Senior web Surfer

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FOREWORD

OVERVIEW

The development and implementation of e-government involves consideration of its effects including environmental, social, cultural, educational, consumer issues, among others. On one hand, e-Government software is mandated to follow very strict requirements in terms of evolving regulation, use of legacy technologies, confidentiality protection, and technical constraints related to the management. On the other hand, the design of e-Government applications must consider the impact on the diversity of users in terms of age, language skills, cultural diversity, literacy, and information technologies literacy. Bad design can have huge impact not only on the adoption of user interface by users but also compromise the validity of democratic processes. So that, accessibility had become a mandatory requirement for any e-Government initiative.

As governmental agencies increasingly move towards developing new way of improving the information exchange and services among citizens, businesses, and other arms of government, there is a strong need for inter-disciplinary empirical and theoretical research focused on Information and Communication Technologies and Computer-Human Interaction to guide the development of accessible and usable e-Government applications.

GOALS

The goal of this workshop is to bring researchers and practitioners together to explore the issues and challenges related to the development of usable and accessible user interfaces for e-Government applications using innovative Information and Communication Technology (ICT).

We wanted to facilitate discussion on the topics of identification and management of the diversity of users (e.g. citizens, stakeholders, etc), requirements and constraints for the development of e-Government applications, user experience with e-Government services, user involvement into the development process, universal access, policies for implementing accessibility and usability culture into government agencies.

TOPICS

This workshop was intended for anyone (researchers and practitioners) who is concerned about the design of interfaces that will be accessible and usable. This will include representatives from administrations, academia (e.g., lecturers in HCI), and policy-making organizations.

Workshop topics include:

- User Characteristics and their Diversity (e.g. citizens, back office, stakeholders, etc)
- User Interface requirements and constraints for of e-Government applications
- User experience with e-Government services
- User involvement in the development process
- Accessibility and universal access design
- Public policies for implementing accessibility and usability culture into governmental and third parties agencies developing e-government applications
- Quality models for measuring the quality of e-Government user interfaces
- Design Methods for e-Government User Interfaces
- Successes and failures stories of e-Government user interfaces
- Recommendations for public Web sites
- Innovative use of ICT technologies including instant messaging (e.g. MSN), GPRS, interactive TV, tracking systems, road traffic management, regulatory enforcement, etc.

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X-Gov: crossmedia for government services

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ABSTRACT
This paper discusses the application of the crossmedia concept to government services. We present some advantages of this approach, as well as the challenges to using this new interaction paradigm. A framework is proposed to provide a technological foundation that assists the development of crossmedia governmental applications and maintains the consistency expected in government services.

Keywords
Crossmedia, government, media transition, framework.

1. INTRODUCTION

Trends in the use of media in developing countries signal that the adoption of information and communication technology is changing the paradigm of communication between government and citizens. In Brazil, services in which person-to-person communication was the only way to accomplish a government service have been gradually swapped into electronic services that allow citizens solve their problems at home or at workplace, saving time and money, both for themselves and for the public administration.

Internet services have led this process in our country as well as in many other places in the world. However, this approach has several drawbacks. The biggest one is that internet does not reach as many people as TV and cell phones do. Despite the growth in the number of internet users in Brazil, internet is still less representative in citizen's life as television and cell phones. This fact can be interpreted as indicative that electronic government in Brazil cannot be based primarily on the internet but instead, must explore other communication media. Also, people can easily use cell phones and TV sets, much better than they use computers and browsers.

Of course, this situation is expected to change in time. The digital native generation is already experiencing citizenship and the compulsory relationship to government. This generation has grown up using several technologies for communication, learning and entertainment.

Here, we advocate the usage of crossmedia as an approach to e-government. We claim that this is a good option for both the digital excluded population and digital natives. We present challenges and opportunities of this approach as well as the architecture we have designed as a solution.

This paper is organized as follows.

In section 2, we discuss current implementations of e-government in multiple media. In Section 3, this paper presents a brief conceptual approach to crossmedia and x-gov. Section 4 is devoted to the discussion of the challenges and opportunities of this interaction concept. In Section 5, we show an architecture that has been designed to meet the proposed challenges. Finally, section 6 discusses the proofs-of-concepts which have been developed to assess the architecture feasibility.

2. E-GOVERNMENT SERVICES AND MULTIPLE MEDIA

E-government (or shortly, e-gov) has been defined as "the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government" [16]. There are many benefits to e-gov: transparency, efficiency and citizen empowerment, besides reducing delivery and management costs compared to maintaining people as public officers. We add accessibility and social inclusion, especially important in developing nations like Brazil.

Allan et al. [1] have surveyed research and professional literature about e-gov, covering G2C (Government-to-Citizen), G2B (Government-to-Business) and G2G (Government-to-Government) interaction. We notice that the expression "e-gov" is commonly used to define the interaction using the internet media to access services, web portals and others applications mainly provided by internet.

In this paper, we use the more comprehensive e-gov concept. We understand that besides the internet, other communication and information technologies like digital television and mobile computing have proved efficient in delivering government services.

Devices like PDAs, laptops, cell phones and tablet PCs have brought the mobility concept to government services. M-government (or shortly, m-gov), as defined by Trimi and Sheng [17] is the strategy and its implementation for providing information and services to government employees, citizens, businesses, and other organizations through mobile devices. Today, several m-gov cases are available in different countries, like Canada Mobile Government [1] and Singapore e-Citizen [2].

[1] http://www.canada.gc.ca/mobile/wireless-eng.html

Another alternative for government service delivery is t-gov, that is, the delivery of e-gov on television. The importance of t-gov is due to the influence of TV in citizens´ life. TV is a communication media installed at almost a hundred per cent of homes of developed and emerging countries. As TV goes digital, it becomes more and more interactive. Unexpectedly, the t-gov is still restricted to a few cases. The United Kingdom is one of the few places around the world that have experienced initiatives like DigiTV[3] that offers interactive content for citizen about jobs, transportation news and local information.

Internet-based e-gov, m-gov and t-gov are solutions that have been conceived and implemented to broaden citizens´ access to services. They are usually developed as independent solutions for an isolated medium-user interaction.

In the next section, we show that integrating these alternatives in the crossmedia paradigm can be a better approach for enhancing G2C interactivity.

3. CROSSMEDIA AND X-GOV

Crossmedia systems are applications that deliver content by orchestrating multiple media, in such a way that the user interaction is directed to different communication channels, fully exploring the potential of each one.

According to Boumans [4], crossmedia has emerged on early nineties, when the television program Big Brother appeared in Holland, bringing a shockwave on broadcast industry. The crossmedia feature was the delivery of the content in a combination of analogue television, interactive cable TV, Internet and mobile telephony, supported by magazines and newspapers.

On the referred report, Boumans listed five characteristics of crossmedia. They are: (1) Crossmedia should involve more than one medium; (2) Crossmedia aims at an integrated production; (3) Content is delivered on multiple devices: PCs, mobiles, TV, iTV; (4) More than one medium is needed to support one message/story/goal; (5) The common message/story/goal is spread on the different platforms and the supporting interaction can take place on these different platforms. Besides Boumans, other authors such as Dena [7,8], Barkhuus et al. [3], de Haas [6] and Antikaainen et al. [2] also support the former crossmedia definition.

The crossmedia concept is founded on three important elements:

-a set of media, each one contributing with its own particularities in terms of preferred formats, languages, target public and interactiveness;

- the content, that is associated to the message that will be delivered; the content is the main narrative and all its complements. Content may have to be adapted to the medium;

- the transitions, that are the means by which users are directed from one medium to the other in order to follow the narrative path. Transitions are composed by a call-to-action (which is equivalent to the label in link) and an associated technological mechanism that performs the exchange (which is equivalent to the HTTP fetching a new page).

Hayes [11] identifies four different styles (or generations) of crossmedia delivery. Crossmedia 1.0 is equivalent to the COPE concept (create once, publish everywhere): the same content is adapted to several media. Crossmedia 2.0 introduces “extra” content, that is, complementary content that adds to the mainstream narrative and that can be deployed in other media than the main one. Crossmedia 3.0 introduces the concept of bridges, which are specially designed transitions that calls the user to act and change to different platforms. Crossmedia 4.0 combines the three previous levels and allows the user to create his/her own content and bridges, in a collaborative environment.

There are several applications of the crossmedia concept in marketing, entertainment and education [4] in all levels defined above. Games and advertisement explore the amusement embedded in the media exchange to create an atmosphere of investigation; news industry use the diversity of formats to convey a richer experience for those interested in a deeper knowledge about something. Also, publishing content in diverse media can be a means of capturing users of different profiles and habits.

Based on the crossmedia concept, x-gov is defined as the delivery of public services across multiple media, in which G2C communication is supported by several media alternatives, each one directing the citizen to the next step in the interaction process and to the more suitable media for that step.

While the e-, m- and t-gov services support the one-user-one-medium paradigm, a crossmedia service reaches citizens through multiple media, providing a richer experience through the variety of content formats and relationships. In this research, we restrict applications to G2C, even though we acknowledge the potential for cross-media in G2B and G2G applications.

Regarding the three elements of crossmedia applications:

- media: governments already use several communication channels to send their messages to citizens: the internet, in desktop or mobile versions; telephone, SMS, fax, banners, outdoors, newspapers, magazines, TV and many others. All of them can be used to deliver part of a government service.

