

## WEB-BASED BILINGUAL INSTRUCTION FOR DEAF CHILDREN

Sonia Martinez<sup>1</sup>, Vicki L. Hanson, Susan Crayne  
IBM T. J. Watson Research Center  
19 Skyline Dr., Hawthorne, NY USA 10532  
{somartin, vlh, crayne}@us.ibm.com

### Abstract

Bilingual education of deaf children involves the use of a natural signed language, such as American Sign Language (ASL), to support the acquisition of a second language. For many deaf children, the second language will be the print form of the local language, such as English. This paper discusses technology designed to support bilingual / bicultural education. A Web application for presenting signed ASL and printed English is described. The development of this application was informed by lessons learned from an earlier project.

### Introduction

Among the many attempts to foster the acquisition of English by deaf children have been approaches that seek to incorporate knowledge and strategies that deaf adults use when teaching their young deaf children. Building on these principles, educators and linguists have pointed to the beneficial role that American Sign Language (ASL) can play in the acquisition of skilled reading and writing (e.g., Johnson, Liddell, & Erting, 1989; Lane, 1992).

Begun originally in 1986, the *HandsOn* project sought to provide schools with computer technology to support bilingual/bicultural programs (Hanson & Padden, 1989, 1990, 1992). Many teachers at the time were seeking ways to incorporate children's knowledge of ASL into an instructional program for language acquisition. *HandsOn* was the first attempt to use computer technology to explore ways in which the two languages could be combined to support language instruction for elementary-aged deaf children. The hypothesis was that students would be able to use the two languages together in a way that would promote acquisition of printed English, while simultaneously reinforcing ASL competence.

The original *HandsOn* program used laser disc technology to present full screen, real people signing ASL. Key to the program was that both ASL video and English text were presented on the same monitor, giving students the ability to view the two languages simultaneously. The software had various reading and writing tasks that were refined over the life of the project, based on student and teacher feedback (see Hanson & Padden, 1989, 1990, 1992).

---

<sup>1</sup> Also, Herbert H. Lehman College, CUNY, Bronx, New York

*HandsOn* enjoyed considerable success. It was popular among students who enjoyed educational materials involving ASL. It was also enthusiastically received by teachers who saw that the software engaged students in reading and writing activities in a way that was not matched by typical textual materials. Especially successful was the 'Caption a Story' activity in which children wrote English translations of ASL sentences and could then play back their translations superimposed on the ASL. Students worked hard to ensure that they had the best translations possible for each signed sentence.

A question often asked in relation to the efficacy of this approach is the following: If you show students signed ASL sentences and ask them to write the English translations, won't they simply 'write ASL'? The analyses of students' captions showed this not to be the case (Hanson, 2002). In their translations, students added prepositions, for example, that did not appear in the ASL. To understand this, consider the ASL sentence: ME GO STORE. The English translation of this sentence requires the addition of the preposition "to" and the article "the" for the sentence "I went to the store". Hanson & Padden (1992) observed that students added English grammatical information such as this in their captions rather than doing straight sign-for-word translations.

Teachers reported that students wrote longer, more complex English sentences when captioning than they normally wrote for classroom assignments. Better morphological agreement and more inclusion of articles were specifically noted. These observations are consistent with other work showing that the writing of deaf children to signed prompts is longer and more grammatically correct than unprompted writing (Kelly, et al., 1994; Mozzer-Mather, 1990). The sentence-by-sentence translation of the ASL apparently allows students to concentrate on the vocabulary and grammar when writing.

A particularly interesting aspect of the captioning activity was conversations between pairs of students in which they would discuss the best way to capture an ASL phrase in English. These discussions demonstrated that the children not only understood the uniqueness of the two languages, but also were actively trying out linguistic theories about relationships between the two.

### **A revision of *HandsOn***

Given the success of the *HandsOn* project, it was desirable to continue. However, the original *HandsOn* project employed videodisc technology, which is no longer generally used. Happily, advances in Web technologies now afford the opportunity for use of video via the Internet. A Web-based version of *HandsOn* has the potential to reach many more users than would be possible with a technology such as videodiscs that requires distribution to each person who will use it. The Web makes it possible for anyone with Internet access to use the software.

For the educational purpose of language learning, it was important to use real signers, not computer-generated avatars (e.g., Cox, et. al., 2002; Verlinden, Tijsseling, & Frowein, 2000). Video streaming techniques, therefore, were employed to present ASL stories over the web in the context of various activities designed for young children. To deal with the issue of download time over the web, the size of the signed files was limited by no longer having the signer presented full screen. Rather, the signer is shown in a window on the web page. Given

the high quality of the original videotaped stories for this project, the signer is still easily seen. On the positive side, the use of a window for the signing rather than full screen allows both the signing and the story text to be displayed onscreen. This is consistent with research showing how deaf parents read to their children in that both languages can be simultaneously present at all times (Schleper, 1996).

