

Initial fieldwork for LWAZI: A telephone-based spoken dialog system for rural South Africa

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Abstract

This paper describes sociological fieldwork conducted in the autumn of 2008 in eleven rural communities of South Africa. The goal of the fieldwork was to evaluate the potential role of automated telephony services in improving access to important government information and services. Our interviews, focus group discussions and surveys revealed that LWAZI, a telephone-based spoken dialog system, could greatly support current South African government efforts to effectively connect citizens to available services, provided such services be toll free, in local languages, and with content relevant to each community.

1. Introduction

There is a growing interest in deploying spoken dialog systems in developing regions. In rural communities of developing regions, where infrastructure, distances, language and literacy are barriers to access, but where mobile phones are prevalent, spoken dialog systems could be key to unlocking social and economic growth. Some notable recent studies in this field include “Tamil Market” (Plauché et al., 2006) and “VoiKiosk” (Agarwal et al., 2008), kiosk-based spoken dialog systems providing agricultural information that were tested in rural, semi-literate communities in India. Nasfors (2007) also developed an agricultural information service, aimed at mobile telephone users and deployed in Kenya. In the health domain, spoken dialog systems have been recently employed to support community health workers in Pakistan

(Sherwani et al., 2007) and caregivers of HIV positive children in Botswana (Sharma et al., 2008). In this paper, we expand on the preliminary experiments of Barnard et al. (2003) and this growing body of work by investigating the role for spoken dialog systems in connecting rural citizens of South Africa with government services, such as free education opportunities and stipends.

South Africa is the leader in Information and Communications Technology (ICT) in Africa and has the most developed telecommunications network on the continent (South African year book 2006/2007: 131). In particular, mobile phone usage has experienced massive growth due in part to its accessibility by non-literate people and its “leapfrog” development, which skipped the interim solutions adopted in the developed world (Tongia & Subrahmanian, 2006). The amount of mobile phone users in South Africa is an astonishing 30 million people - out of a total population of 47 million (Benjamin, 2007). The percentage of both rural and urban households with mobile phones tripled from 2001 to 2007, while “landline” use declined. The accessibility and widespread use of mobile phones make spoken dialog systems a good candidate for low-cost information access.

In addition, telephone-based spoken dialog systems overcome barriers of language and literacy. In South Africa, there are eleven official languages. Private companies, NGOs and government offices who wish to reach South Africans through print or audio, find it extremely costly to do so for each language. Heugh (2007) shows that in terms of speakers' proficiency,

there is no single lingua franca for South Africans (see Figure 1). In fact, less than half of South Africans understand English, the language in which most government messages are currently disseminated (Heugh 2007:PANSALB 2001).

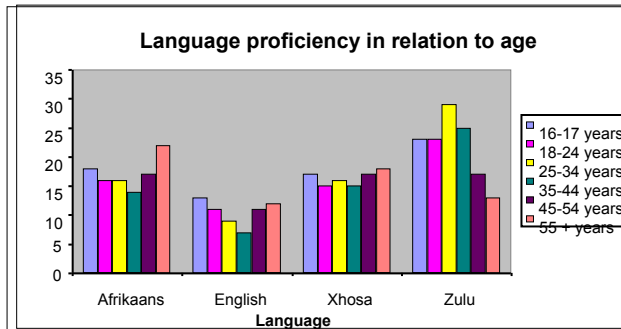


Figure 1: Language proficiency of South Africans.

Heugh (2007) also reports that between 35% and 45% of South Africans above the age of 16 cannot read or write. Illiteracy is disproportionately high for women and for people living in the primarily rural provinces: KwaZulu-Natal, Limpopo and Mpumalanga. Mobile phone use is widespread in these areas among semi-literate citizens and speakers of all languages.

Communities in rural areas struggle to access government services due to their remote locations. Most community members must travel long distances by foot or rare and costly public transport to access basic services. In their longitudinal household study on the costs and strategies of coping with chronic illnesses Goudge et al. (2007), for example, found that people in rural areas of South Africa do not go to free health care facilities because they cannot afford transport.