- content in government services is usually informative, such as announcements on government decisions, facts and accomplishments as well as numbers that demonstrate a country situation. Content can be transactional, that is, exchanged between citizens and government.

[2] http://www.ecitizen.gov.sg/mobile/index.html

[3] http://www.digitv.gov.uk

- transitions are almost inexistent in present applications, except for call-to-actions that imply manual accomplishment of the change (for instance, an outdoor announces the telephone number of a service)

4. OPPORTUNITIES AND CHALLENGES OF THE X-GOV APPROACH

X-gov applications are different from other crossmedia applications in some aspects, which implies in special requirements. In this section, we explore some opportunities and challenges of x-gov applications.

When compared to e-gov, x-gov presents many advantages. The first one is the potential to reach citizens. In a developing country like Brazil, the Internet approach has the disadvantage of depending on computers which are not possessed by the population, despite of the increasing efforts by governments and the civil society to provide computer in schools and other public locations. Providing for delivering content in alternative media can be more interesting than independently offering services in one single media, because of increased coverage. Also, users can reach government anywhere, anytime.

A second benefit is the possibility of moving electronic interaction beyond the point where it gets interrupted today: electronic transactions give place to person-to-person interaction when the main medium is unable to handle the message– for instance, a paper document is needed or a payment must be made and the citizen´s bank is not integrated to the government network. In both cases, cross-media could help citizens providing an alternative means of communication, including the fax, for instance.

Third is benefiting a diversity of users: people with some kinds of disabilities could communicate with government using the most suitable channel, according to personal preferences or skills. In this case, content can be deployed in different formats in alternative media – while interacting with a computer, the deaf user can have additional explanations in sign language in his or her TV set; blind users who are not skilled with screen readers and keyboards may prefer accessing a service by telephone instead of using a computer.

Fourth, modern life presses on cross-media language: we send an e-mail at the same time we talk on the phone and check news; we download internet music while watching the show on TV. Why shouldn't we file an electronic form with a cell phone, following instructions and options presented on the television?

Fifth, the x-gov approach may help promoting the government services. A former field study [9] has revealed that the population is unaware of electronic government services. The crossmedia approach is very effective in promoting the services and in developing the necessary meta-communication that is required to create the self-service culture, without which all investment in e-gov becomes useless.

Finally, x-gov has a distinctive characteristic from other crossmedia applications. Although a deep planning study is needed to decide what content should be on which medium, unlike communication industry, government content has persistence and do not need to be renewed frequently. This makes costs of crossmedia production more palatable for governments than for private companies.

Despite the many advantages, there are points of concern too. We present them in three groups. The first group contains challenges that refer to crossmedia technologies, which are still incipient. The second group collects challenges respective to the government domain issues. The third group discusses challenges respective to x-gov users.

4.1 Crossmedia technology challenges

Content management. Two crossmedia content elements can keep three different relationships: **corroborative**, if both elements represent one single message, that may be different in format but the same in meaning. In this case, they can be distributed in different media; each one will confirm the message delivered by the other. Content elements can be **complementary**, when both are needed to deliver the full message. Finally, two elements can be **concomitant** of they are needed at the same time to deliver the meaning. Crossmedia content management is an important issue, because content elements can easily become redundant and contradictory, if spread over multiple platforms, destroying the message that would be conveyed.

The patchwork effect. An unplanned development of government applications using crossmedia will lead to several interaction models, as each different application may develop its own. For instance, one service may allow payment using the cell phone, and another one will require a faxed receipt to complete the payment task. Inconsistent interaction models will be seen by citizens as confusing patchwork, from which they will not be able to develop a mental model.

Seamless transitions. A crossmedia service must integrate media and offers transition possibilities to make a media or device handover. X-gov applications require simple and efficient media transitions. While transitions are not a big issue in games and entertainment applications, in e-gov applications one can expect a difference in user motivation and mood, easy to understand if one compares a citizen that is asked to change media, for instance to pay a tax or communicate a problem, to someone else having fun while responding to an advertisement. Some of the call-to-actions, that send the citizen from one media to the other, will require a special handling, because the user will be expected to continue the dialogue. However, crossmedia-specific technology is still not available.

4.2 Government challenges

Cost-effectiveness. Services are delivered at a certain cost. Internet-based government is anchored in a cost distribution that considers that if the user does not possess the computer, he or she will have access from digital

inclusion centers, schools or work. Adding communication channels to this scenario means to add new players to this equation.

Conversion rates. Crossmedia antagonists argue that crossmedia applications are not effective in terms of conversion rates because it is not possible to follow users in their movements. In internet applications, the server that provides the application can manage conversion rates.

Expertise. A crossmedia project needs a multidisciplinary team that develops systems for multiple platforms. Given the need of expertise in those different platforms, it may be hard for the government analyst to keep up-to-date knowledge about every different technology and device that can be used for interaction. Government teams usually have little time to learn new concepts and applications; innovation is often compromised by the need to deliver reliable applications in the shortest time, at the lowest cost.

Interoperability Government services usually connect different public departments and levels. Frequently, each instance of government has its own technological platform. In order to deliver crossmedia services, an interoperability standard must be defined. Brazilian government has a federal initiative to standardize the operation between online services [5], which will have to be extended to multiple media environment.

4.3 User-related challenges

User identification Some government services require citizen identification. The identification can be a general attribute for example the location, time, age, gender, etc, or personal attribute as name, identification number, etc. Identification is needed for several purposes. In crossmedia environments, identification may require information about preferred media (in order to increase service accessibility, for instance) but also the identification of user's interactive resource location – telephone number, for instance – so that transitions can happen and information is pushed on the citizen (for instance, sending a SMS message).

Cost distribution Usually, in cross-media applications, costs are usually shifted from the sender to the receiver. This should not be the case of a public service. If the user needs a fax to send his piece of documentation, fax service should be available for all citizens. A business model must be defined so that using a crossmedia application is economically feasible for the population.

These points of concern have been addressed by the proposal of a framework for crossmedia applications, in which reusable components can be aggregated to deliver a *family* of x-gov applications. Next section presents this solution.

5. THE X-GOV FRAMEWORK

The x-gov framework is a technological infrastructure that aggregates reusable components for cross media interaction to support government services.

A framework can be defined as "a skeleton of an application that can be customized by an application developer" [12]. It is the result of a domain abstraction that can be reused in several applications. The framework dictates the application architecture and predefines design parameters so that the application designer or developer can concentrate on the specifics of his application. A framework provides a standard for components to handle errors, to invoke operations on each other, and to exchange data [12]. Flexibility is provided by hotspots, which are framework elements that can be customized for specific requirements.

The X-Gov Framework has many architectural decisions that support the crossmedia and electronic government domain. It intends to offer managers and developers a tool for overcoming some of the challenges described in the previous section, making easier the description and implementation of x-gov services.

In this section, we first present a quick view of the architecture and how it is used. In sequence, we present the architectural decisions, in the light of the challenges we want to address.

5.1 A quick view of X-Gov architecture

The X-Gov application can be described as an orchestration of components performed by a server that is capable of handling a crossmedia session. The Service Manager is this server, which distributes the narrative by media components, according to the prescribed service sequence, and performs the transitions from one medium to the other. The Service Manager has also the capability of dealing with crossmedia content and interfacing with legacy government systems. Figure 1 depicts in a quick view the skeleton of an X-Gov application.

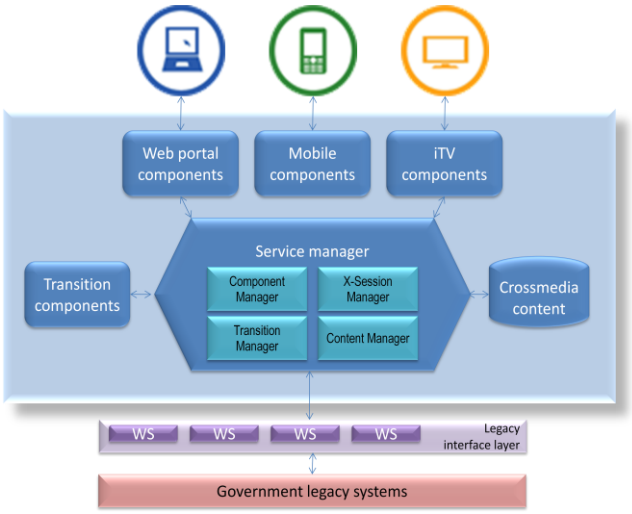

Figure 1- Overview of an X-Gov application

As in any framework, reusability is consequence of a domain analysis. For X-Gov, we have analyzed both the crossmedia domain and the G2C services domain. Our analysis of the crossmedia domain has been focused on understanding what makes crossmedia different from other multimedia applications and these are the crossmedia

transitions. We have investigated practical examples of crossmedia applications to obtain characteristics of transitions and their technological infrastructure.

The set of crossmedia transitions has been implemented in a corresponding set of components, which can be customized for the X-Gov application. This architecture implements crossmedia in Hayes' level 3, by providing planned bridges, which are the crossmedia transitions. Level 4, in which citizens can contribute in providing content and new bridges, is planned as an evolution of this work.

On the other hand, the analysis of e-gov domain has been focused in looking for common elements that could express the G2C communication. We have represented the result as a set of 18 task patterns. They express information retrieval tasks, citizen-government relationship tasks, documentation-related tasks and transaction tasks. X-Gov task patterns are listed in Figure 2 and have been described in a previous work [14].