While real literature in the form of published storybooks would have been desirable for content, the rights to use these materials were not available. Therefore, stories for *HandsOn* were original material created for the project.

The stories were presented using a book metaphor, as shown in Figure 1. As can be seen, the ASL is shown on the left side of the book, with English on the right. The ASL and English are synched, so that as the student moves through the ASL or English version, the other version progresses in step with it.

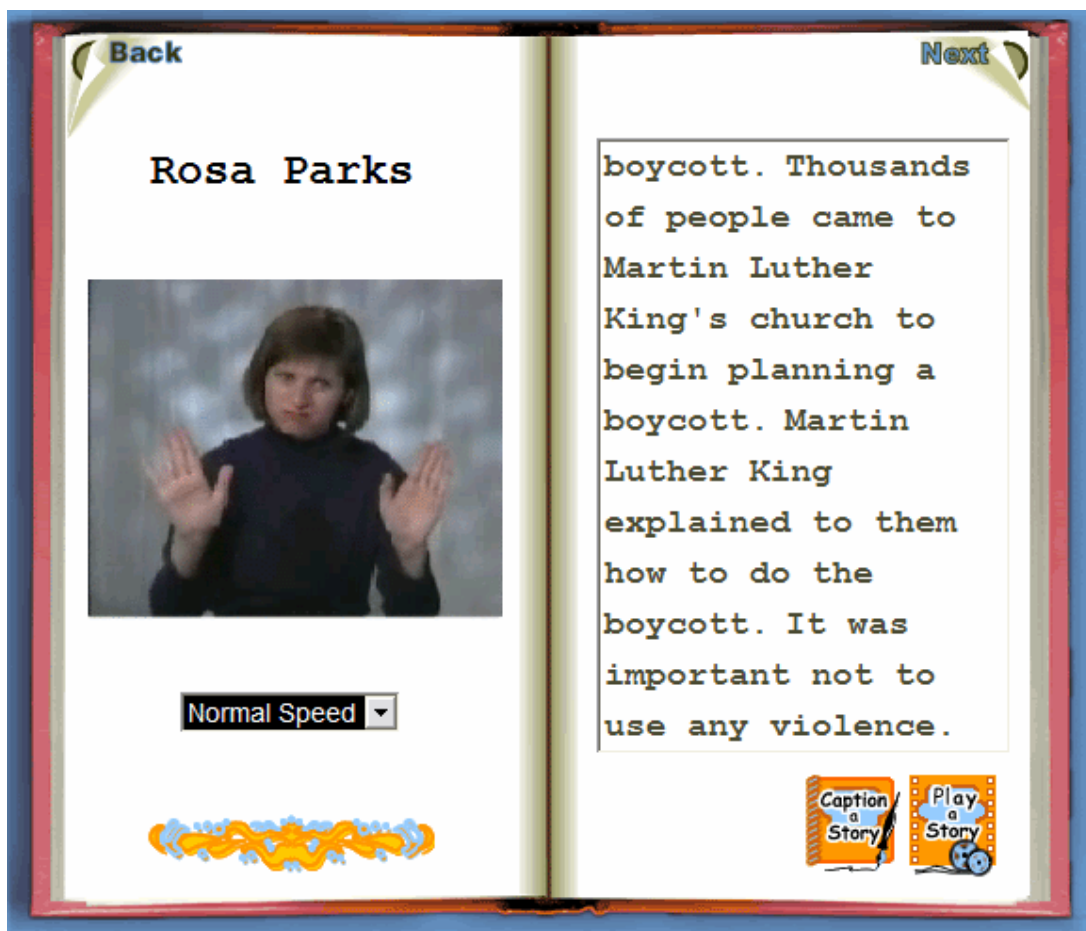


Figure 1. A screen capture showing the book metaphor for presentation.

When originally created, the stories were first videotaped in ASL and then English translations

of the stories were written (Hanson & Padden, 1989). Rather than being direct sign-to-word translations, the English translations capture the semantics of the ASL. An example is the following:

ASL: IMPORTANT THEY-GROUP NOT USE ANY VIOLENCE, NO.

English: *It was important that they not use any violence.*

The activity options in *HandsOn* include the three most successful activities from the original project: Play a Story, Read a Story, and Caption a Story. For testing, we began by using some of the stories from the original projects. The ASL stories were originally recorded on 1-inch videotape. Stories were transformed into digital recordings suitable for viewing using QuickTime. The topics of these stories included both Deaf Culture and subjects that would be covered in an elementary curriculum (e.g., science, social studies, and the environment)

### **The Web Version of *HandsOn***

The Web version of *HandsOn* was designed as a series of Web pages. The home page of the application permits the user to download any necessary software that is not already on their machine. The required software includes a Java plug-in and QuickTime. The other application downloads are specific to the *HandsOn* software itself.

