Language and technology literacy barriers to accessing government services

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Abstract. The paper presents research aimed at overcoming barriers to citizens' ability to access electronic government services. Our concern is specifically 'non-connectivity' barriers to electronic service delivery including cultural background, language, literacy and level of technology experience. These issues are investigated and solutions researched in a developing world context. The project on which the paper is based aims to develop a service delivery framework and technology where service delivery is personalised to citizen's unique circumstances taking into account the means by which they will have access to government services and individual characteristics such as language preference. In order to develop appropriate technological interventions, a number of field experiments are done to gain an improved understanding of the extent to which citizens' exposure to technology and home language affect their ability to access electronic services. These experiments will influence technology development on the project that will be incorporated in a technology demonstrator.

1 Introduction

The "Government to citizen e-governance" project is a three-year research and development project aimed at developing technology to enable effective electronic service delivery to citizens in a developing world context. The project is being undertaken by the Council for Scientific and Industrial Research (CSIR) in South Africa and the Fraunhofer-Gesellschaft: Research Institute for Open Communication Systems (FOKUS) in Germany. FOKUS has developed the Enago Open Services Platform [1], which is an advanced, standards-based, distributed, object-oriented application integration middleware platform. CSIR has experience in technological innovation aimed at developing and adapting technology to developing world conditions such as those existing in South Africa.

In Section 2 we sketch the context within which the research is being done. In section 3 we detail factors that will influence the design of such services, and motivate the choice of telephone services for conducting initial experiments. Thereafter we discuss some of the usability issues that will be considered during development

(Section 4). In Section 5, we describe our experimental approach, and Section 6 provides initial conclusions on the work undertaken so far.

2 Context

The demand for e-government services in South Africa results from requirements to: improve the efficiency and quality of government services, ensure that government services are delivered to all levels of society at the most convenient times and locations, grow government's portfolio of services, create government service transparency, and provide citizen with feedback mechanisms. In support of these requirements the focus of the project is primarily on the innovative re-use of current or established technologies and integration of such technologies into an effective service delivery platform accessible through different devices under South African conditions and applied in a South African context. Two basic assumptions behind the project are:

❑ Effective electronic service delivery has to enable citizens to access government services in different ways and
❑ Government services have to be presented to citizens in an integrated, citizen-centric manner.

The Enago technology provides functionality that will enable service delivery given these assumptions. The main research challenge of this project is to extend this technology to the demands of a developing world context. Factors such as language, culture, economic means, geographical location, literacy and previous exposure to technology are considered. The goals of the "Government to citizen e-governance" project therefore are to:

❑ Improve knowledge about how citizens interact with government services through electronic means and improve our understanding of how different user populations interact with electronic government services
❑ Develop technology and methodologies for application development that will allow for improved government to citizens interaction.
❑ Demonstrate the potential for citizens to interact with government via electronic means through a practical demonstrator built on existing and new technology

3   Factors to consider in designing e-government services in the developing world

The deployment of e-government services is far less advanced in the developing world than in countries with sophisticated infrastructure [2], therefore one of the goals is to build on learning from the developing world. The success of such services is

likely to depend on the interactions between four groups of factors: cultural background, literacy levels, technological medium and the nature of the service.

In a developing context cultural factors are particularly important for the successful deployment of most electronic services. One reason is the relative lack of accommodation between many traditional cultures and modern electronic media. Whereas popular culture has already adapted to technologies such as the Internet in most developed countries (and has in turn shaped those technologies), the cultures of developing nations need more careful consideration when these technologies are to be employed. Because of the mass media play a smaller role in the developing world, cultures tend to be less homogenized, increasing the importance of explicit consideration of cultural factors.

In the developing world, functionally illiterate citizens are often a significant fraction of the population. This constrains the delivery of electronic services, which usually require fluent literacy as well as a technological sophistication that builds on such literacy.

A third factor to consider in the developing world is the relative scarcity of financial resources and general infrastructure. This implies that the delivery media for e-government services are typically required to be even more cost-effective than in the developed world – and cannot assume that citizens will have access to tools such as Internet-connected workstations.

These factors will play a substantial role in determining the nature of the services that can be deployed successfully and could place limitations on the nature of services that can be provided electronically in developing countries. By taking proper account of these factors, we can deliver services that address the most salient user concerns, which are directly expressed in concepts such as access, control, content, and equity. Our principal concern will be to understand how these subjective user goals can be reached through an understanding of the objective characteristics of user, task, and technology.

3.1 The telephone as preferred carrier

The factors described above suggest a multi-dimensional grid of possibilities that should be considered in developing appropriate e-government services. To simplify this grid, we will initially limit our attention to telephone-based service delivery. This medium strongly suggests itself in the developing world, because of the rapid growth in the availability of telephone connections in many countries [3].

A further advantage of telephone-based services is the relatively low levels of infrastructure and user sophistication at which such services can operate. We believe that useful services can be delivered to citizens equipped with nothing but a normal telephone (mobile or fixed-line), and requiring no more than the ability to understand and respond to spoken commands. Such a verbal interface is highly appropriate from a cultural perspective in many developing countries, where a strong oral tradition exists amongst a pre-literate or semi-literate population. Thus, telephone-based services place a very direct focus on the role of Human Language Technologies (HLT) in the

developing world, and will hopefully assist in drawing resources for the development of such resources.