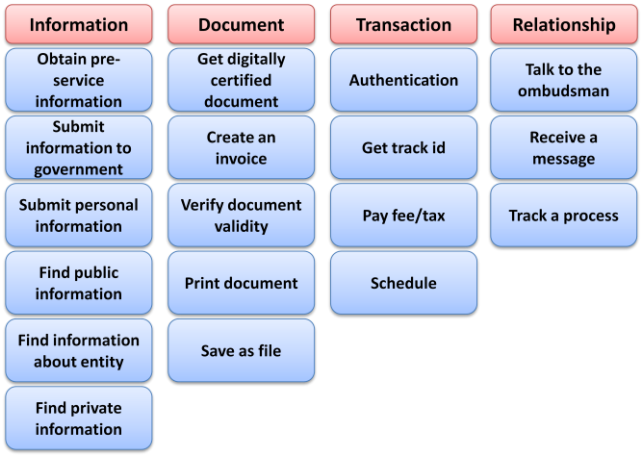

Figure 2- X-Gov task patterns

Task patterns are realized by user interface task components, developed for different media: mobile, web and iTV. Because each medium has interaction restrictions and qualities that must be considered, the implementation of a task pattern is different for each platform.

Each task requires specific information to be accomplished. The task pattern "Pay fee/tax" requires, for example, information on the specific tax, the contributor identification, tax value and due dates. This information must be served by the government service legacy system, which is interfaced with the crossmedia layer by a set of web services. The bottom layer is representative of government existing service implementation, or technological infrastructure that is able to execute the service requirements.

Other crossmedia content that may be needed by task components, such as audio descriptions, movies and text are stored locally within the application and handled by the crossmedia content manager.

5.2 A quick view on the use of the framework

The crossmedia application development process has some distinctive activities that must be included in the usual software development process.

In order to make easier the task of building X-Gov applications, the X-Gov framework offers building tools. The application skeleton is produced from the description of the government service using a two-step application builder and can be later customized by the developer, as Figure 3 shows.

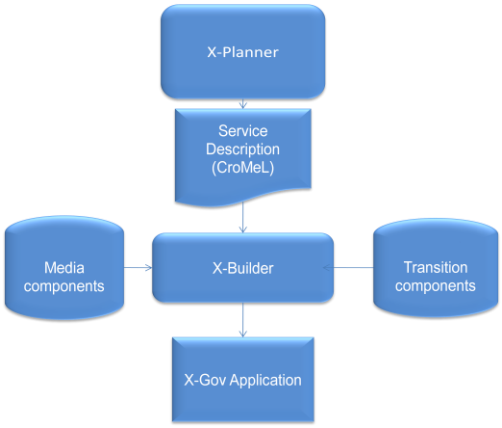

Figure 3- Building an X-Gov application

The crossmedia application development starts with the government process modeling, using the description tools. This first step is supported by the X-Planner tool. Its user is the Government Service Analyst, a person who knows the government service and is able to describe it as a business process. The Government Service Analyst may not be able to write code; however, she can specify which activities will have to be performed by the citizen, which activities will have to be executed by the government legacy systems and in between, which are the activities executed by the crossmedia application. She uses the X-Planner graphical tool to sequence task components and crossmedia transitions, as well as custom activities, using a modified Business Process Model Notation. Given the interactive profile of each conversational step, a crossmedia planning algorithm [10] will suggest the best medium for the step. The X-Planner tool produces, as a result, a service description in a domain-specific language, CroMeL.

The application builder tool, X-Builder, assembles the skeleton application by interpreting the CroMeL script and setting appropriate configuration of the Service Manager server. X-Builder instantiates service components from the framework's repository of media and transition components.

The resulting application can be modified by the Government Application Developer, who is able to program the framework hotspots. This means writing any complementary code needed to customize the resulting

application: setting technical parameters as servers and database locations, writing specific rules and defining interface design style so that the crossmedia application is compatible with the government agency visual identity, such as colors, background, logo and font styles.

The application configures itself as a crossmedia interaction layer to the government services. It is responsibility of the government legacy systems to execute the transactions. Thus, next step is the infrastructure configuration. The government legacy systems are connected to the framework by the development of a set of web services that will provide and request necessary information to the crossmedia layer. The SOA approach gives flexibility to connect the crossmedia service to any technologic platform.

5.3 Facing challenges

Section 4 has presented some challenges for x-gov applications. In this section, we discuss how the X-Gov Framework can help address these challenges.

Content management

Because of complex relationships that may occur between crossmedia between content elements, it is interesting that crossmedia content is represented as components. The X-Gov framework considers that a content element may have alternative format and aliases and that it may be related to other content elements by the corroboration, complementation and concomitance relationships.

Thus, when the Government Analyst associate content to a task component, X-Builder places the content and its metadata in the Crossmedia Content Repository and orchestrates a service to retrieve it when needed. When the X-Gov service is executed, the suitable component element is retrieved by Content Manager and presented in the most suitable format.

The patchwork effect

The X-Gov framework is based on components which have been derived from task patterns. Each task pattern embeds its interaction model, in terms of its signs and features. We expect that the level of reuse provided by task patterns and components seduce government analysts to keep customization in the parameter level, preserving the interaction model. This would reduce the patchwork effect in a family of applications. In maintenance, inconsistency is avoided because updating the component result in updating all derived services.

The framework is flexible to allow changes in components; consequently, the interaction model can be adapted if needed.

Seamless transitions

De Hass has expressed the concern about the need of seamless device switching [6]. Yet there is no solution to automatic handover. The framework provides resources to make changes between devices an easy movement, because citizens' motivation to the use of crossmedia in government services is not the same as those who are enjoying a crossmedia game or advertisement.

Transitions can be performed manually, when the user inserts the address of the service in the next medium (for instance, the user reads in a magazine that he may find more information about the e-gov service in a certain website; he opens his browser and keys in the URL). This kind of transitions does not need to be supported by the framework.

In some cases, the citizen can use some technological aid to switch from one medium to the other. One example is the automatic phone call that could be started by a click at web page or TV interactive application. This mechanism is named *click to dial* or *click to call* [15]. Another interesting transition mechanism are 2D barcodes as QRCode or DataMatrix.[13] These barcodes can encode long text, URL addresses, and phone numbers. A camera, which can be coupled to the mobile phone, capture these barcodes, which are decoded and automatic redirect the device to the encoded URL. Existing solutions such as those mentioned above offer more comfortable transitions for the user; however, from the technological point of view, those transitions require platform integration. Because prospection and integration of many transitions can be a hard work for the developer, the X-Gov framework incorporates available solutions as components.

Some transitions between media do not count yet with technological solutions. We are presently working on implementing new components for transitions from voice portals to web and from iTV to cell phones.

Conversion rates

The X-Gov framework has addressed the question of conversion rates in the X-Session manager. This element of the architecture is responsible for handling the user session, regardless of the media in use. Thus, it makes possible to track citizens' transitions from one medium to the other, as well as any other session parameters.

Government expertise

The X-Gov framework must require the minimum programming effort possible; must be easy to learn and operate. It has been conceived to reduce the effort in crossmedia application development process. The use of a graphical tool in X-Planner and the opportunity of describing components orchestration using a DSL are examples of effort reduction in the service description level of application development.

Reusable components accelerate the writing of code. In particular, reusability and maintainability is reinforced by the configuration parameters. The Component Manager is responsible for dynamically providing parameters for each component instantiation, either for tasks or transitions. For example, suppose a task component that implements the

citizen's need to follow up a certain issue, given a tracking number (this is the TrackAProcess task pattern). Suppose the tracking number is composed by six numeric digits. This is stored as a configuration parameter. Modifications of business rules could change the tracking number format to one alphabetic character and seven digits. This customization will imply only in changing the component input parameters instead of source code.

Interoperability

The X-Gov framework is a service-oriented architecture. Service oriented architecture (SOA) represents a model for distributed computing. Its advantage is the loose coupling between elements. SOA was selected also because it has been the choice of many governments to interoperability. In particular, web service technology is viewed as an appropriate solution to the needs of interoperability in an environment of heterogeneous platforms, in which reading and writing messages in XML format to allow flexibility for the exchange of messages between different subsystems.

e-GIF (e-Government Interoperability Framework) is one of the major references of interoperability standards for e-gov. The British government framework, already in its sixth edition, can be used for exchange and management of data and metadata [18]. Brazilian government's interoperability standard, e-Ping [5] also suggests web service technology.

The X-Gov Framework has been implemented in a service oriented approach in two layers. The communication between the x-gov application and the legacy government services and databases is standardized by a set of web services which are responsible for data exchange. WSDL interfaces provided in the framework description reduces the effort of interfacing existing systems to the crossmedia interaction layer.

The second case is the internal communication, within media components. Because each medium has its own technological platform, web services are suitable for flexible integration. This decision intended to increase flexibility in case of adding new components to the framework. RESTful web services have been chosen instead of SOAP web services because the data transmission can use lightweight message formats, e.g., the JavaScript Object Notation which reduces the processing overload.

User identification

Watson's and his colleagues' uniqueness concept in ubiquitous marketing [19] can be applied to the cross-media government services. This refers to the media and devices used by unique person. The mobile phone is the best example because users rarely share them: each person has his own device and number that provide uniqueness. Learned preferences and location are also features that can add to this uniqueness concept.

Besides the need of identifying the citizen in authentication procedures, user identity recognition is needed because automatic transitions must push data on user's devices.