NGOs face the same challenge when trying to reach rural populations. Many produce information to assist households affected by HIV/AIDS, for example, but most of the materials are published on websites; the cost of providing multilingual print materials is often too high. Due to low literacy levels, language, and a lack of infrastructure, the information

remains inaccessible to the people who need it, especially those living in rural areas and townships (Benjamin, 2007).

Given the well developed mobile phone network and the relatively sparse alternative options in rural South Africa, the authors believe that multilingual spoken dialog systems can provide a low-cost solution to improving the ICT access of citizens who may currently be excluded from government services due to language, literacy and location. However, it is imperative to understand the target users and their environmental context as a first step to designing such a system (Nielsen, 1993). In this paper, we provide background on the current state of rural government service delivery in South Africa and introduce the LWAZI project, we describe our field methods, and finally, we present our findings from the initial field work with design implications for the LWAZI system.

2. Background

In South Africa, rural citizens are faced with a lack of economic activities and limited access to resources. These include access to basic services such as health care, legal advice, water, sanitation and information. The government of South Africa is aware of these problems and offers many services to stimulate social and economic growth throughout the country. For example, citizens are eligible for free health care at certain clinics, free education for children and adults, free job training, foster grants, and financial aid for veterans, students, children, the disabled, and the elderly. However, rural citizens participate less in the services due to the long distances they are required to travel and in many cases, their lack of knowledge about the existence of such services. The South African government is aware of the need to improve citizen access to services, as well as the specific challenges that rural communities face. In this section, we describe the particular ICT project known as LWAZI (section 2.1) which is a system designed to add to government's accessibility by eligible citizens.

2.1 Project Lwazi

As part of the great ICT initiative, an ambitious, three-year project is currently being conducted by the Human Language Technology (HLT) research group under the Meraka institute, at the Council for Scientific and Industrial Research (CSIR) in South Africa. This project is funded by the South African Department of Arts and Culture to develop a multilingual telephone-based spoken dialog system that would assist South African government service delivery. “Lwazi,” derived from the IsiZulu word for *knowledge*, aims to make a positive impact in the daily lives of South Africans by connecting them to the government and health services (Lwazi, 2008). The HLT group is currently developing speech and language technologies (including speech recognition, text-to-speech and telephony platforms) for limited-resource languages. The ability of spoken dialog systems, powered by such technologies, to overcome barriers of language, literacy, and distances, led the Lwazi team to explore a low-cost application. This application will be modelled after and support the current successful, national initiatives (e.g., TSCs, CDWs) operating primarily in rural areas.

3. Method

Eleven community-based centres in six of the nine provinces were visited by small, interdisciplinary teams of researchers over a period of 3 months in the year 2008. Of these eleven centres, three were in peri-urban societies and the rest were based in rural settings. In each visit, the Lwazi team gained access to the community through the Thusong service centres (TSC’s) manager. These individuals provided materials, connections with key people at the TSC, CDWs, and access to community members. They also provided their office space for these researchers to conduct meetings and interviews.

We conducted key informant interviews, focused group discussions, and community and household interviews in each community. We especially met with government workers charged with disseminating information to the community and community members who received services and information. Data collection in

these communities was primarily to investigate the suitability of the Lwazi spoken dialog system and to determine key user and contextual factors that would drive its design. In particular, we sought to:

- Gather rural community information needs.
- Investigate how people currently get information.
- Determine which cultural factors would impact the Lwazi system.
- Determine level of technical competency.
- Gauge both interest in a Lwazi spoken dialog system and belief that such a system will be useful in improving livelihoods and access to government services.

4. Results

The LWAZI spoken dialog system must adhere to international standards wherever possible (Suhm, 2008; Nielsen, 1993). In many cases, however, the rural context of a developing region may present unique design challenges. For example, in Sharma et al. (submitted), it was found that among semi-literate women of neighbouring Botswana, pressing buttons and using speech to navigate a spoken dialog system was equally effective, but that unlike users in the developed world who preferred speech input, the users of Botswana preferred pressing buttons for reasons of accuracy and privacy. In this section, we present our results from field visits in eleven communities of South Africa. In particular, we report on factors that influence the design and potential uptake of the Lwazi spoken dialog system in this context: the information needs and sources (Section 4.1), cultural and social factors (Section 4.2), suitability of the technology (Section 4.3), and user experience (Section 4.4).

