular use, was most affected by having content diversity on the bulletin board and when many people made contributions and consumed them (called reciprocity or the ratio of “givers” to “takers/lurkers”). Others (Preece, 2001) have also suggested that usability, reciprocity, diversity of contributors and level of participant interaction are indicators of success. A sign language bulletin board will likely succeed and can be assessed based on these same factors.

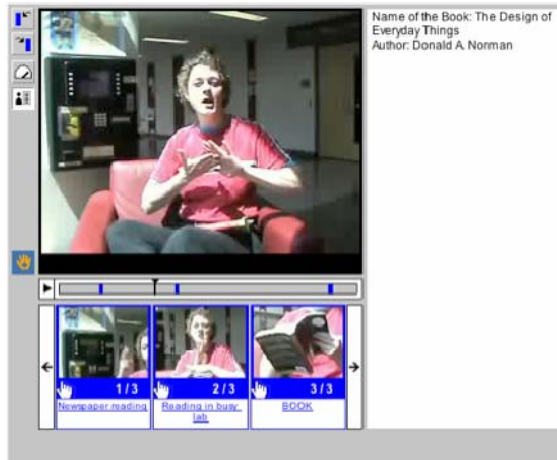
There is very little research reporting the beginning and development of bulletin boards. For example, developing a sufficiently diverse database of content may require some initial instigators to post messages on fairly controversial topics that will encourage others to contribute rather than lurking, “taking” only, or losing interest. Rafaeli and LaRose (1993) suggest that an investigation on failed bulletin boards may shed some light on which factors seem to drive their failure.

Usability of bulletin boards is facilitated through software applications such as the one described in this paper. Preece (2001) suggests that in order for bulletin board applications to be successful the basic functions of finding, reading and generating or replying to messages on specific topics must be (1) easy to learn and remember, (2) take as little time as possible with as few errors as possible, and (3) be satisfying to users. Ease of learning and remembering the steps to accomplish the basic functions can be supported through the use of consistent interface elements between the bulletin board software and the hosting environments.

If sign language based bulletin boards are to be established, populated and proliferate in the Deaf community, they must demonstrate all of the general factors identified as contributing to a board’s success (e.g., it should be easy to find, read and generate replies to messages). One of the most basic functions of message management is linking between messages. In a sign language based bulletin board or forum, this could be facilitated through signlinking and SignLink Studio (SLS).

## **Signlink Basics**

A signlinked video is basically a bundle containing a video and player interface that lets the user interact with the video in various ways (Figure 1). The most important interaction, from a Web perspective, is to access hyperlinks (signlinks) that the author has added within that video.



**Figure 1:** A signlinked video

Signlinking is conceptually equivalent to text hyperlinking. However, while text hyperlinking identifies the space occupied by a string of text on a page that links to some other resource on the Web, signlinking identifies a time interval of video during which the signer refers to the resource.

As the video is played in the browser, the presence of a signlink at a particular time interval is conveyed by a red “signlink indicator” that surrounds the video. Red was selected because it is a fairly common convention on the Web to use red to emphasize a link that is currently under the mouse pointer and ready to be clicked.

It is not enough, however, to expect sign language users to watch every video from start to finish in order to locate the links. When multiple hyperlinks appear in a textual webpage, sighted users can simply scan over them to gain an overall view of the distribution of links with respect to each other and to the rest of the text, enabling them to form a quick, intuitive understanding of the webpage’s role (e.g., the page is a content page or an index to other pages). In signlinking, this top-level view is achieved via the interaction of two navigation aids. The first is a “signlink density display” that shows the location and relative length of all of the signlinks in the video, with the current link displayed in red. Clicking on a link lets the user discover the content of the link as it is played in the video area.

The second navigation aid is the signlink thumbnail images. These are arranged, three at a time, in a row below the video. The thumbnail images, one for each signlinked time interval, represent a full or partial frame captured from the respective intervals in the video. Each thumbnail image is given focus with red highlighting when the corresponding signlink occurs in the video. The static thumbnail images are not necessarily sufficient to unambiguously label what the signer is saying, since movement is critical to sign language, but they are often enough to provide a hint or trigger recall for a returning user.

Users navigate to the target of signlinks by clicking on “jump to link” buttons located below each thumbnail image and below the video when a link is current. The “jump to link” buttons are marked with a “pointed finger” icon that follows the browser convention of showing a “pointed finger” mouse cursor when the user hovers over a link.