User identification is provided by the X-Session manager in the X-Gov framework. The X-id is the user identification in this system and is an extension of the v-card concept. X-id incorporates governmental personal identification such as social security numbers or, in Brazil, the CPF or RG identification. X-id holds information about how to reach a given citizen: his mobile telephone number, iTV set identification, e-mail and surface address besides personal preferences such as favorite format or media.

Cost effectiveness and cost distribution

The framework can reduce the development cost but does not address operation and delivery costs. In our work, we still have not defined a cost model. New players in a crossmedia service are the telephone operators and iTV distributors. Because these players are looking for prospective markets, crossmedia government services may bring up their interests.

6. PROOFS-OF-CONCEPT

The X-Gov framework has been developed by an iterative process based on proofs-of-concept (POC). Each POC has been preceded by a SWOT analysis in which we identified the relevant research questions to be addressed in that cycle. So far, three POCs have been developed.

POC #1 intended to clear the concept of crossmedia and to improve the team's expertise in technologies involved in developing applications for mobile computing and iDTV. We departed from the crossmedia planning algorithm in [10] and planned a service for enrollment of children in schools. After a paper prototype, a first version of the service was developed for web, mobile and iTV. As a result of POC #1, development platforms were defined and the planning algorithm was refined.

POC #2 was intended to explore the concept of task patterns and crossmedia transitions. The same service of children enrollment was thus refactored, this time using components which implemented the task patterns for each medium and transition components.

POC #3 intended to identify the best architecture to orchestrate several components and at the same time, to allow for coupling the framework with legacy government systems. The target service for POC #3 was a hospital facility for image exams, involving the citizen's appointment and result delivery. This POC implemented the SOA approach to the architecture. Another important achievement has been the definition of Service Manager, like X-Session and Component Manager, that allowed seamless transitions of the user from one media to another. Finally, the DSL CroMeL and the graphical modeling tool have been added to the X-Planner application toolkit.

POC #4 is under specification to date and is addressing the content manager and legacy government systems interface.

CONCLUSION

This paper has presented x-gov, the concept of crossmedia in government services, extending the concept of e-gov framework for x-gov applications. We advocate that crossmedia, being a new interaction paradigm, based on the coordinated usage of multiple media, can enhance G2C communication.

We have proposed the X-Gov framework as a technological solution to promote the development of crossmedia applications and benefit of many opportunities. We claim that the reusability capability of the framework can stimulate the usage of crossmedia in government services.

X-Gov reusability has been based on architectural elements: the task patterns have captured common behavior in citizens' use of government; crossmedia transitions implement seamless exchange of media; a SOA approach guarantees that the framework can be connected easily with e-gov legacy systems, besides providing an expansible architecture.

ACKNOWLEDGMENTS

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Profiling User Requirements for Multi-Target e-Government Applications: a case study

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ABSTRACT
The increasing use of the Web as a software platform together with the advance of technology has promoted Web applications as a starting point for improving the communication between citizens and administration. Currently, several e-government web portals propose applications for accessing information regarding healthcare, taxation, registration, housing, agriculture, education and social services, which otherwise may be difficult to obtain. However, the adoption of services provided to citizens depends upon how such applications comply with the users needs. Unfortunately, building e-government web site doesn't guarantee that all citizens who come to use it can access its contents. These services need to be accessible to all citizens/customers equally to ensure wider reach and subsequent adoption of the e-government services. User disabilities, computer or language illiteracy (e.g. foreign language), flexibility on information access (e.g. user remotely located in rural areas, homeless, mobile users), ensure user privacy on sensible data are some of the barriers that must be taken into account when designing the User Interface (UI) of e-government applications. Whilst several initiatives (such as the W3C WAI) focus on how to promote usability and accessibility of content provided via e-government, many governments are enhancing their technology to make their services compatible with new communication channels available through multiple devices including interactive digital TVs (iTV), personal digital assistants (PDAs), and mobile phones. In this paper we focus on this latter issue, which means the development of multi-target e-government services available across several platforms. In this paper we present a case study focused on the development of multi-target e-government services available across several platforms. We discuss the major constraints underlining the importance of investment on the UI's design of e-Government applications.

Keywords
User interface design, ubiquitous services, multi-target applications, design for all

1. INTRODUCTION

The large variety of computing systems available nowadays (e.g. desktop/notebook computers, cell phone, Smartphone) has created a milestone for cost-effective development and fast delivery of multi-target applications. During the last decade, users have become accustomed to new means of service delivery in the private sector. Nowadays, users expect the same level of service availability from the public sector: they want their interactions to be convenient, and they prefer to be online rather than in line [18]. Faced to these expectations, some administrations started exploiting a variety of channels that allow users to consume their services anytime, anywhere and anyhow. However, the decision of deploying e-government services on new communication channels should accommodate competing objectives [9]: to improve the quality of public services and the way in which it serves the community *versus* to reduce the costs of services. In this context some issues highlight the importance of investment on the User Interface (UI) design of e-Government applications:

- Public administration should ensure multiple access points to e-Government applications (e.g. home access via Internet, computer-based kiosks, mobile platforms).
- The ever growing number of users of e-Government applications calls for universal access to e-Government applications. Usability has become one of the major challenges for large adoption of many e-services provided to citizens, in particular those suffering from some kinds of disability or having some literacy barriers (e.g. illiterate users, immigrants seeking information about the country).
- E-Government applications present several advantages for both front office users (e.g. citizens, associations, companies and so on) and back office people (e.g. government employees, administrative clerks) as they reduce costs of information transfer and treatment. Thus front office and back office users are two sides of the same coin. Whilst universal access should be provided to front office users, usability for back office users should not be neglected as some usability problems could cause errors and/or losses of data that might compromise the quality of the whole system.

As far as the costs of services is a major issue, it should not be counted as a simply addition of costs related to implementation, deployment and maintenance of applications but it must include the adoption rate of

services by citizens. A countless number of e-government initiatives worldwide failed because by low technology adoption levels in their communities. Concerned by these problems, a number of recent studies have investigated the general adoption of e-government services in developed countries [5, 6, 15]. It has been shown [13] that faced to the choice of e-government services available in more than one communication channel citizens tend to choose the most familiar option; however, when task complexity increases citizens change their line of reasoning to a thought elaboration between tasks to be accomplished and channel characteristics.

This paper discusses how to envisage scenario for new communication media and in particular, their deployment over many platforms. At the light of a real case study of e-procurement services for students applying for scholarships, we discuss solutions for delivering multi-target user interfaces. Our work is underlined by two main assumptions:

- By focusing on end-users' requirements we can improve the usability of the UIs and select the platforms that best suit their needs, thus reducing the risk of rejection;
- By focusing on users' tasks we can determine the complexity of the steps required to accomplish an administrative procedure and then assess the technical feasibility of deploying tasks on multiple platforms.

2. STATE OF THE ART

In this section we present a summary of the most relevant communication channels nowadays for the e-government domain.

2.1 The World Wide Web Platform

The World Wide Web was the starting point for integrating services available 24/7 while promoting faster and efficient connection between agencies, processes and systems. As far as e-government services are a concern, one can notice several stages of sophistication [3, 9] including:

- Emerging Web sites: much of the information is static and there is little interaction with citizens.
- Informational Web sites: citizens can download forms and documents including law and regulations;
- Transactional: two-way interaction between 'citizen and government' where all operations are conducted online (e.g. web-based tax declaration).
- Full-case electronic case handling including connections with actors involved in the process (e.g. central and local government agencies, direct connection between citizens and governments, and connections among stakeholders).

In the last years, several initiatives try to develop guidelines for developing usable and accessible e-government services [19]. Concerned by the ever growing use of the web as a common platform, the World Wide Web Consortium (W3C) [1] has started recently a new interest group for improving access to government through better use of the Web. Among the activities performed by this new W3C group is the recommendation for shaping up Web applications for delivering content through many communication channels. This interest group is related to previous W3C initiatives on mobile platforms and accessibility; the latter become one of the most important references for e-Inclusion initiatives undertaken by any democracy in the digital era.

2.2 Non-Traditional User Interfaces

The Web is still the primary platform for delivering e-government services but other platforms such as mobile networks and interactive TV (iTV) are quickly emerging as suitable alternatives for delivering e-government services.

The huge penetration of mobile technology (even in developing countries) has motivated many public organizations to make e-government services through mobile devices. Nowadays, there are about 3.3 billion mobile users around the world, and a growing user base, the prospects and possibilities in using the mobile phones as a two-way service delivery platform are incredible. So that the current demand for mobile applications to support e-government initiatives is huge. Mobile phones are sought to foster an innovative method for citizens to interact with Government [14]. Government can provide needed and sometimes life-saving information to citizens via phone or SMS[1] based alerts. Mobile technologies has been used for tighten communication with citizens and organization and for delivering advanced services. For example, the BlueTo application [4] deploys a location-based solution for delivering digital content previously distributed by the public administration on traditional media but including located content to citizens and tourists (e.g. basic tourist information, emergency numbers, and events in the city).

Mobile technology provides many opportunities but it has also lots of drawbacks for example, the screen size and resolution limit interactivity, cell phone can be easily lost or stolen so they are not suitable for storing private data. It became so important in these days that sometimes refer applications in this domain as m-government (for mobile government). However, many organizations are deploying huge efforts to find solutions to foster e-government initiatives through mobile technology, which is often referred as m-government or mobile government[2].

