Building Bridges for Deaf Telephony in South Africa
A Community-Centred Approach

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Introduction

The majority of the Deaf community in South Africa is marginalized from First World telecommunication solutions by a variety of factors. Fortunately, these detrimental factors provide opportunities to advance research methodology and technical solutions for Deaf Telephony. Without human-mediated telephonic relay between Deaf and hearing users in South Africa, we leap frog past the developed world's Deaf Telephony relay solutions to a fully-automated solution. This solution is evolving through a community-centred approach. First, we directly engage the Deaf community, and the people with whom they need to communicate, to refine system and Human Computer Interface requirements. Secondly, we choose a Community Computer rather than a Personal Computer approach to deployment. We developed a technical solution that provides a mechanism for rapidly prototyping user interfaces in cyclical field trials. It converts a communications stream between various communication modalities, and is not limited to text and speech. Our methodological and technical approaches are applicable to other developing world communication arenas, such as language translation and other forms of the Digital Divide.

Deaf Telephony in South Africa

Providing telephony services to the Deaf in South Africa is challenging. As with the rest of the world, roughly 10% of South Africa's population is either Deaf or Hard of Hearing. The majority of this community experiences poverty, illiteracy and little or no access to Information and Community Technology (ICT). The South African telco, Telkom, provides a locally produced text telephone called the Teldem. Field trials revealed that the Teldem does provide real-time communications between two parties, Deaf or not. Because both parties must use a Teldem, there is a relatively small "calling circle". The monthly Teldem rental charge is R18, about US$3, but duration-based call charges remain an obstacle to an essentially poor community. The over-riding factor was that neither the South African government nor Telkom are willing to subsidise a human-mediated relay between the Teldem and the Public Switched Telephone Network (PSTN).

Common in the developed world, Voice Relay Service (VRS) places a human operator equipped with both text and normal telephones between a Deaf user with a text telephone and a hearing user with a normal handset. The operator converts the Deaf user's text to speech, relays the speech to the hearing user, and vice versa. VRS assumes a degree of literacy on the Deaf side, or has to provide some form of "text enhancement" when the input text is illegible or follows the vagaries of the local Sign Language dialect. Numerous examples of sophisticated VRS systems abound, including video (for signed language) and web-based solutions. However, because of the poverty, literacy and ICT obstacles in South Africa, none of these solutions are truly appropriate.

In both developing and developed countries, many believe the Short Message System (SMS) over cellular networks can provide inexpensive Deaf Telephony. However, SMS cannot effectively substitute for real-time synchronous communication. Rapid

SMS exchanges can approximate semi-synchronous communication, but in reality, SMS is intrinsically unreliable. One never knows if the other party has actually read a message or not. SMS may be useful in some Deaf Telephony situations, but it is not applicable to all situations, particularly where synchronous, acknowledged communication is required. In addition, SMS is not appropriate for more formal communication requirements.

Community-centred Approach

Due to the problems with Deaf Telephony in South Africa, we have opted to by-pass VSR and go straight to a fully automated relay service, a relay without human-mediation. Such a system is fraught with issues of poor quality with Automatic Speech Recognition (ASR) and Text-to-Speech (TTS). Because of human mediation, VSR has been able to circumvent these issues. With a community-centred approach to Human Computer Interface (HCI) design, we are building bridges for Deaf Telephony where the interfaces, rather than the underlying ASR/TTS technologies, deal with poor Quality of Service (QoS). Fieldwork commenced with Teldem trials in the Deaf community and their calling circle. Learning from those trials, we are now engaging communities via a Deaf NGO, the Deaf Community of Cape Town (DCCT). Direct involvement with the communities will enable us to learn how to adapt the human computer interface for both Deaf and hearing users.

Computing in the developing world is often community-based rather than individualistic. This goes beyond the need to take into account the ethnographic differences of individual users to realise that an end-user machine will be used by many people rather than an individual. Thus, one has a Community Computer (CC) rather than a Personal Computer (PC), a Group Digital Assistant (GDA) rather than a Personal Digital Assistant (PDA). Community-based computing has implications for software systems since they must allow multiple users, each with his/her own workspace. For a GDA this implies having multiple personalisations, as with the Simputer's smart card arrangement. Both CC and GDA approaches interest us for the current field trials. The Teldem can also function as a community resource.

Building Bridges

We have developed an application server platform that embodies and empowers the community-centred approaches to HCI design. The SoftBridge server provides the underlying mechanisms for bridged multimodal exchanges. The interfaces to the users are provided by a SoftBridge client. For a Deaf user, this could be a standard IM client such as Exodus. Cyclical interaction with the Deaf community will provide information on how to tailor such clients on the Community Computer, and how to represent the interface on the two line Teldem device. Cyclical interaction with the Deaf community's hearing calling circle will yield requirements for multimodal modifications in order to provide voice input and output on a variety of devices. Of concern to both parties is how to adjust the HCI to make up for poor QoS experienced from the ASR and TTS web service overhead and performance. We borrow heavily from IM research to build in presence and awareness to make up for communication delays. In summary, the SoftBridge represents bridging between various communication modalities, and is not limited to text and speech for Deaf and Hearing users. The SoftBridge, and our approach to building it and its client interfaces, can easily be made applicable to bridge other forms of Digital Divide.