Get Mobile Captioning Anywhere

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Abstract—This paper describes the C-Print technology and highlights a recent development, C-Print Mobile, which is currently being evaluated with National Science Foundation funding. The C-Print captioning technology is used to produce a text display of spoken information for individuals who are deaf or hard of hearing (or other individuals who may have difficulty understanding speech). The C-Print service has most often been provided in educational settings, primarily to provide communication access for a deaf student enrolled in a class with primarily hearing students. C-Print may also be used in business and community meetings, presentations, and many other situations. The new C-Print Mobile app allows users to view captioning in a variety of settings: for example, in traditional classrooms, labs, and meetings. Users can also use the Mobile app to view captioning in remote settings, such as a classroom field trip. In July 2013 the app for viewing C-Print real-time captions on mobile devices was released to the general public as a free download from the Apple iTunes and Google Play stores.

Keywords— communication access, deaf, hard of hearing, technology, deaf education.

I. INTRODUCTION

When deaf or hard of hearing (D/HH) individuals participate in classes, meetings, etc. with hearing individuals, they often have difficulty understanding the speaker and other participants. Access services help D/HH individuals understand the participants who speak. One reason that providing appropriate access services is difficult is that different D/HH individuals have different communication needs. One D/HH individual may use sign language and use an interpreter for communication access. Other individuals may rely on speech-reading and a hearing aid or cochlear implant and know little sign language. Another challenge is the setting: D/HH individual’s communication access needs may be different for a history class and a business meeting.

Real-time captioning, also called speech-to-text, is one way to provide communication access for D/HH individuals. Other options for communication access are sign language interpreting and note taking. The captioning option recognizes the importance of printed information for D/HH people: These individuals often send text messages; read captions on television, etc.

In real-time captioning a service provider, called a “captionist”, who is often in the classroom or other setting with the D/HH individual (s) produces text as it is being spoken by a speaker (teacher, etc.) and displays it on a device so that the D/HH individual can understand what is happening in the class, meeting, etc. The C-Print captioning technology is used to produce a text display of spoken information for individuals who are deaf or hard of hearing (or other individuals who may have difficulty understanding speech). For the past 25 years, a group of researchers and developers in the National Technical Institute for the Deaf (NTID), a college at the Rochester Institute of Technology (RIT) has been developing this real-time captioning system. The name, “C-Print” refers to the sound of the “C” being the same as the word, “see,” and indicates the system’s real-time provision of print that can be seen; “C” is also the first letter for “computer,” and reflects the system’s computer-based operation.

A. C-Print Captioning Technology and Service

This paper describes the C-Print technology and highlights a recent development, C-Print Mobile, which is currently being evaluated with National Science Foundation funding. Figure 1 provides a schematic of how C-Print works.

The C-Print system requires a trained transcriptionist who uses computerized abbreviations and condensing strategies to produce the text display of spoken information. At almost the same time, the spoken information is displayed on a computer or mobile device. The content can be saved and distributed as a transcript afterward. C-Print is a keyboard-based system. (It uses a standard keyboard.) To increase typing speed, the captionist uses a computerized word-abbreviation system to speed up typing. C-Print abbreviations are primarily based on phonetic rules. The examples here demonstrate how the abbreviations typed in the C-Print software expand into the information displayed.
A captionist types:
“wlkm t nxl tknkl nsttt f t deaf”

The information displayed:
“Welcome to the National Technical Institute for the Deaf”

Fig. 1: How C-Print real-time captioning works

The C-Print service may also be provided remotely. If a captionist is located remotely, the captionist hears the spoken information via a phone or VoIP service and the information is transmitted via Wi-Fi or mobile data service so the student can view the information in class.

The C-Print system enables a captionist to produce a display of text that is a thorough and complete translation, or paraphrase, of the spoken English content. Although C-Print sometimes does not provide word-for-word transcription because it may not keep up with the speed of speech (variable, but often approximately 150 words per minute), the system does capture virtually all of the meaning of the lecture.