Interactive TV (iTV) is another promising communication channel for delivering e-government services. iTV combines television content with some of the interactivity we are now used to on the internet such as clicking on links. iTV channels are supplied onto a television set through a 'set top box', which sits near the TV [12]. The

[1] SMS: Short Message Service

[2] http://www.mgovernment.org/

interactive element comes from the channels having a means whereby the user can send their own signals back to the broadcaster. This allows users to request different pieces of information, still images or video clips, within a browser environment similar to but less sophisticated than a web browser. TV, after the radio, is one of the most popular and diffused communication channels even in developing country and iTV are expected to replace traditional TV systems quite soon. A typical example of iTV usage in the e-government domain is the system VOICE[3] which is employed in India to disseminate information about government activities and to enable online services (Figure 1).

Whilst the technology of iTV is recent the preliminary results look very encouraging [12]. However, there are also various potential problems with the medium, however: only small amounts of text can be used on each screen, as it is viewed at a distance; it is generally used with a remote control, which is far more restricted than a computer keyboard; and the speeds of interaction are not good. Interactive services may also not be suited to the television viewing habits of many users – unlike the web, TV is a medium often used for recreation or relaxation by several people at once [2]. Making sure that iTV contents and devices are flexible enough so that people are able to perceive, understand and interact with them is an essential requirement for the democratization of information via TV broadcasting.

Figure 1. VOICE application (i.e. ITV systems) for checking information related to birth.

2.3 Multi-Channel Delivery of Services

Most of currently available applications are deployed in a single platform but one of the most remarkable trends is the development of multi-channel services. A typical example of such initiatives is 'Looking Local[4]' (see Figure 2), a versatile application in UK which is accessible at major UK interactive TV platforms (Sky and Virgin), from mobile phones and on some kiosks.

Figure 2. Application 'Look Local' available on interactive TV (at left) and on cell phones (at right).

Indeed, many governmental reports strongly recommend that e-government services must be deployed in many different platforms in order to provide better coverage of services and reach users with special needs [1, 8, 9, 16]. The study launched by the European Union (EU) [9] assessed a very broad range of communication channels supporting communication between citizen and government including: Web, iTV, mobile platforms, call-center, e-mail. It provides a detailed list of criteria for evaluation multi-channel delivery of e-government services (e.g. accessibility and inclusion, speed delivery for time-critical information, etc) and it points out to some best practices. One of the main contributions of such as a study is to classify communication channels according to benefits for end-users (i.e. citizens) but also for administrations.

The deployment of e-Government services through several communication channels can be sought as an ultimate goal for reaching all citizens. However, this diversity offers important challenges such as:

- Constructing and maintaining versions of single applications across multiple devices;
- Checking consistency between versions for guaranteeing a seamless interaction across multiple devices;
- Building into these versions the ability to dynamically respond to changes in the environment such as network connectivity, user's location, etc.

The availability of several communication channels does not mean that applications will convey the same information and services across different platforms. On one hand, technical constraint (such screen size) can prevent the display of large amounts of information. On the other hand some applications can convey information and services through the communication channel that best suits user needs. For example, support online fill-in forms via Web and notify users of approaching deadline for complete procedures via SMS.

3. CASE STUDY

In order illustrate how the difficulties and constraints for delivering services in different communication channel, we

[3] Versatile Online Information for Citizen Empowerment: http://www.ourvmc.org/

[4] http://www.digitv.gov.uk/

present in this section a case study issued by the Regional French Administration Midi-Pyrenées (RMP), one of the partners in the MyCitizSpace consortium. Due to some private issues, some internal aspects are voluntary removed. We introduce all actors involved and their interactions along the process which is enough for our purpose. Our focus is on end-users' (i.e. citizens') requirements for adapting the UI according to different contexts of use.

3.1 Informal description

Vocational high schools offer hands-on training to students and prepare them for careers in fields such as information technology, marketing, business, engineering and the medical professions. However, to attend some technical programs such as Plumbing, Electricity or Cooking, students should bring their own equipment to classes (e.g. purchase of knives, aprons and suits for inn students). BRPE (French acronym for "Regional Scholarship for First Equipment") is a program of RMP which provides students with a scholarship for buying such equipments.

A student can only apply to this scholarship once whilst attending a specific technical program in a vocational high school. However, a second application is illegible if students change to a different technical program. High school's principals are in charge of advertising students about the calendar and procedures and help them to prepare applications. BRPE applicants get forms from high school principals. For students under the age of majority, their parents or legal tutor are the ones allowed to firm the form. The forms and required documents (e.g. bank account statement) are given back to high school principals who are in charge of controlling the completeness of forms and sending the complete ones to RMP. On receipt, RMP agents treat BRPE applications. If the application is accepted by RMP, the accounts department (a state institution distinct from RMP) pays the BRPE scholarship through bank transfer to the bank account of the student (or his parents).

3.2 Analyzing Users' tasks in the procedure

The general procedure required for implementing a BRPE application can be summarized by Figure 3. Like many other governmental programs, BRPE is a complex program that integrates actors with diverse juridical status such as citizens (i.e. students/parents), units of the regional governmental (i.e. RMP), state governmental (i.e. accounts department), and educational units (i.e. high schools) [18]. Educational units are controlled by Education Offices (i.e. "rectorat" in the French system), which discuss BRPE scholarships amounts with RMP once a year. For the sake of simplicity, Education Offices and accounts departments and National Banks will be considered as "state units".

From an administrative point of view, the procedure starts with the annual definition of money allocation for a scholarship which varies according to the technical program. It is important to note that the scholarships are subject to the annual budget approval from the RMP's council (step 2). Citizens do not request BRPE scholarship directly to RMP: the process is mediated by the high school's principal who notifies students (step 4) and explains how they should fill in the form (step 5). Principals are also responsible for checking the completeness (i.e. no required document is missing) and correctness of requests (e.g. attest that students are regularly attending a vocational high school) he gets back from students (step 6). RMP receives student's applications and verifies their correctness and eligibility again (step 8). Problems (e.g. fraud, missing information) are reported to high school principals (step 7) who also can monitor (step 6) the status of applications of students attending program at his school. Eligible applications are duly recorded, and letters of credits are sent to beneficiaries (step 9). Finally, RMP addresses a payment request (step 10) to the accounts department (step 11).

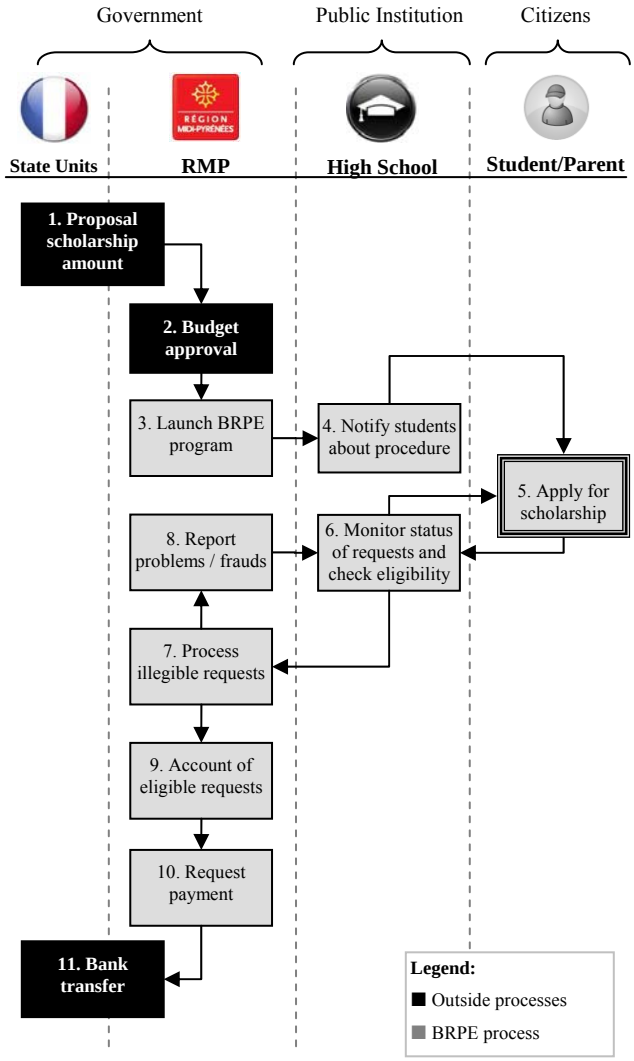

Figure 3. Overview of the BRPE application.

The most important task for users is to 'Apply for scholarship'. Users are requested to perform a set of sub-

tasks to accomplish an application as shown by Figure 4. Notice that tasks can be performed either online or by other means, e.g. 'provide paper-based certificates' (B2).

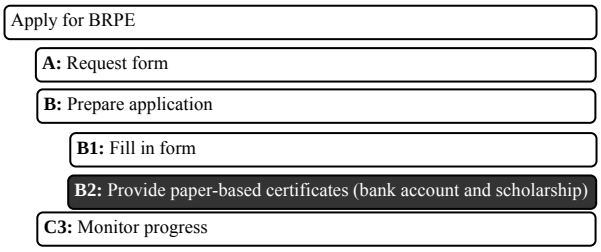

Figure 4. Users' tasks with the BRPE application.