We conducted between one and five key informant interviews at each site. The interviews were generally conducted with the TSC manager, other employees of the TSC, CDWs of the community, and community members. In four of the eleven sites, we also conducted a focus group discussion. In two sites, we

shadowed a CDW during a typical day and we toured the communities, including visiting farms, day-care centres, churches, markets, youth centres, clinics, businesses and households.

The eleven communities we visited were located throughout eight of the nine provinces of South Africa. They varied greatly in available infrastructure and language spoken. They shared an economic dependency on nearby cities and, in some cases, reported social problems. These communities also share a dependency on government social grant. As mentioned above, because of high levels of unemployment, these community's livelihoods is sustained by grants from government.

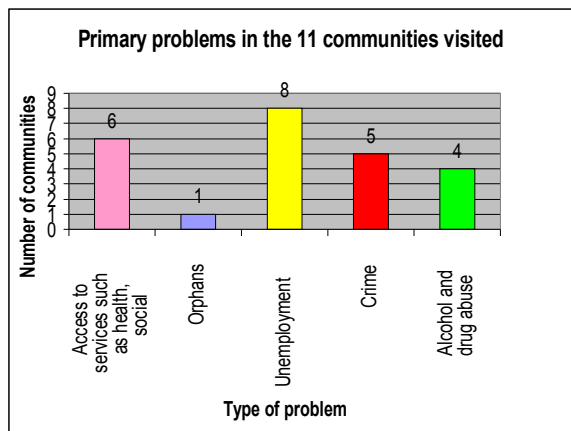


Figure 2: Number of the eleven communities that site these as primary problems in the community, as reported by interviewees.

There are four mobile providers in South Africa namely Cell-C, MTN, Virgin Mobile and Vodacom. The two landline companies, Neo-tell and Telkom are not familiar in the communities visited by Lwazi team. Community members prefer and use mobile phones because of ease of use and accessibility. Figure 3 illustrates the use of mobile providers in the eleven visited communities.

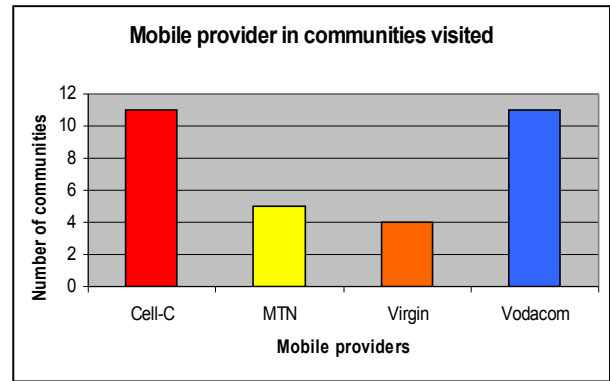


Figure 3: Mobile provider in communities visited

Figure 4 below shows that all eleven communities visited received government information through print. This, as mentioned earlier, is one of the problems the government is trying to address because of a high illiterate number. The second commonly used source of information was the community development workers. This is a useful source because they are the ‘foot soldiers’ of the government; they are responsible for door to door visits, collecting and delivering information. This source has its own challenges as discussed above.

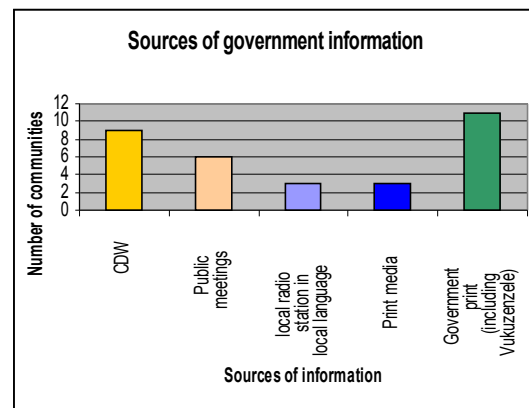


Figure 4: sources of government information

4.1. Information Needs and Sources

The majority of communities report a lack of economic activity as the primary problem in the community, and as could be expected, we observed very high levels of unemployment. . Grants are offered by the South African government to address the imbalance and

stimulate the economy of these areas. There are six types of grants, namely: War Veteran grant, Old Age grant, Disability grant, Care dependency grant, Foster care grant and Child support grant. Citizens can apply for these at their nearest local South African social security agency (SASSA) or district office. The qualifying ages are as follows:

