

READ-MY-LIPS: A MULTIMEDIA PROJECT FOR THE HEARING IMPAIRED

Read-My-Lips is an interactive multimedia system designed to help instructors teach language and communication skills to the hearing-impaired. The system comprises three multimedia instructional modules. (1) Babel is an expert system that translates text to speech in any language that uses the Roman alphabet. This module depicts the process of speech by displaying a front view and a profile cross view of a human face in synchronization with the output sounds of a speech synthesizer. (2) Read & See consists of a series of stories and games that are displayed with text and full video motion. Selected vocabulary within the story is signed and spoken using digitized video sequences. (3) Fingerspelling allows the student to request any word or number to be "fingerspelled."

INTRODUCTION

The computer has become a popular instructional tool used in school programs for the hearing-impaired.¹ Many computer programs are geared exclusively to the presentation and practice of academic content.² Yet several software packages for the hearing-impaired focus on specific speech, speech-reading, and/or auditory skills. Hearing-impaired students have great difficulty mastering these skills because of their degree of hearing loss. They demonstrate a wide range of communication deficits including receptive skills, language development, and expressive skills.³ Since hearing-impaired pupils need to develop both communication skills (speech, speech-reading, auditory training) and language skills (word recognition, comprehension of the printed word), software should be designed with both skills in mind. Literature shows, however, that computer packages combining these two deficit areas are not available. In this article, we will review software designed to reinforce and improve the communication skill of speech-reading and discuss a program being developed to integrate both communication skills and language activities for the hearing-impaired.

BACKGROUND

The existing software for hearing-impaired students focusing specifically on speech-reading skills generally uses a drill and practice format. In the early 1970s, low-cost videocassette equipment for educational use began to be exploited for speech-reading.⁴ For example, Jacobs⁵ produced self-instruction videotapes for college-aged hearing-impaired students at the National Technical Institute for the Deaf in Rochester, New York. The students viewed a prerecorded set of twenty-five sentences on a given topic and responded to paper and pencil tasks. Two other conventional videotape training programs titled *Read My Lips Course* (1987), available from Speechreading Laboratory, Inc., and *Lipreading Made Easy* (1987),

available from the Alexander Graham Bell Association for the Deaf, use drill and practice methods for the speech-reading of everyday utterances.

As technology has improved, interactive video has been used in designing speech-reading programs. A system titled *DAVID*⁶ (dynamic audio video interactive device) was created in 1978. It requires students to view single sentences on videotape and then type into the computer what was said. Students can view a sentence again at any time by using a "repeat" key. "Help" keys are also available. Help is given in three ways. First, a clue is given about the subject matter of the particular sentence. The second help request results in a computer-generated fill-in of the first missing or incorrect letter in the student's typed response. If the student requests help three or more times, the computer fills in the first missing or incorrect word. After each of two consecutive help requests, the student is forced to view the sentence again before receiving further assistance.⁷ Analysis of data collected on student proficiency indicated increased performance in their speech-reading.

Kopra et al.⁸ detailed the first use of laser videodisc for speech-reading practice. They used such a system to present 300 sentence-length stimuli shown in order of increasing difficulty. Boothroyd et al.,⁹ Tyler et al.,¹⁰ and Bernstein and Eberhardt¹¹ have also used interactive videotape or disc to investigate the benefits of cochlear implants and tactile sensory aids in speech-reading and to research some of the components of speech-reading.

Today, most software packages for speech-reading entail drill and practice. The student views someone making a statement and then responds by either writing down what was said or typing it into the computer. Drill and practice activities have their place in the education of the hearing-impaired, but how can this often difficult task be enlivened, especially for the young deaf child?

READ-MY-LIPS

Read-My-Lips was designed and developed with the educational needs (language and communication skills) of young deaf children in mind. It uses state-of-the-art multimedia technology that enables the creation of powerful and entertaining interactive instructional materials. The system helps instructors learn and teach the nuances of lipreading. Three instructional modules comprise Read-My-Lips: Babel, Read & See, and Fingerspelling.