3.3 Indentifying Special Users' Requirements

Much of the success or failure of Information Technologies implementation programs such as BRPE relies on the adoption rate of the applications by the end-users. However, it is clear that some actors involved might have conflicting requirements. For example, citizens would like to have a close contact with stakeholders which might delay the treatment of requests. Table 1 presents some requirements for the three main actors of BRPE. Some requirements such as "ensure eligibility of applications" can be a common motivation to both stakeholders and citizens.

Table 1: Requirements affecting adoption of the BRPE.

Users	Criteria
RMP stakeholders	Costs
	Prevent frauds
	Time for checking eligible applications
	Traceability of applications
High school's principals	Visibility on students applying for the scholarship in his/her institution
	Time for checking eligible applications (e.g. no required information is missing)
	Time for assisting students to filling in the forms
	Pedagogical value of procedures in daily life
Citizens	Ensure eligibility of application
	Time for filling in the forms
	Time for obtaining the scholarship
	Full transparency

Due to space constraints we focus hereafter only on a particular category of users, i.e. citizens. Once citizens agreed on the advantages of applying to a BRPE, we can start investigating how to better provide access to this service and what would motivate them to move from paper based applications to procedures based on new information technologies. Inside the community of users we can identify three main user groups: parents (or legal tutors), students under the majority age and young adults. In order to understand the diversity of users and capture their needs, we have created user archetypes using the "Persona" technique [7]. A persona is a description of a user archetype that is mainly used to communicate requirements with the development team during the design process. A persona archetype can be synthesized from a series of field activities such as interviews and work observations resulting in a representation of an individual that embodies the characteristics of a target user population [11]. For the purpose of this paper, we have created user archetypes (i.e. fictional characters) for describing the main target population of students that might be interested in a BRPE. User archetypes are named after a fictional character to help designers to talk about a specific user profile without having to describe all their attributes. Table 2 and Table 3 provide a example user profiling.

Table 2: Persona "Rémi": archetype of students with no special motivation for using new Information Technologies.

First name	Rémi, the nature boy
Age	16 years old
Nationality	French
Family status	Single, living with his parents in a farmer.
Education	Repeating first year at the vocational high school Saint Paul on Veterinary Scholar Program after failing a first year in a traditional high school.
Information Technology skills	He prefers to surf the Web at school because of the low Internet bandwidth in the rural area where he lives. He gave up with cell phones because of the poor mobile network in the farmer.
Motivation for using new information technologies	He does not have any specific motivation but he knows how to use computer to check his assignments at the electronic kiosk available at the school.
Professional projects	To finish high school and go back to the farm to work with his father.

Table 3: Persona "Sarah": archetype for students that like new Information Technologies.

First name	Sarah, the blogger girl
Age	17 years old
Nationality	Lebanese
Family status	Single, living with his uncle (30 years old) which is his legal tutor in France. Her parents still live in Lebam.
Education	Second year of cooking program in the vocational high school George Sands.
Information Technology skills	She has created her own web site and she maintains a regular blog.
Motivation for using new information technologies	She makes good use of IT for communicating (e.g. email, skype) her parents and friends staying in Lebam. Since she got an iPhone from her birthday, she is using it for surfing on the Web and read emails.
Professional projects	She plans to open her own restaurant.

3.4 Context of Use for the BRPE application

The description of the BRPE application does not imply any particular communication channel. However, we must ensure that implementations of BRPE will fulfill specific users' requirements. Hereafter we present some scenarios that illustrate how the application BRPE could evolve over the platforms Web and mobile (i.e. iPhone) and according to the users profiling described above.

Basic scenario: Rémi is informed about that BRPE system is now receiving new applications. He goes to the school library that is equipped with computers and Internet access. He launches the web application e-BRPE and opens a session. Once registered, he fills in his personal data and selects a scholar program. The next part of the form has to be filled in by his parents as he is under the age of majority. Rémi saves his session. Once back home he can finish the procedure. The system indicates that his application has been submitted to the high school principal. Rémi then provides the principal with specific paper-based certificates. One week later, Rémi is interested to know the state of his application. He goes to the kiosk in his high school where e-BRPE is available. The system indicates that his application is complete and that it will be sent to the RMP. One month later, Rémi receives a letter telling him that his request will be funded. Figure 5 shows the UI for this scenario. The UI remains classic in that it is form-based and centralized in a unique desktop. There is neither adaptation to the user nor to the environment: adaptation is limited to the screen size. It is performed when the user launches the application. The state recovery is the user's session.

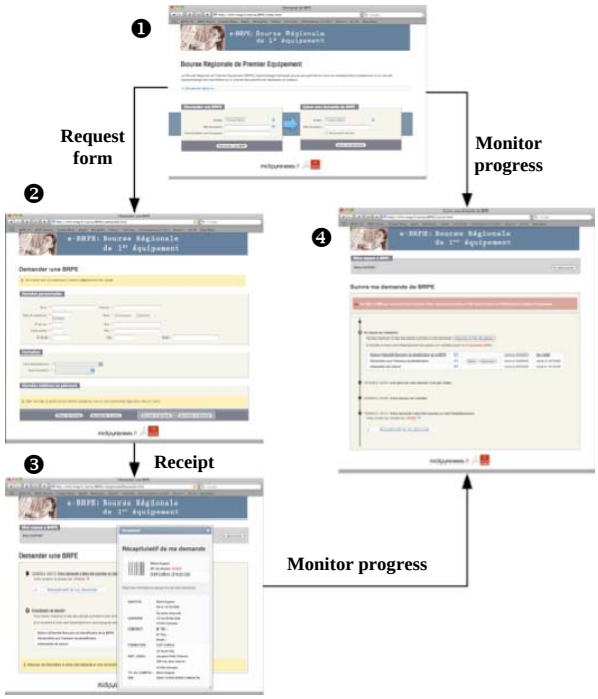

Figure 5. BRPE as it is available on the Web.

Multi-platform scenario: refers to applications that provide is available over many different platforms. In our example, we might consider an e-government service that is available over the Web but can also be accessed via a cell phone. This scenario illustrates adaptation to the platform with effects on distribution and interaction styles. Figure 6 presents an adapted version of the application to be displayed on iPhone. Notice that the form fill is presented in several screens (i.e. 2.a, 2.b, 2.c). On one hand, the limited number of form fields per screen reduces the need of scrolling whilst keeping the text legible. On the other hand, the system can record the information filled across the pages so that Sarah does not have to start from the beginning if he is interrupted by a phone call. In addition, a vocal service is offered with phone platforms. The e-BRPE service is also available over the Web, as presented in the basic scenario (Figure 5).

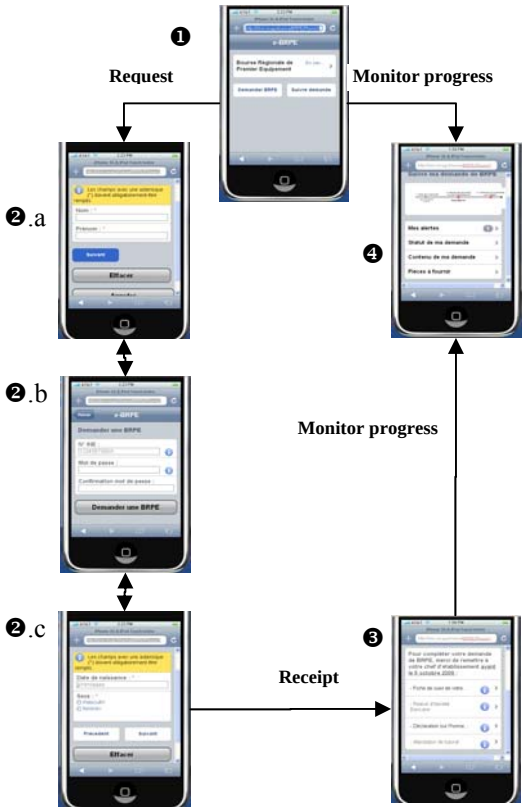

Figure 6. BRPE as it is available on iPhone.

Advanced scenario: in this scenario, the application was conceived to support continuous interaction across more than one interaction technique (e.g. command-line in the web-based version and speech recognition on the cell phone version). The context of use should take into account the changes on user tasks accordingly to the platform. The adaption of the user interface might take into account some unplanned tasks that occur accordingly to, for example, environmental conditions. In this scenario, users can not only decide which platform to use to access the service (the Web browser or a cell phone) but also to interrupt a task on a platform (for example fill in an application form over the

Web) and resume it in another one (for example, monitor progress of applications on a cell phone). For example, the student is informed about the availability of the BRPE at the school and on his way back home he uses his iPhone to apply for a scholarship (Figure 7.1). He starts filling the forms (Figure 7.2.a) but as his battery was too low, he could not fill in all the forms fields. Arriving at home, He decides to resume the BRPE using the Web version because his computer desktop provides her with a larger screen (Figure 7.3.b).

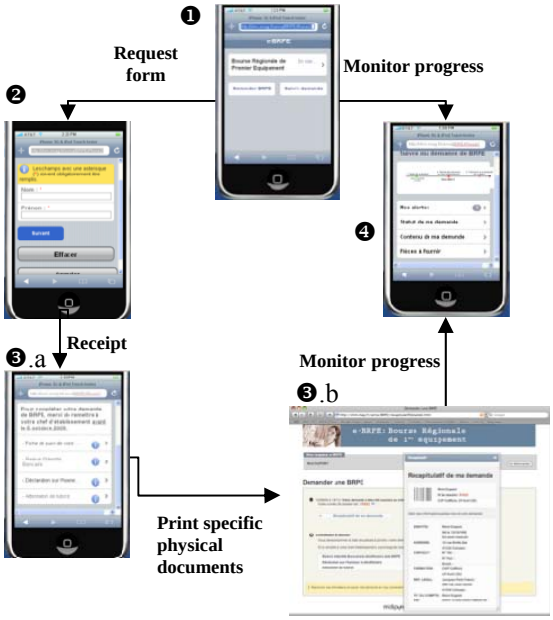

Figure 7. UI migration in BRPPE application.