Type of pension	Qualifying age
Old Age	For female 60 years and above, male 65 years and older
War Veteran	60 years and older, or veterans under 60 due to medical reasons.
Disability	Between the ages of 18 and 60 if female and 18 and 65 years if male.
Care dependency	Between the ages of 1 and 18 years.
Foster care	Between the ages of 0 and 18 years
Extension order	Can be given until the age of 21 years.
Child support grant-	Between the ages of 0 and 14 years

Table 1: Government grants qualifying ages

There are various supporting documents needed to apply for these grants. Information on these and other services was initially only accessible in writing and in English, which excluded the majority of the population. In addition, this information was only available at certain locations (e.g. government department offices). In many communities we visited, social grants were by far the primary source of income for the community, after remittance (money sent home from family in nearby cities). Community members of all ages depend on these grants and want to be updated regularly about the developments of social grant policy. We found, however, that in addition to social services, the older population is also interested in local politics; young people are more interested in

entertainment and employment opportunities and the social service services (Gumede, Plauche and Sharma, 2008).

At the time of the visits, these communities received information from the Thusong Service Centres. Government departments, NGOs, municipalities and research institutes such as CSIR, used the TSCs as a platform to disseminate information. At a more grass roots level, African communities in South Africa share information by word of mouth. This has led to information being shared via local radio stations and newspapers in local languages. Following is a case study illustrating a typical scenario.

CASE STUDY
 Kgautswane is a village near Ohrigstad in the Limpopo province. According to the community development worker, the youth in this community are “lazy”. She said that there usually are a number of employment opportunities advertised in local newspapers and municipal offices, but they never apply. A majority of them are not computer literate so they receive news via local radio and word of mouth. A few of them use the Thusong Service Centre as it has a soccer field, hall, computer centre and NGOs who do community projects and employ people via the centre. The CDW’s conducts ‘door to door’ visits to households to ensure that all those who are eligible for a grant is registered to receive it and is actually receiving it. They also ensure that all disasters are reported to the relevant authorities. The CDW must pay for her own transportation and mobile phone bill. A free spoken dialog system that could broadcast announcements to her community members and allow her to connect directly with different government departments for reports or inquiries would greatly facilitate her job.

4.2 Cultural and Social Factors

The population in these communities is usually older people taking care of grandchildren whose parents work in nearby cities and visit

once or twice a year. As we have previously mentioned, the lack of economic activity means that these communities depend heavily on government social grants. Older people in these communities are often unable to read and write. In some cases, their limited eyesight restricts their ability to use the cheaper “texting” feature of their mobile phones. In the communities we visited, ten out of the eleven official South African languages were spoken. Each community typically spoke two or more languages, not necessarily the historically dominant languages (Afrikaans and English). A LWAZI system that delivered information about SASSA services would be more accessible to the older, rural population than current methods; however, it must support all eleven languages or at least a majority of them in order to be usable.

4.3 Suitability of Technology

The investigation prior to the design of the Lwazi system investigates how to ensure that the proposed system will be suitable to the lifestyle of the community to be served. We do know that currently, communities have other means of accessing government information, including the free “Vukuzenzele” monthly magazine and local radio stations. Like these current means, Lwazi must be free in order to be effective and it must contain locally-relevant content in order to be useful to these poor communities. Government departments will find LWAZI to be a very useful and low-cost way of disseminating their information. Rural South Africans will benefit from the alternative source of critical information.

Case study

Sterkspruit is about 250 km from Bloemfontein in Eastern Cape province but near the border with the Free State province. This community is characterised by a high unemployment rate. However a majority of households have cell phones. Lwazi will be able to connect these communities to government departments. For example: in the Focused group discussion (FGD) we had with

the CDWs, they mentioned that the communities they each serve are far apart from each other. They therefore are unable to service all of them as quickly and efficiently as they would like. They also mentioned that because some of the communities are located in mountains, it is thus extremely difficult to get transport to these areas. Consequently they need to walk. Because of this challenge, they sometimes find that there are a number of cases already waiting for them.