In order to support bilingual (sign language and print) applications, optional text features are available. The first is an optional text label that can be added below each thumbnail. The text label is a hyperlink with the same URL as the signlink it is associated with. The second text feature is an optional text content area displayed on right of the video. Authors can use this area to provide whatever level of text support they wish, from a list of topic keywords to a short description to a full alternate text version. End users can chose to display the text content area or not by clicking on an icon for text display. The text can include hyperlinks, but these are limited to the same resources that are already linked with a signlink, ensuring that the text version is not more richly linked than the signed version.

### **Changes for Version 2.0**

Since we introduced Signlinking 1.0 in 2005, the Web has changed, but not always as expected. The *de facto* standard for interactive Web applications and video has moved from Quicktime to Flash. We, therefore, decided to use Flash as we undertook our new round of development. The use of Flash has the further advantage of reducing the number of files required for each signed webpage from over 20 to just two: 1) a small executable file (\*.swf) and 2) a larger video source file (\*.flv). Also, Flash support is available for all major browsers and platforms.

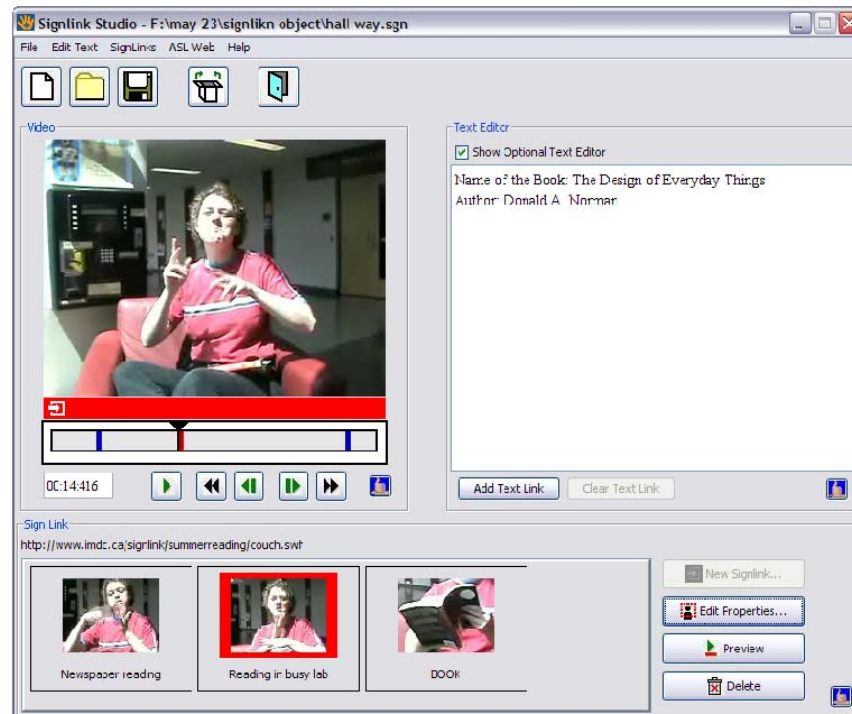
As much as possible, the basic user interface design of signlinking and Signlink Studio were preserved, as these had emerged from an iterative design process involving much expert input and two rounds of user testing with signing users (Fels, Richards, Hardman, Soudian, & Silverman, 2004). There are, however, several differences:

1. In version 2.0, even if the author has provided text labels and text description for the signed object, the user can choose to hide them.
2. In version 2.0, the signlink icon has been changed to a pointed finger to mirror the appearance of the mouse cursor when a link is active.
3. In version 2.0, the author has the option of choosing HTML frame targets for hyperlinks. This allows a signlinked video in one frame to control the signlinked videos in another frame, enabling a wider variety of webpage designs.

### **Signlink Studio (SLS) Authoring Tool**

In order to facilitate authoring of signlinked videos, a (free) authoring environment called Signlink Studio (SLS) is available (Figure 2). It allows authors to import existing videos and then add signlinks, create optional text content and export the finished signlinked videos. SLS also includes a

help feature called ASL tool tips that provide short ASL explanations of the various controls. For a complete description of the previous version of SLS, see (Fels, Richards, Hardman, & Lee, 2006).