B. Settings for C-Print

The C-Print service has most often been provided in educational settings, primarily to provide communication access for a D/HH student enrolled in a class with primarily hearing students. When the service is provided to a student it is usually the only accommodation that the student receives. This assumes that there is only one deaf student in the class. If there is more than one deaf student, there are often other accommodations, such as an interpreter. In addition to the real time display during class, the text is saved for later study. The software also has a feature for messaging between the student and captionist that is separate from the display of captions. Students can use the C-Print software for participating in class. Figure 2 provides a schematic of the provision of C-Print captioning in a classroom with primarily hearing students. It shows the C-Print captionist in the room listening to the teacher and producing the captions that are transmitted via Internet to the student’s computer located on a desk for viewing.

C-Print is used in many other settings than classrooms. These settings include:
- Group discussions
- Business meetings
- Community and private meetings/events
- Presentations

For example, a deaf student in an internship at a company may use C-Print during a meeting. A hard-of-hearing patient may use C-Print to better understand conversation in a group meeting with medical staff and family.

Fig. 2: Schematic of provision of C-Print service in a classroom

C. Benefits

C-Print helps facilitate communication by aiding access to and understanding of spoken communication. The words in the C-Print display remain on the computer screen for enough time for an individual to comprehend and consider them. In contrast, with a sign language interpreter, individuals only see the words for a fraction of a second. In addition, captions are visually accessible: This means that the captionist arranges the information in a visually informative way. For example, in certain situations the captionist may highlight, bold, or use numbers.

C-Print provides a succinct delivery of spoken information. The C-Print captionist produces text that states information concisely. The text includes all the meaning, but does not include redundancies. Stating information concisely means that the C-Print transcript, or C-Print notes, will be shorter and easier to study after class, meeting, etc. than a verbatim transcript.

C-Print provides a record for review after a class, meeting, etc. The stored text, or C-Print notes, is a valuable study tool. The similarity between the text that an individual sees during the class, meeting, etc. and the text they use to study afterwards helps individuals relate the information to the class, etc.

C-Print may also help improve a D/HH or other individual’s language use. The C-Print captionist produces a display of the written language that provides repeated
exposure to a model of the language. Another benefit of C-Print is that D/HH and other users can view the spoken information from a remote location; they do not need to be in the class or meeting room.

D. Training of Providers of C-Print Captioning

The C-Print captionist is trained to include all information being said in producing the text display. One cannot just go into the classroom and provide C-Print services; training in provision of C-Print services is necessary. On average, learning the abbreviation system requires about 50 hours of training. In this training, the captionist learns abbreviations for words in order to increase typing speed by 50% and to reduce strain on wrists and hands. The trainee learns a set of rules for abbreviating; the trainee does not memorize individual abbreviations for the words. Additional parts of the training include condensing spoken information, the provider’s role, formatting text, and preparing notes for distribution. Providers must sometimes eliminate a few of the spoken words, such as very repetitious material. Training for C-Print providers is online, and it is desirable to have a mentor, such as a person who is already a provider of C-Print services. Mentoring may be by phone or online, as well as in person. After enrolling in the training, a person has a year to complete it. More than 2000 individuals have completed or are undergoing C-Print training.

E. To Get Started with Using C-Print

If you know of an individual who can benefit from using the C-Print assistive technology, here are recommended next steps:

1. Identify a transcriptionist to provide the captioning.
2. Procure the C-Print system from RIT (software and transcriptionist training).
3. Supply the equipment needed to provide the service (computer and viewing device).
4. Register the transcriptionist for the C-Print online training course.
5. Begin offering captioning service!

