Preparation of Deaf end-users and the SoftBridge for semi-automated relay trials

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Abstract—Following on the development of several prototypes, we have built a semi-automated Deaf Telephony prototype on the SoftBridge platform. This prototype relays text and speech between Deaf users on the Internet and hearing users on the telephone system. Previous work with a pilot trial in the laboratory revealed several opportunities for enhancement. We added a Wizard of Oz (WoOz) to replace the poorly performing automatic speech recognition functionality as well as H.323 breakout, more extensive logging and advanced call initiation functionality. In order to trial the current prototype, we initiated an Information and Communication Technology (ICT) training programme with the Deaf Community of Cape Town. Twenty Deaf users participated in the training. In addition to the training, much baseline user data was collected to give an indication of how Deaf users communicate with hearing users as well as how familiar they are with ICT devices and services. The work for the rest of this year requires us to recruit and train a WoOz operator. Subsequent trials will essentially consist of monthly cycles of prototype introduction, training, automated metric and log collection, user feedback and then feature enhancement. Linguistic analyses of the text output of the Deaf users will be analyzed. We hope to refine the SoftBridge prototype to fit the needs of the Deaf and hearing users, from both technical and social viewpoints. We expect that these iterative cycles will continue for some time and will teach us many lessons regarding multi-modal semi-synchronous IP-based communications systems.

Index Terms — Action Research, Deaf Telephony, User-centred, Information and Communication Technology Training.

I. INTRODUCTION AND BACKGROUND

Numerous Internet Protocol-based multi-modal services exist in the developed world for Deaf telephony [6]. Although the South African Deaf community numbers anywhere between 380,000 and 4 million, the telecommunications options for South African Deaf end-users are extremely limited. Many are still forced to rely on another person to mediate for them on the telephone.

Text telephones, such as the Teldem, are available, but seldom used [4][8]. If the Deaf have anything, they have cell phones and can use the Short Message System (SMS) to exchange text messages. This is however, asynchronous, unreliable and expensive. An ISDN-based video interpreting relay service called Telephone Interpreting Service for South Africa (TISSA) was available for a 6 month trial period, but the pilot is now over. The only remaining options are Internet-based, but the Deaf community finds itself on the disadvantaged side of the Digital Divide because of a history of poor education, limited employment opportunities and therefore, low socio-economic status [1]. Furthermore, there is no relay service between Deaf and hearing users available in South Africa.

In order to redress this situation, and attempt to provide equal access for Deaf end-users, we aim to increase connectivity options for the Deaf by providing a solution that is semi-synchronous, automated, multi-modal and mobile. The need is to provide a service that is low-cost and community-based. To this end, we initiated a cyclical design, development and measurement process for the Deaf community [5][9].

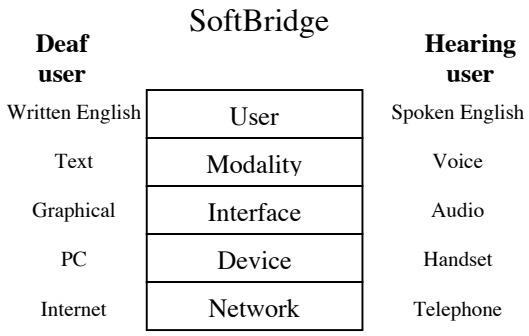

Figure 1: The SoftBridge prototype provides bridges across various gaps in order to link a Deaf user on a PC to a hearing user on a Public Switch Telephone Network (PSTN) or mobile handset.

II. PROTOTYPE ACTIVITY

Our current prototype is an application of the SoftBridge approach (see Figure 1) to semi-synchronous multi-modal IP-based communications [3]. A significant contribution of the SoftBridge approach is to recognize the importance of the user within the system design, development and measurement process. With respect to the Computer Human Interface community, this is termed a user-centred approach and encompasses both Participatory Design (PD) [7] and Action Research (AR) [2]. The Deaf Telephony SoftBridge connects a Deaf end-user on a community-based PC to a hearing end-user with a handset on the PSTN or cellular network. [6]. The interface to the Deaf end-user is a standard

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IM Jabber client. The Deaf Telephony SoftBridge uses Text-to-Speech (TTS) and Automatic Speech Recognition (ASR) to relay text to and from the Deaf and hearing end-users.