**Figure 2:** The main editing window of Signlink Studio.

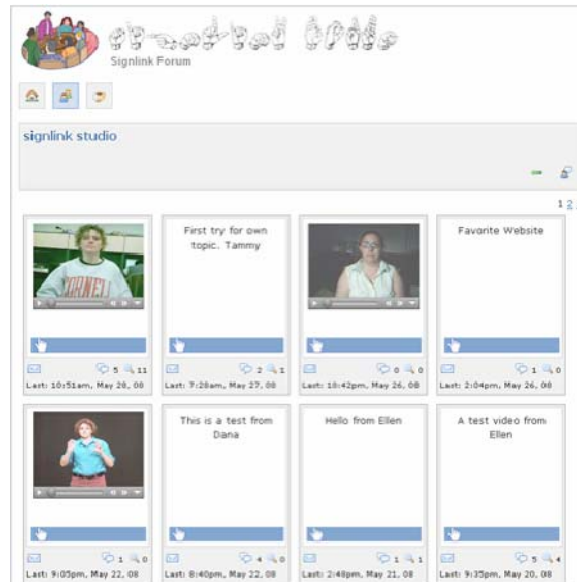
## SignlinkCMS Software

With Signlinking 2.0 on a more solid technical footing, we wanted to explore the feasibility of providing content management system (CMS) functionality for sign language information. Our test application (SignlinkCMS) currently has three modules under development: 1) a discussion forum that supports video and text posts, 2) a vlog module, and 3) a webpage authoring module. The discussion forum module is the first to be evaluated and the results of the initial evaluations are reported in this paper.

Currently, there are few, if any, bulletin boards that allow video messages to be included in quite the same way as text typically is. YouTube allows videos and video comments to be posted, but hyperlinks within videos are not available. Churchill and Nelson (2007) developed a digital bulletin board that is physically located in a public space. On the bulletin board's touch screen users can enter text as well as create finger drawn graphics and scribbles, but video messages are not supported.

The SignlinkCMS discussion forum (figure 3) allows new discussion threads to be started with a "subject" and an "initial message". The subject can be either a video, graphic or text and the initial

message can be either a signlinked video (described above), video or text. Replies can be signlinked videos, videos or text.



**Figure 3:** SignlinkCMS Forum used in the pilot study

To add a signlinked video to a message, users must use SLS 2.0 to create and export the two flash files to their computer and then upload the files to the forum. Videos and graphics are similarly uploaded, whereas text can be entered directly.

The key design challenge for the discussion forum was the need to display together messages created in different media (text, graphics, video and signlinked videos) requiring different amounts of space due to display and layout considerations. The approach we took was to display thread subjects (video, graphic, or text) in groups of eight as cells in a grid. Clicking on the hand icon in a cell goes to the initial message for the thread, with any replies listed underneath.

## **Pilot Study of SignlinkCMS**

### ***Method***

A pilot study was conducted to test the usability and acceptability of the SignlinkCMS discussion forum among sign language users. Since development was ongoing and known technical issues existed, signing participants were recruited who had a high level of interest in the Web and who, therefore, might be more likely to persevere through technical difficulties. Participants were asked to complete English-based pre- and post-study surveys.

The pre-study survey primarily collected demographic data and information about previous computer, Internet and discussion forum experience. The post-study survey asked the users about

their experience in the forum and allowed them to provide feedback for improvements. Specifically, questions were asked on the frequency of accessing the forums, types of posts that were viewed, type of posts that were made, which posts were easy or difficult to understand, and the length of time to post a message. Participants were asked to rank the quality of their experiences with the forum (e.g., uploading video) using a 7-point Likert scale ranging from “very difficult” to “very easy” with an option to select “I did not try that” where appropriate.

Ten people (six female and four male participants) were selected for the study, which lasted three weeks. Only six (four female and two male) participants remained throughout the whole study. The others could not continue due to issues unrelated to the study. All six participants were familiar with sign language, five had 11 or more years using sign language, and one had three or more years. All six had more than 11 years of using computers and rated themselves as intermediate to advanced level computer users. All were skilled with English reading and writing, familiar with viewing standard webpages, and viewing standard videos and videos with signed content on the Web. All participants stated they were familiar with using a video camera, but five were not familiar with downloading and editing videos from their cameras. All participants agreed that the use of sign language supports Deaf culture and a sign language forum was a good idea.

### ***Results and Discussion***

Participants were generally successful at viewing messages in the forum. They accessed the forum an average of 12 times during the study (standard deviation of 7.5). There were a total of 37 postings made to the forum within nine topics. Of those posts, 17 were text, 16 were raw video and six were SLS objects. Three of the six participants viewed all 37 postings during the study while the other three viewed fewer than half of them (one participant viewed 12 and the other two participants viewed 5 or 6 respectively). One participant did not view any of the posted messages, but was able to post three messages in video format. Two participants only viewed messages created by others, but did not generate any of their own (lurker behavior).

On the post-study questionnaire, four of six participants said that it was either easy or very easy to find the postings, one did not try and one found it only slightly easy. All participants found it easy or very easy to read the postings. As described in the literature (Preece, 2001), these tasks are critical in establishing a successful bulletin board or forum.