The critical factor in beginning C-Print services is finding a good person to provide the service. If that person is already trained in providing C-Print services, you can, of course, just go ahead and start providing the service. Often, however, the best way to begin is to hire a person with good potential to become a C-Print captionist. Completion of online training requires several weeks. Once this training is completed, it is desirable for the trainee to practice providing the service for a few weeks in an environment similar to the one in which the trainee will be providing services, such as a classroom. Altogether, this training and practice process requires a few months. For further information regarding C-Print training, visit the C-Print website, http://www.rit.edu/ntid/cprint/, or contract the C-Print development and training office: cprint@rit.edu; 585.475.7557 (voice/TTY)

II. C-PRINT MOBILE

The new C-Print Mobile app allows users to view captioning in a variety of settings, for example, in traditional classrooms, labs, and meetings. Users can also use the Mobile app to view captioning in remote settings, such as a classroom field trip. C-Print Mobile was developed partly to incorporate advances in technology, such as wide use of iPads, other tablet devices, and Smart phones, and also to enable C-Print to effectively meet D/HH communication access needs in situations where it has not been possible to effectively provide services with standard laptops. For example in laboratory settings, lab tables often have considerable paraphernalia, and a laptop for viewing captions takes up too much table space. In addition, students often need to move around a lab when carrying out an experiment, go up to the instructor, etc., and it is cumbersome to carry and read an open laptop while moving around the laboratory. Figure 3 shows a deaf student viewing C-Print Mobile in a biology lab. Note how the mobile device is more suitable for the available space than a standard laptop.

Fig. 3: Deaf student viewing C-Print Mobile in a biology lab.

C-Print Mobile has been developed in part with NSF support (Award 0726591) and is being evaluated in laboratory contexts at RIT and 3 other postsecondary institutions (Award 1032033). In July 2013 the app for viewing C-Print real-time captions on mobile devices was released to the general public as a free download from the Apple iTunes and Google Play stores. Figure 4 show C-Print being displayed on a standard iPad and a mini iPad.
**A. Downloading and Using C-Print Mobile**

C-Print Mobile is easy to use. Here are the steps to start viewing captions with C-Print Mobile on your device:

1. First, you will need a wireless or data connection to connect to the current session.
2. Go to the app store (Google Play or Apple iTunes) and download the C-Print program to your Smartphone or tablet OR use the QR code.
3. Locate the C-Print icon in your apps and tap to open the program.
4. Tap in the ‘Host’ field and enter name or IP address provided.
5. Tap in the ‘Username’ field and enter a username of your choosing.
6. Tap ‘Connect’.

**Fig. 4 C-Print display on a standard iPad and a mini iPad.**

**B. Comments about C-Print Mobile**

With funding from the National Science Foundation, a project based at NTID is surveying D/HH students who have been using C-Print Mobile in mainstream college science, technology, engineering, and mathematics laboratory courses where most students are hearing. Here is what the D/HH students have had to say about C-Print Mobile:

- The phone doesn't take up work space we need for labs. It's small and easy to carry and easy to read!
- It is easy to read, especially white lettering on black. The print is big enough for me to sit back and read.
- It's light and easier to move around with.
- It is smaller so it isn't as noticeable.
- I can easily search for terms, like 'procedure', and it shows when the professor discussed procedure changes that were necessary for experiments.
- It allows me to have the instruction right in front of me and “hear” what's going on.
- I carry around the mobile device with me throughout the whole class. When I was sitting down talking in a group I would place it on the table near my notebook.

These comments indicate that one major benefit of C-Print Mobile is size of the device. Observations of the labs during this project have revealed that the lab tables are very crowded, as shown above in Figure 3. Students prefer a small device for these situations instead of a standard laptop. There are, of course, many other situations where a small device for viewing captions is helpful.

Another benefit of C-Print Mobile is that small display devices are portable. For example, students in labs often need to move around. They may go to various parts of a lab to do a procedure. They may need to go up to the instructor to ask a question. Students appreciate being able to easily carry the device.

Usability is a third benefit of C-Print Mobile. The most recent version of the software has made it much easier to connect to the captionist. The current version of C-Print Mobile is the latest of several iterations, and the development team at NTID is working on further improvements in the product.