This case study is another example of where Lwazi will be able to assist community members – a person could leave a message for the CDW to visit them whenever the CDW is required.

4.4 User Expertise

The Lwazi system must also be usable to the target audience. We also sought to evaluate the expertise of potential Lwazi system users by gauging their current expertise with telephony and other ICT technologies. The user expertise of telephony systems differ between young and old. As mentioned earlier, households have at least one cell phone. The older members of the community use it to call and receive calls from friends and children away. They do not know how to send text messages. Some children have saved the full ‘Please call me’ line as a quick dial so that their elder family members can just press them in cases of emergency. The young people on the other hand are well versed with telephony technology. Most of them are also familiar with the basic use of a computer, despite their limited access to them. The Lwazi system must be as simple as making a phone call to a friend or relative in order to be accessible to all. In most household, however, there is someone who is technically competent. Based on our fieldwork and recent user studies of spoken dialog systems in developing regions (c.f. Sherwani et al., 2007; Shwama et al., submitted), a LWAZI system would be useable in the rural context of South Africa, even among the elderly and those who do not read and write.

5. Discussion

5.1 Potential Uptake

We saw two main areas where a telephony service could be very useful. The first is in supporting communication between community and government. For example, a multilingual, automated service could direct calls from community members to the appropriate TSC office or CDW, or perhaps provide locally relevant information such as office hours of operation, directions to the office, and eligibility requirements for services. Such a service might reduce the amount of calls that a TSC office or CDW would need to take personally and could likely save a community member a trip if they were sure beforehand what paperwork they needed to bring and when the office was open. It is important to mention here that the project will require a buy-in from the local councillors of the communities we will be piloting in.

The second area in which a telephony service could be useful would be in facilitating internal communication among government service providers. CDWs may need to meet community members face to face whenever possible. Coordinating with government staff across the municipality, district, province, or country could happen remotely and efficiently if government staff could use an automated telephony service to send audio messages to several staff members at once. The national coordinator for CDWs, for example, could notify every CDW in the country of upcoming events and policy changes with a single phone call.

Our field work revealed the effectiveness of national government programs to connect rural citizens to available government services. Our major finding was that although particulars about the communities differed, individuals in the eleven communities visited experienced barriers to information access that could be solved with automated telephony services, provided that such services are toll free and localized to the language and information relevant to the particular rural community. Whereas infrastructure such as roads, services, and in

some cases, electricity were limited, the mobile phone network of South Africa is reliable and widespread. We feel optimistic that the LWAZI system will build on the available infrastructure to transcend the barriers of geography and improve the connection between citizens and services.

5.2 Challenges

In a country like South Africa, that is vast and rich in culture, language and socioeconomic status, deploying a spoken dialog system intended for universal access is a great challenge and an ambitious goal. However, the CSIR, HLT research group is already developing the language resources and systems in parallel with our investigation into rural communities. The LWAZI project is expected to be employed by summer 2009. In addition to research into community needs and resources, community buy in is critical to the success of an ICT deployment. We found not only that the TSC and CDW national coordinators but also each of the communities visited were all excited about the potential of the proposed system.

Many government officials, including Thusong centre managers, felt the system might assist them in communicating with the communities they serve. There was, however, a concern from one site that there are sections of the population that do not have mobile connection or a reliable source of electricity to charge their phones. These could be the communities that need government services the most. In these cases, LWAZI will have to play a supportive role to the existing services, the CDWs, rather than allowing direct access by community members.

6. Conclusion

In this paper we evaluated the potential role of LWAZI, a telephone-based spoken dialog system, in improving access to important government services. The Lwazi project will create an open platform for telephone-based services for government to provide information in all eleven languages. The design of the

technology makes accessing government information free and as easy as calling a friend. LWAZI will be especially useful as it will cut down on the distances that people travel to get information on government services and that government workers travel to check in with municipal offices. Our team plans to conduct pilots in two communities in the summer of 2009. A successful pilot in one of these communities will then burgeon into a national service for all South Africans to empower themselves through improved access to information, services, and government resources.

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