The main function menu allows the user to choose between Play a Story, Read a Story, and Caption a Story activities. Within each of the three activities, a Java applet that manages the video streaming is embedded. The applets work on both Mac and Windows computers.

The Play a Story activity involves a user selecting a story to be played in ASL. The user chooses a story from a list of links. A movie is then played in ASL. A user has the option of pausing, stopping or adjusting the play back speed of the movie.

The Read a Story activity lets a user read a selected story in English, and has the option of translating selected English sentences into ASL by clicking on them. In addition, Read a Story also has the option for adjusting the play back speed of the movie. Shown in Figure 2 is a sample screen from this activity. As shown here, the user has requested that a sentence from the Rosa Parks story, "It was important not to use any violence", be signed in ASL. This request was made by clicking on the sentence in the English version of the story. The requested sentence is highlighted in yellow in English and the corresponding ASL translation is shown on the left-hand side of the book (here shown in freeze frame).

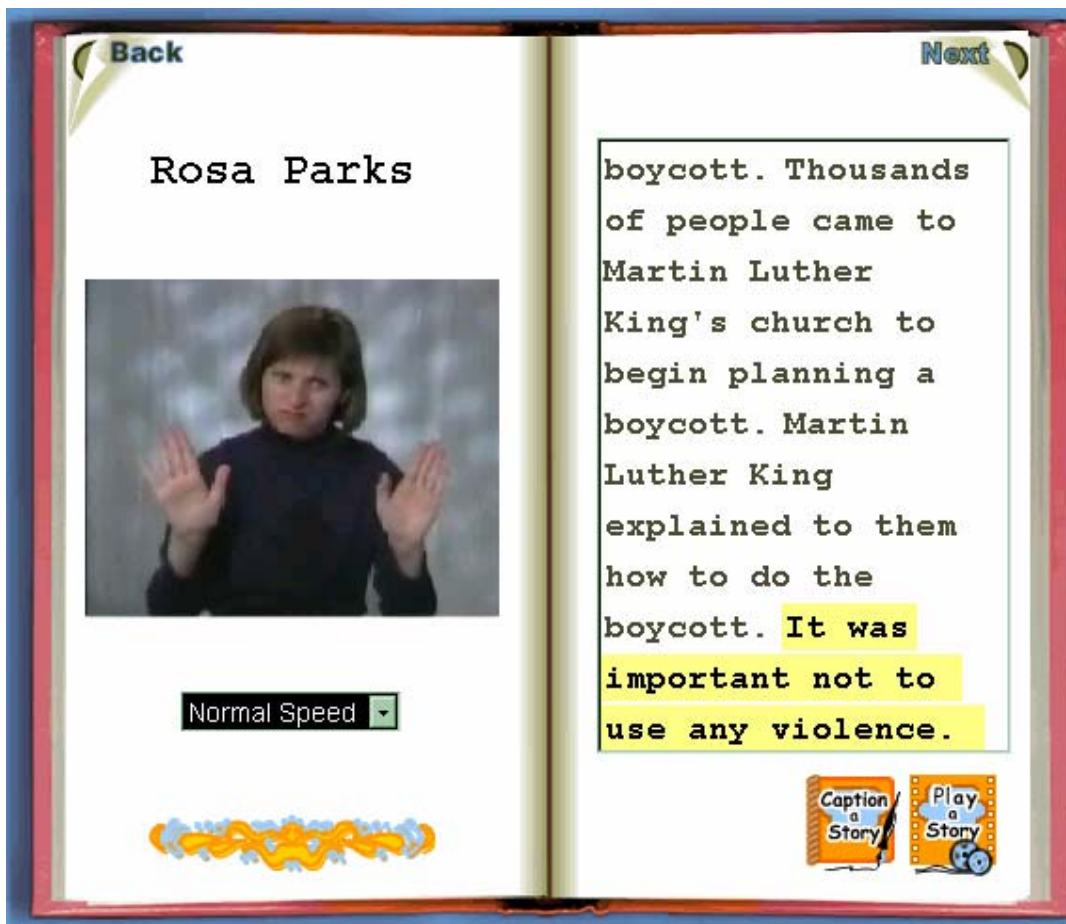


Figure 2. A screen capture showing a sentence being signed using the 'Read a Story' activity.

The Caption a Story activity lets a user create a story. There is a specific layout design in the creation of a story. It is geared so that the story has to be typed in by rows (sentence by sentence). All sentences in the story are numbered. Caption a Story contains three activities: Edit a Story, Save a Story and Open a Story.