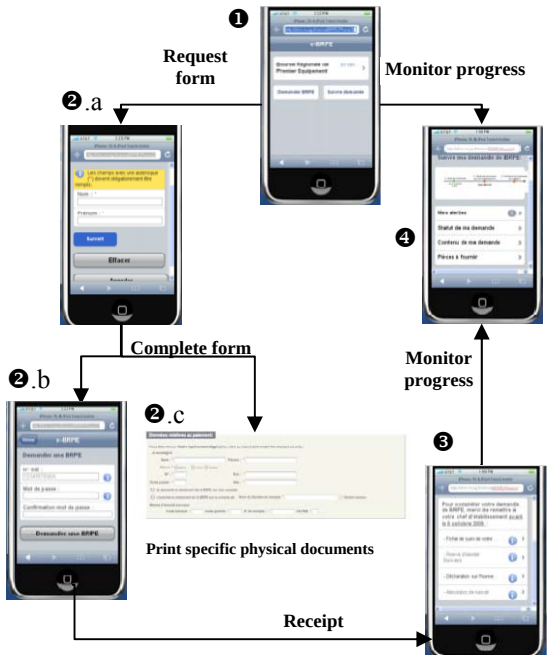

Figure 8 Continuous interaction with BRPE across devices.

These scenarios could evolve to integrate even more advanced interaction techniques, such as the user interface migration from devices. User interface migration refers to smart applications that can migrate via the network from a platform to another [10, 17]. Such as application can adapt the user interface according to the devices constraints (e.g. screen resolution, input devices available, etc.). In this context, the application becomes distributed onto several devices, with different levels of interaction style. The adaptation specifications are weaved into the UI and the user is able to specify the distribution organization. Figure 8 shows the continuous interaction across theses adaptations. This scenario addresses early adopter's needs that are keen to explore the full potential of interaction techniques and devices.

4. DISCUSSION AND FUTURE WORK

In this paper we have presented a case study describing user needs and technical constraints related to the development of multi-target user interfaces for the e-government domain. As we shall see, deploying services on multiple communication channels is not just a matter of technological platform. On one hand it requires a deeper understanding of user needs to propose solutions that fulfill their needs and thus has a better chance to get adopted by the community. On the other hand, there are many platforms available and the best user interface depends on the adaptation of services accordingly to platforms constraints. Currently there is no single answer to the questions such as: 'Which is the best the user interface?' or 'Which is the best communication channel for deploying e-government services?' So that we need a multidimensional space for supporting decision-making. End-user requirements and user interface are useful criteria for grounding decisions but they certainly should be considered in a larger picture than presented here. However, user interface is a key aspect that it worth to be studied on its own dimension before be aligned with business processes constraints, political/social wills, and so on etc.

Faced to the complexity of such as tasks, it seems clear that deciders need some help to find the most cost-effective solutions to delivering services. In the present work, we have grounded our research on a deep review on end-users' requirements which are formalized by the means of Persona archetypes. One of the main advantages of Persona is that archetypes can be easily understood by all people involved in the development of e-government services, from administrative stakeholders, IT experts, decision-makers and even citizens. Based on such as description we can assess credible scenarios that worth the investment on new development.

The case study for the development of the BRPE has lead to successful implementations on two platforms (i.e. mobile and Web). The scenarios presented in the present case study allow us to visualize the continuous interaction

across different platforms. However, it is clear that the development of such as multi-target applications is not seamless and requests an intricate composition of services hosted and distributed among the platform used by the user (e.g. mobile) and on the server. As we shall see, such as distribution is also subject to administrative constraints (in our case study the need of paper-based certificates) that might prevent any kind of electronic process and thus some task should be composed with more traditional administrative procedures.

Our goal is not propose a definite solution to the problem but rather to exemplify some challenges one is faced to whilst trying to conceive multi-target user interface for e-government services.

This work is part of large national project which aims is to provide a framework for developing the next generation of user interfaces for application in the e-government domain. Based on this experience we have started some generalizations towards a plasticity space for multi-target user interface for the e-government domain. Future work will include refinements on criteria for helping administrations to better chose communication channels for e-government services. Additional work will be done to explore the user interface adaptation on promising communication channels (not exploited here) such as the interactive TV.

ACKNOWLEDGMENT

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MultiStates: Monitoring Databases With Acoustic and Intuitive Perspective Wall Interaction

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ABSTRACT
In this paper, we describe the prototypical implementation and evaluation of a database performance monitoring tool for large database management systems (DBMS). These DBMS provide the technological background for many complex e-Government applications and the availability of the managed data is crucial. The implementation focuses on the creation of application-specific gestures on a touch input device, such as the Apple iPhone 3G with software version 2.2.1. A perspective wall is used to display the data in conjunction with an acoustic indicator for navigating through the information space non-visually. We report on an exploratory investigation of the prototypical monitoring tool based on an evaluation with two groups of users: inexperienced users with no database-related professional background and users, whose daily work is closely related to database monitoring. We conclude, knowledge in the area of the respective application is helpful to make better use of the prototypical tool. Furthermore, the flexibility of the perspective wall as the visualization of choice is shown by the good overall user acceptance. Finally, the acoustic indicator gives an idea of how to support even visually impaired users in finding occurrences of problems in large information spaces, such as database performance criteria.

Keywords
Mobile interfaces, gestures, visualization

INTRODUCTION

The increasing growth of digital data

Since the number of people using a computer and surfing the Internet grew from about 19.5 million in 1997 [1] to 1.2 billion [2] today, it is obvious that the amount of data stored and processed grew accordingly. It is expected that the total amount of data stored in 2006 (281 Exabyte) will be surpassed tenfold in 2011 without an end of increase in sight [3]. However, not only the amount of data increases, but also the availability of relationships between the data. As it became popular with the term “Web 2.0” the so-called “semantic web” tries to relate isolated pieces of information to each other, in order to create well-structured and accessible information. All of this data needs to be organized, stored and made accessible for users, whether these are practitioners, developers or even end-users. The need for systems taking care of the data management is reflected in the growing number of database management system in the public sector.

DBMS in e-Government applications

In order to provide centralized data management and to use synergetic effects of shared knowledge domains, many regional and national governments in Germany enforce the establishment of new IT infrastructures. Examples are the LUSD system (Lehrer und Schüler Datenbank, teacher and pupil database [4]) in Hesse, Germany as well as the German Patent and Trademark Office (Deutsches Patent- und Markenamt [5]). The first one has been built to create a central access point for teachers and state officials to get an overview of all registered pupils in Hesse and to provide a communication platform for all persons related to teaching in schools. Thus, the system consists of very sensible data, which is important to ensure the organizational structure of the Hessian schools. The latter system offers overview, search and registration of patents and trademarks to end-users. It contains all patents and trademarks registered in Germany and therefore relies on a large and complex information set.

The importance of mobile database monitoring

As the description of the two examples above suggests, the availability of the maintained data is crucial. Therefore, database administrators (DBAs) take care of monitoring and optimizing the databases, keeping the systems up and running. This task needs to be performed throughout the day, independently from the current position of the DBA. A failure of a database might not only result in a costly unavailability of data, but also in a loss of sensible data, which is inacceptable especially for e-Government applications. Especially the complexity of current solutions for database performance monitoring implies the need for a desktop computer system or at least a fully featured web browser. This contradicts the prerequisites mentioned before and leads to the idea of creating a mobile application

with a reduced feature set, similar to the "schema later" approach by Jagadish *et al.* [7], which intends to hide the complexity of a system from the user. As a result, good interfaces for such complex tasks need to be simple enough to make them understandable even for people without knowledge of the whole system. This can be achieved by providing a certain level of "ad hoc"-ness [6] when working with the application, which is similar to the ease of input in search engines, where a simple text field is sufficient. Combined with less textual and more graphical information and a reduced informational depth, this is a promising approach for creating a novel interface for mobile database performance monitoring.

RELATED WORK

As mentioned previously throughout this work, many similar approaches in terms of visualization and support for visually impaired people are available. Nevertheless, they have mostly a more narrow focus of application. An example for an application specialized on supporting blind users in using touch-based interfaces is Slide Rule [15], where the graphical user interface (GUI) is replaced by an overlay, which recognizes new application specific gestures and relates them to content laid out in a grid. The earPod [19] application also leverages audible feedback in combination with a click wheel touch input.

Similar to the tilt control of MultiStates is the speed-dependent automatic zoom approach of Eslambolchilar *et al.* [20] where the tilt angle influences the degree of magnification (which is not supported in MultiStates), as well as the scroll direction and scroll speed. Since the amount of available visualizations in products and prototypes only the two most influencing publications are mentioned here: At first, the perspective wall concept by Mackinlay *et al.* [21] and second, the ZuiScat [13] system, which incorporates a useful combination of geometric and semantic zoom, which has been used in the MultiStates variant of the perspective wall. Although the main aim was to make a complex database monitoring system usable on a mobile device by providing intuitive interaction and helpful visualization while supporting individualization, we discovered ideas for building a foundation to support blind and visually impaired users.