We therefore envisage services that citizens will access by calling a central toll-free number; they will be given a menu of choices, and be able to obtain or provide information over the telephone. The exact mode of information input raises a number of intriguing research issues – for example, will technologically unsophisticated users fare better using speech recognition or keypresses as input to an automated system? Or, how should prompting be structured to assist a user who has no mental model of the functioning of a computer system? It is likely that good answers to such questions will assist us in developing interfaces that can help bridge the digital divide – not just in e-government, but also in other walks of life.

4 Usability issues

Graphical user interfaces have been studied intensively in the past two decades, and there has been tremendous progress in determining how to develop usable solutions with such interfaces. Much of that information can be generalized to spoken interfaces. In particular principles crucial for any user interface, regardless of modality include: careful user modelling, thorough understanding of the task domain, and the characteristics of the underlying technologies.

Another principle that holds equally true for graphical and spoken interfaces is the importance of usability testing: by involving trial users (outside the design team) throughout the design process, an improved product can be developed in a reduced amount of time.

These principles will go some way in assisting us with the development of user interfaces for the services we wish to develop. However, the specific nature of the spoken interface – especially for users with limited literacy and technological experience – is certain to introduce issues that have not been considered before in the delivery of services for e-government. (For example, we need to understand how requirements for trust and accountability are satisfied with a telephone-based interface). We will therefore develop a programme of carefully designed experiments to study usability issues when a spoken (telephone-based) interface is used to deliver e-government services.

4.1 The influence of culture

The South African context provides a good example of the cultural issues that should be addressed when developing user interfaces for e-government service delivery in the developing world. The people of South Africa speak 11 distinct languages, and there are wide disparities within and between the various language groups in socio-economic standing and literacy [4][5]. Before 1994 a racially selective elite ruled the country in non-democratic fashion, and this history has fostered a deep mistrust in government. Compensating for these historical injustices requires particular attention

to the needs of citizens who are functionally illiterate, do not speak a "world language" (such as English), and have been denied access to the benefits of modern technology.

This situation calls for the development of services that explicitly take into account the variables that will influence the user's interaction with the service. These variables include: Language of choice, Age group, Gender, Level of functional literacy, and Mean family income. We intend to investigate the role of these variables in user access to e-government services. Our initial analysis suggests that a useful ordering principle is to make a primary distinction based on geography – in South Africa, citizens' style of access will be largely determined by whether they reside in an urban environment, the rural countryside, or in an informal peri-urban settlement.

5 Experimental Approach

The issues raised above clearly require inputs from experts in a variety of disciplines. To gain access to such expertise, we have initiated a series of workshops with specialists on topics such as human-computer interfaces, cultural factors, and government services. These workshops have provided us with a wide range of opinions on the interface approaches we should attempt, the user populations we should investigate, and the evaluation criteria for assessment of the various approaches. Below, we describe the application that was targeted for our development, and initial results obtained.

5.1 Application Selection

To investigate the HCI issues, a practical service delivery application was selected, based on a few criteria. The application had to be complex enough to explore the issues raised above. It also had to be feasible with a telephone-only interface, and be practically relevant for non-specialized users. We decided to implement a system that would make it possible for telephone users to obtain information on, and apply for, the Unemployment Insurance Fund (which is currently of much interest to the South African Department of Labour [6]).

5.2 Design and implementation of speech and DTMF systems

User interfaces using DTMF (keypresses) and speech recognition have been designed that allow the various issues to be probed. A working version of the DTMF system was implemented, as well a "wizard-of-oz" mock-up of a speech-recognition system. Wizard of Oz refers to an approach that is commonly used in developing and prototyping speech recognition systems [7]. In a Wizard of Oz a human operator imitates the working of the recognition component. The results of the experiments will

be analyzed in terms of transaction completion and user satisfaction, stratified across the various user and technology variables introduced in the study.

We have performed an initial analysis of the DTMF-based system, using the methodology of Heuristic Evaluation [8]. This evaluation demonstrates the complexity of designing such interfaces: although the system was broadly judged to be successful, it was found to be lacking in unexpected ways by users from specific cultural backgrounds. For example:

- ❑ Certain evaluators found terms such as "valid" or "menu" to be confusing.
- ❑ Commands such as "to do X, press Y" were judged too authoritarian in certain cultural settings; evaluators preferred "If you would like to do X, press Y".
- ❑ Even though the system cannot be used to obtain money directly, some evaluators felt that it was not sufficiently "secure" or "private".

We are currently expanding our evaluation to include "naïve" users from various population groups; these groups will also be exposed to the speech-based system. This will allow us to understand these issues quantitatively.

6   Conclusion and Outlook

The rewards from successful service delivery to citizens of the developing world are potentially huge: in South Africa alone, millions of citizens stand to gain access to facilities which are currently either impossible or highly inconvenient for them to use. However, there are significant challenges to effecting truly usable service delivery, caused by lack of literacy, limited resources, and lack of knowledge on how to deliver services in culturally and socially appropriate ways. We have embarked on a program to investigate these issues in the context of a telephone-based solution. Two test platforms (for DTMF and speech-based input) have been developed, and we are in the process of performing a more extensive analysis of the properties of these classes of interfaces.

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