- Edit a Story lets a user see an editable overall preview of the story that he or she has created. All the sentences are combined and displayed in a text area. A user has the option of making modifications or adding extra content. Upon completion they can choose to print their story.
- Save a Story lets a user save the created story on a server. A user must have a previously assigned username and password. The original layout of the story and the edited layout of the story if created are saved. A story name is required and both stories are saved with the same name. Alternatively, if only the original format was created than only that story is named. A user can later retrieve either format and will be able to export their stories to word processing software for editing and printing.

- Open a Story lets a user retrieve previously saved stories. Once the username and password are verified, a list of existing story names is displayed. A user can select which story and format (original or edited) to open from the displayed list. The stories are opened in their original created location.

Shown in Figure 3 is a sample screen from the Caption a Story activity. In this Figure, a caption (English translation) is highlighted for sentence 28 of the story. At the bottom on the right-hand side of the book is the sentence typed by the user. Here the user has asked to play the sentence (on the left-hand side of the book), so the typed sentence is shown below the ASL as the sentence is signed. The user could also select the Play All option, in which case the story would be played from beginning to end, with captions for all sentences synchronized with the signing and shown in the box below the ASL.



Figure 3. A screen capture showing a sentence being signed in the 'Caption a Story' activity.

Stories are saved in a relational database (IBM DB2 Universal Database) on a server. *HandsOn* is a three-tiered application. The Caption a Story applet communicates with the servlets and the servlets communicate with the database and vice-versa in order to retrieve stories or save them. IBM WebSphere Application Server (2003) hosts the servlets.

### Future directions

Given this Web development effort, this redesigned version of *HandsOn* is ready for the next stages of curriculum integration and testing with students. For this next stage, new stories need to be created that are more aligned with current educational curricula for young deaf children.

We will look once again to creating original source material for this project that is relevant to the lives of deaf children.

In the meantime, this software is ready for pilot testing with schools and students who wish to serve as early adopters and provide feedback.

## References

- Cox, S., Lincoln, M., Tryggvason, J., Nakisa, M., Wells, M., Tutt, M., & Abbott, S. (2002). TESSA, a system to aid communication with deaf people. *Proceedings of the Fifth International ACM Conference on Assistive Technologies, ASSETS 2002* (pp. 205 - 212). New York, NY: ACM.
- Hanson, V. L. Signing computers. (2002). Paper presented at *CVHI II: Conference and Workshop on Assistive Technologies for Vision and Hearing Impairment*. Granada, Spain.
- Hanson, V. L., & Padden, C. A. (1989). The use of interactive video for bilingual ASL/English instruction of deaf children. *American Annals of the Deaf, 134*, 209-213.
- Hanson, V. L., & Padden C. A. (1990). Bilingual ASL/English instruction of deaf children. In D. Nix and R. Spiro (Eds.), *Cognition, education, and multimedia: Exploring ideas in high-technology*. Hillsdale, NJ: Erlbaum. Pp. 49 - 63.
- Hanson, V. L., & Padden, C. (1992). : A multi-media program for bilingual instruction of deaf children. *IEEE Computer Society Proceedings of the 1992 Future Directions Workshop*, 5 - 6.
- Johnson. R. E., Liddell, S., & Erting. C. (1989). Unlocking the curriculum. Principles for achieving success in deaf education. Gallaudet Research Institute Working Paper 89-3. Gallaudet Research Institute: Washington, DC.
- Kelly, R.R., Samar, V.J., Loeterman, M., Berent, G.P., Parasnis, I., Kirchner, C.J., Fischer, S.D., Brown, P., & Murphy, C. (1994). CC School project: Personal captioning technology applied to the language learning environment of deaf children. *Technology and Disability, 3*, 26-38.
- Lane, H. (1992). *The mask of benevolence: Disabling the deaf community*. New York: Alfred A. Knopf.
- Mozzer-Mather, S. (1990). *A strategy to improve deaf students' writing through the use of glosses of signed narratives*. Gallaudet Research Institute Working Paper 90-4. Washington, D.C.: Gallaudet University.

- Schleper, D. R. (1996). Principles for reading to deaf children. <http://clerccenter.gallaudet.edu/Literacy/srp/15princ.html>
- Verlinden, M., Tinseling, C., & Frowein, H. (2000). A signing avatar on the WWW. Retrieved May 28, 2003 from <http://www.visicast.sys.uea.ac.uk/Papers/IvDGestureWorkshop2000.pdf>
- WebSphere software platform.* (2003). Retrieved May 28, 2003 from <http://www-3.ibm.com/software/info1/websphere/index.jsp?tab=products/appserv>