Posting messages to the forum proved to be more of a challenge. Two participants were unsuccessful in posting any materials after struggling twice for more than one hour each time. Of those participants who were successful in creating and posting their own contributions, two of four spent more than 30 minutes creating and posting their first two video posts, while their last video posts were created and uploaded in less than 30 minutes. Two participants spent less than 10 minutes posting a video or a text message.

Two participants found it easy to create a video and open it in SLS, three found it difficult or very difficult and one did not try. Only three participants attempted to use SLS to put links in their video.



One reported that this process was very easy and was able to successfully upload the SLS object to forum, while two thought it was slightly difficult and were unable to upload the SLS object to forum. Three participants found that it was slightly easy, easy or very easy to upload/post a text, video to SLS object to the bulletin board, while two found it to be a slightly difficult or difficult task and one did not try. When SLS objects were made it took up more than 40 minutes to make and post them. Only one participant was generally successful in making and posting SLS objects.

An important challenge during this study proved to be working with video. Approximately ten days were needed for all of the participants to develop sufficient familiarity with the system (making a video from a webcam, downloading the video to their desktop computer, editing it, adding signlinks using SLS and posting it to the forum). Compounding this were technical issues such as: 1) different webcams producing different video formats, 2) different video editors, 3) confusion between video files and movie project files, and 4) bugs within SLS. Unfortunately, this left relatively little time in the study for participants to post messages in the forum. This was a vivid demonstration of the need to provide rich training materials related to capturing, editing and uploading video.

One central difference between sign language bulletin boards and text-based boards is the level of technical sophistication that is required of users. In order to be successful bulletin board users, sign language users must not only be able to generate content as video material, but they must also use sophisticated editing software and be aware of the multitude of possible video formats. Text-based content is much simpler to author and requires only standard text entry controls directly on a webpage.

From this study it seems that sign language users are motivated and willing to invest the additional time and effort required to produce content sign language bulletin boards. However, it remains to be determined whether this initial enthusiasm is a novelty effect or whether sign language users are truly willing to invest this extra time and effort to create and manage sign language bulletin boards. Further research is required to evaluate which measures identified in the literature apply to sign language communication networks or whether new measures are required. Success indicators as proposed in the literature (Rafaeli & LaRose, 1993) such as adoption and contribution rates, longevity and content diversity can only be measured once sign language bulletin boards have been established and used. Measures such as the convenience factor identified by Wagreich (1982) may not even apply to sign language boards and users.

An unanticipated challenge was that the forum was started with a 'blank' page and participants were unsure what to post other than "hello, I am here" message. At the end of second week of study, several new topics were introduced by the researchers to specifically elicit responses from the participants and encourage them to 'reply' as in a true discussion format. There is little published work that addresses the issue of how to begin a successful board, but based on this very preliminary study, we suggest that new bulletin boards or topics need to be seeded with contributions from an interested party in order to attract others. Beginning with controversial topics may be an additional way of inducing others to submit posts.

Overall, despite the problems, all of the participants said they would participate in a signed forum again and would recommend the forum. Even the participants who were unsuccessful at posting were still in favor of a signing forum. All participants said extra time required for posting signed videos over text messages was justified. One said, "I like the whole idea of being able to sign a post, or type a post or have a combination of both". Another participant said "This feels more personal, more real that I use sign instead of text. It's like writing a letter by hand on paper with pen." Participants reported it took less time to post video messages into the forum as they developed familiarity with the SignlinkCMS interface and uploading videos into the forum.

Some issues that were not addressed in this limited study included the method that participants used to create their video. There may be a need to provide more guidance on appropriate video quality and formats, lighting, signing speed, clothing, and background. Once sign language users are able to create and post successfully, new research questions arise that can probe some of the deeper technical and cultural issues. For instance, is the choice of background for a video interpreted on a symbolic level, such as part of the poster's identity or part of the message, or is a background just a background? Is a sterile and static background required for a forum posting, or does it convey detachment? If the background is not plain, must it be static (e.g., bookshelves, furniture, plants) or are dynamic backgrounds acceptable? Cultural questions might include whether online discussions in sign language are supportive of people from different backgrounds, geographic locations, age and interests.

## **Conclusion**

For most linguistic groups, the World Wide Web has delivered on its remarkable promise; allowing people to work, learn, connect, play and express themselves in whatever language they wish. However, for the millions of people around the world for whom a sign language is a first or preferred language the Web has not yet brought all of these benefits. In particular, participation in social and communication networks is very much reliant on text. After upgrading our signlinking technique, we carried out an initial study of an online tool (SignlinkCMS) that includes a discussion forum feature that supports sign language video material, including signlinked videos. The results of this study shows that even with technical difficulties and software limitations the use of sign language video in forums and other more interactive settings is desirable and of use to deaf people.

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