Our previous work piloted the SoftBridge approach with an ICT-literate Deaf user in the laboratory [9]. Feedback from this pilot was used for subsequent development of the prototype. We added presence indicators on the Deaf side, as well as full instrumentation for detailed logging. After considerable critical reflection, we have made several adjustments in order to carry out trials in the Deaf community.

First, we have added a Wizard of Oz web service to replace the ASR engine. We built a Graphical User Interface (GUI) for a person to transcribe speech to text. We wrapped this functionality inside a web service, just as for the ASR engine(s). We have, however, left the TTS engine in the system, and the SoftBridge system performs all call routing functionality, not the person. In addition, we have introduced more detailed system instrumentation to collect metrics on system component overhead and the resulting delays. We can also extract user usage statistics from the log.

A significant change in system requirements came from realizing that the hearing end-users in the trials would not have any access to PCs and the Internet. Therefore, we added an H.323 gateway in order to break out to the PSTN and reach landline and cellular handsets. Finally, we also worked on user login and call initiation functionality. For the Deaf user, login and call initiation is as simple as creating an account and sending a message with the Jabber IM client. For the hearing user, however, we implemented a simple Interactive Voice Response (IVR) interface login system for both user login and call initiation. Both functions can make use of dual-tone-multi-frequency (DTMF) input and/or speech recognition.

III. Data gathering and ICT training

Because the Deaf community has historically had little or no access to ICT hardware, training or experience, an ICT training programme was instituted [8]. We began with a baseline data collection process within Deaf Community of Cape Town (DCCT). Two student audiologists conducted individual interviews to establish biographical background information relevant to Deaf telecommunications and ICT in general. Focus group discussions followed to provide an opportunity for discussion on the telecommunications and ICT issues relevant to the participants and the Deaf community in general. The main goals were to determine what the Deaf community knew about and had experienced, what they liked, what they disliked and what they actually wanted with respect to ICT and telecommunications. Importantly, a South African Sign Language (SASL) interpreter facilitated communication for the entire duration of the interviews and focus group interaction.

To initiate the process, two PCs were installed DCCT's community centre. These PCs are linked to the Internet via an ADSL line with wireless LAN (802.11B).

Twenty Deaf people were identified by DCCT and participated in the interviews and focus groups. Of these, eighteen participated in two three-hour training sessions each. Again, a SASL interpreter was on site for pre-training, training and post-training activities. Before the training commenced, each participant was evaluated with a pre-training skills checklist. The skills include the ability to use a PC and its peripherals in addition to several software applications: email, Instant Messaging and web browsing. Learner Support Materials (LSM) were specifically produced for these users and a copy was given to each participant. The same evaluation checklist was used after the two training sessions. Analysis of the results are in progress [8]. It should be noted that this work was approved by the University of Cape Town Faculty of Health Sciences Research Ethics Committee.

IV. Future work

The work for the rest of this year is to firstly recruit and train a Wizard of Oz operator in order to open trials of the Deaf Telephony SoftBridge to the Deaf community. Subsequent trials will essentially consist of monthly cycles of prototype introduction, training, automated metric and log collection, user feedback and then feature enhancement. The Deaf text will be subjected to linguistic analysis with reference to the TTS transformation. The way in which the language and literacy skills of Deaf users impacts on the use of a TTS engine will be examined. We hope to refine the SoftBridge prototype to fit the needs of the Deaf and hearing users, from both technical and social viewpoints. We expect that these iterative PD/AR cycles will continue for some time and will teach us many lessons regarding multi-modal semi-synchronous IP-based communications systems.

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