Babel

Babel is an expert system that can graphically animate and acoustically reproduce a text in any language that uses the Roman alphabet. This module has been developed to aid learners and to help instructors teach phoneme discrimination. Each phoneme has a unique sound and thus requires a precise positioning of the vocal organs, which are displayed on the screen in two projections: a front view and a profile cross view of a human face in synchronization with the output sounds of the speech synthesizer (Fig. 1).

Read & See

This module consists of a series of hypermedia (fiction or nonfiction) stories that students have already been exposed to in the classroom. The stories are told with text and full video motion sequences; students can read the passage at their own pace (Fig. 2).

New vocabulary within the story is highlighted, so the students may click (with the mouse) on the words they want to see signed and spoken with the lips (a digitized video is then superimposed on the screen). Thus, students can see how the word appears on the lips and also review how the word is correctly signed. After the entire story is read and viewed, different speech-reading activities are presented so that students can participate in using the new vocabulary, both in isolation and in the context of sentences (Fig. 3).

Students must first understand the language being used in a speech-reading exercise for the activity to have any meaning. By integrating a language component with speech-reading, they can see the relevance of particular speech-reading activities to them and understand those around them.

The digitized video sequences of Read & See were created using the video-editor facility of *IBM StoryBoard Live!* in VGA (640 × 480 pixel, sixteen-color) resolution. The digitized video sequences were displayed with only twelve shades of gray. Thus, illumination in the video shooting was critical to ensure the display of vocal organs, particularly to discern tongue, lips, and teeth.

Fingerspelling

The last component "fingerspells" any word or number requested by the student. This task is accomplished by a program that retrieves and displays digital video interactive files showing a person fluent in sign language signing and fingerspelling the alphabet and the basic set of numbers.

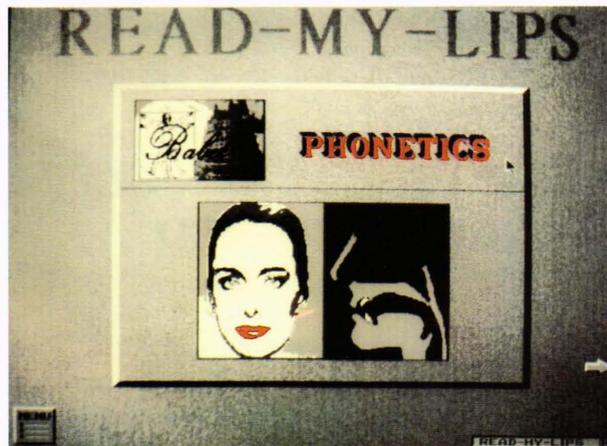


Figure 1. Babel's projection of the human face.



Figure 2. Read & See module.



Figure 3. Read-My-Lips speech-reading exercise.

SUMMARY

The purpose of this project was to develop an interactive multimedia system designed to help hearing-impaired students learn, and to help their instructors teach language and communication skills in the context of a selected subject matter. The next step is to explore the usefulness and acceptance of the system.

Read-My-Lips will be tested with hearing-impaired students in the primary/intermediate level at Metcalf Laboratory School on the campus of Illinois State University. Specifically, it will be used to teach science applications at different grade levels and in different settings (i.e., mainstreamed classrooms as well as self-contained classes for the hearing-impaired).

To explore the usefulness and acceptance of Read-My-Lips, research goals and objectives have been generated:

Goal 1. To assess the effect of PC-based multimedia instruction in third- through eighth-grade classrooms on communication skills (specifically speech-reading and signing) and on content mastery.

Objective 1.1. To develop a complete PC-based multimedia science instructional unit for three different grade groups (third/fourth, fifth/sixth, and seventh/eighth).

Objective 1.2. To conduct a longitudinal experiment to collect data about the acquisition of speech-reading and signing skills and mastery of content when using the instructional units.

Goal 2. To analyze the behavior and performance of hearing-impaired students in grades three through eight when interacting with PC multimedia-based instructional modules.

Objective 2.1. To determine prominent patterns of access (in terms of degree of linearity or nonlinearity) that hearing-impaired children use in navigating through a multimedia instructional module.

Objective 2.2. To examine the relationship between these patterns of access and students' scholastic aptitude, gender, age, and other variables.

Objective 2.3. To provide system designers with information about hearing-impaired children's preferences in interactive characteristics so they can develop those characteristics to invoke good representation models for the students.

Goal 3. To study the effect of using PC-based multimedia instruction on the success of incorporating the hearing-impaired child into mainstreamed classes.

Objective 3.1. To evaluate the effect of technology on the social acceptance of the hearing-impaired child by non-disabled peers.

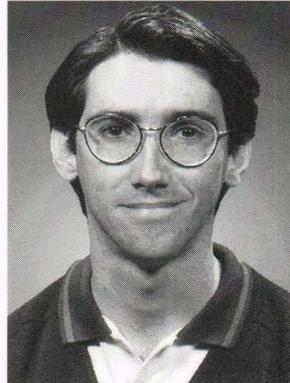
Objective 3.2. To evaluate the effect of this technology on self-concept.

REFERENCES

- ¹Denninger, M. L., "Is It Still an Apple for the Teacher?" *Am. Ann. Deaf* **130**, 332-339 (1985).
- ²Braden, J., Booth, K., Shaw, S., Leach, J., and MacDonald, B., "The Effects of Microcomputer Telecommunication on Hearing-Impaired Children's Literacy and Language," *Volta Rev.* **91**, 143-149 (1989).

- ³Fulton, R., Larson, A., and Worthy, R., "The Use of Microcomputer Technology in Assessing and Training Communication Skills of Young Hearing-Impaired Children," *Am. Ann. Deaf* **128**, 570-576 (1983).
- ⁴Sims, D., "Video Methods for Speechreading Instruction," *Volta Rev.* **90**, 273-288 (1988).
- ⁵Jacobs, M., "Programmed Self-Instruction in Speechreading," *J. Acad. Rehab. Audiol.* **8**, 106-109 (1975).
- ⁶Newell, W., Sims, D., and Clymer, W., "Meet DAVID, Our Teacher's Helper," *Perspectives* **2**, 15-18 (1984).
- ⁷Sims, D., Scott, L., and Myers, T., "Past, Present, and Future Computer Assisted Communication Training at NTID," *J. Acad. Rehab. Audiol.* **15**, 103-115 (1982).
- ⁸Kopra, L., Kopra, M., Abrahamson, J., and Dunlop, R., "Development of Sentences Graded in Difficulty for Lipreading Practice," *J. Acad. Rehab. Audiol.* **19**, 71-86 (1986).
- ⁹Boothroyd, A., Hannin, L., and Waltzman, S., "Development of Speech Perception Skills in Cochlear Implantees," in *Proc. 10th Ann. Conf. Rehab. Soc. N. Amer.*, pp. 428-430 (1987).
- ¹⁰Tyler, R., Tye-Murray, N., and Gantz, B., "Relationships between Vowel, Consonant, and Word Perception," in *Proc. Int. Cochlear Implant Symp.*, Cologne, West Germany (1987).
- ¹¹Bernstein, L., and Eberhardt, S., *Johns Hopkins Lipreading Corpus I-II: Disc 1*, videodisc, distributed and produced by The Johns Hopkins University, Baltimore, Md. (1986).

THE AUTHORS



JOAQUIN VILA is an Assistant Professor in the Applied Computer Science Department at Illinois State University. Born in Mexico, he obtained a B.S. degree in computer science from the Instituto Tecnológico y de Estudios Superiores de Monterrey in 1982. He also earned an M.S. degree in computer science in 1986 and a Ph.D. degree in engineering management in 1989, both from the University of Missouri—Rolla. Dr. Vila's expertise is multimedia technology and artificial intelligence.



KATHLEEN M. AHLERS is a teacher of the deaf at Metcalf Elementary Laboratory School on the campus of Illinois State University. She received a B.S. degree in 1983 from Illinois State University in deaf education. In May 1991, she received an M.A. degree from Gallaudet University in Washington, D.C., in reading and deafness. Besides working with Joaquin Vila on this project, Ms. Ahlers has made presentations on whole language to various special education groups. She is a member of the Council for Exceptional Children, the International Reading Association, and the Illinois Teachers of the Hearing Impaired.