DESIGN OF MULTISTATES

To offer a mobile solution, we designed the MultiStates prototype, which makes use of geometric and semantic Zoom, leveraging a modified version of the perspective wall [26]. MultiStates runs on an Apple iPhone 3G, currently with software version 2.2.1. MultiStates provides a new way of monitoring databases on the go by combining two IBM products used as desktop solutions: IBM DB2 Performance Expert V3 [8] and IBM Data Studio Administration Console [9]. The focus lies on the creation of the so-called "Health Summary" in conjunction with the dashboard view of the latter product. The prototype uses dummy data, which are not synched with a server, representing a use case to discover and analyze lock conflicts and deadlocks.

Applied interface design principles

When it comes to working on a mobile platform, users need to be supported by a tailored interface, which comprises intuitive forms of interaction and simple visual cues. Furthermore, the option to configure or filter the displayed data should be given for expert users. We used Nielsen's [10] user interface design "rules of thumb" as a checklist for ensuring a flawless transition from a stationary to a mobile interface. The key attributes for MultiStates are: user control and flexibility, as well as consistency and visual feedback. User control and flexibility imply that only the user initiates interaction and that he/she may chose from a set of input method his/her favorite. Furthermore, the option to reset the view of the application is important to allow the user to go back to his/her starting point. Consistency and feedback are provided through the consistency with the original desktop product, by using e.g. the same vocabulary and color-coded information.

These four criteria mentioned above also reduce the memory load for the end user, as well as support recognition of items and interactions rather than enforcing the need to recall complex interfaces and interaction techniques. How this has been achieved is described in the following subsections.

Database state visualization

To ensure a clean and simple visualization on the screen of the iPhone, the perspective wall has been chosen. This selection results from a comparison of multiple visualization techniques, which concentrate on the presentation of a central focus region, while avoiding the desert fog [11] problem, where users get lost in their potentially large dataset. Although many systems, such as DateLens [12] or ZuiScat [13] support geometric and semantic zoom to reduce screen clutter, they do not provide a fluent transition between focus and context. Hence, the perspective wall was used to visualize the Health Summary. Although the perspective wall seems mainly suitable for showing information related to time, by using time as the measure for a long horizontal X-axis when scrolling, it is feasible to use it for database states.

In order to make the perspective wall usable for our database monitoring purposes, the dataset needed to be matched to this visualization. Since the displayed data needs to be aligned along a small Y-axis and a longer X-axis, we used the performance criteria for the Y-axis. For the potentially unlimited length of the X-axis, we decided to align the list of monitored databases to it. However, since the iPhone is used in portrait mode by default, the perspective wall has been turned 90°. Now the distorted areas are located at the top and at the bottom of the display, while the focus area maintained its position in the center.

Unlike existing applications using the perspective wall (such as TimeWall [14]), our implementation of the perspective wall is not limited to zoom within the graphical

borders of the wall. Thus, the zoom operation may enlarge parts of the displayed data beyond the visual borders of the display. This results in a more appropriate visualization of a so-called drill-down into the information space. Figure 1 shows the four most important visual steps when drilling down on a problem. Each state icon (green = everything is fine, yellow = a warning occurred, red = a critical exception occurred) represents a performance category and each row represents a database. The further a user zooms in, the more information is revealed – first textually, later visually through performance graphs relating to each performance category. At the highest degree of magnification, the user may drill down on a problem, which is indicated by the blue arrows within the performance graphs.

Interaction techniques

As mentioned previously, we tried to offer the users redundant interaction techniques to allow the selection of a preferred method. Most importantly, we added two new gestures. First, shaking the phone results in resetting the Health Summary back to its original zoom level (in case the user lost orientation within the large dataset). Second, we designed the tap hold/tilt gesture to allow zoom operations single-handed. By default, the iPhone zoom operation is executed through the pinch gesture, which makes the use of both hands necessary. For tap hold/tilt (Figure 1) the user simply taps and holds a finger on the display. Then, he/she may zoom in by tilting the phone to the right or zoom out by tilting the phone to the left. Other interaction techniques are as shown in Table 1: swiping the finger across the display to scroll in one of four directions. Tapping for item selection and tilting in one of four directions to scroll. It is to note that the double tap gesture is not used, since all navigation tasks have been covered by the gestures defined beforehand. Furthermore, no special drill-down gesture has been implemented (e.g. drawing a circle around an item or drawing the letter “L”, such as in [15]) since it is hardly

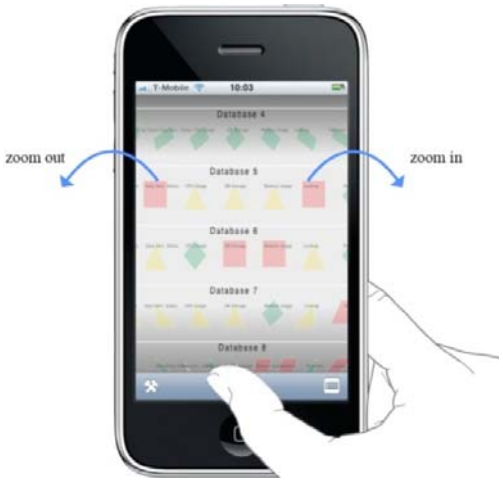

Figure 1. The tap hold/tilt interaction technique.

possible to ensure a precise selection of a state icon at the lowest zoom level and the one-handed usability of MultiStates would degrade. This approach contradicts the idea of Nicholson *et al.* [18], where the created application makes use of specifically designed gestures only, thus raising the memory load for each user significantly.

Configuration through filters

It is clear to see that the display of a mobile device can hardly show all data available. Therefore, and to better support expert users, we introduce several types of filter settings, to reduce screen clutter. Activating these filters results in the hiding and displaying of state types (all states/alerts and exceptions/exceptions only) or performance categories. The setting of such filter options in the preferences panel equals a degree of interest (DOI – as suggested in [16]) function, where the user sets his/her personal area of interest within the application.

Systems, such as LensBar [17] use this kind of functions in order to selectively suppress information. Furthermore the preferences offer the possibility to compress the displayed

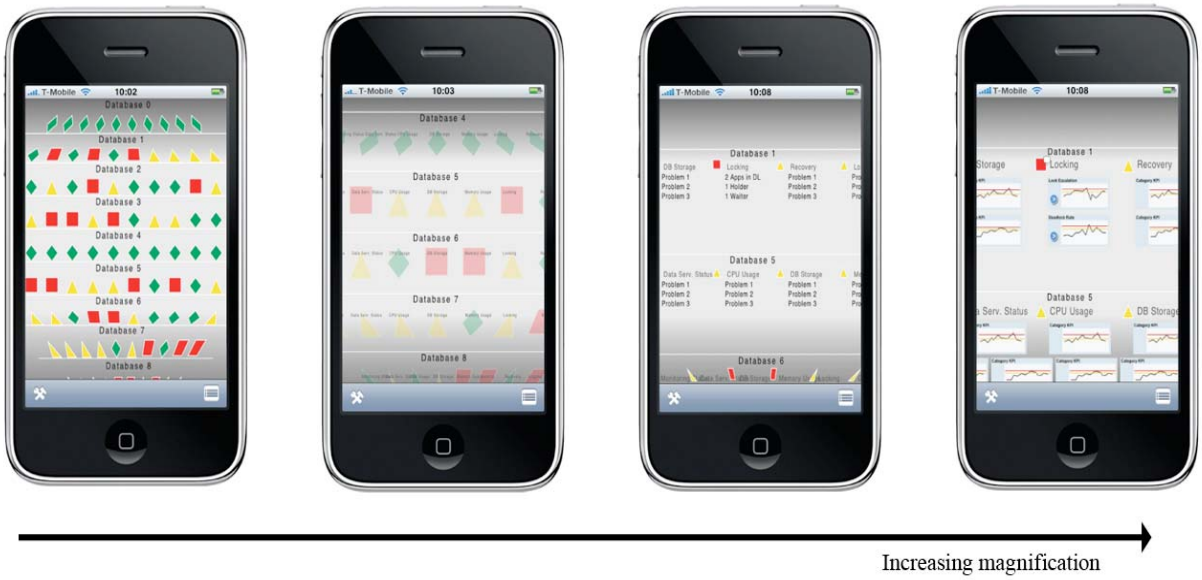

Figure 2. The different zoom levels of MultiStates. The magnification increases from the leftmost to the rightmost image.

information by ignoring empty screen space (because of filter settings) and align the database states at the left edge of the display. By filtering for a specific performance

User Interaction	Output
Pinch out	Zoom in
Pinch in	Zoom out
Swipe left	Scroll right
Swipe right	Scroll left
Swipe up	Scroll down
Swipe down	Scroll up
Tap	Select an item
Tilt up	Scroll down
Tilt down	Scroll up
Tilt left	Scroll left
Tilt right	Scroll right
Tap hold and tilt left	Zoom out
Tap hold and tilt right	Zoom in
Shake	Reset the view

Table 1. Interaction techniques available with MultiStates.

category, the user may hide complete databases if no alert or exception has occurred within this category. This may also be accompanied by an audio indicator, which can be used for navigating blindly through the dataset.

Support for non-visual exploration

By enabling the audio indicator and a filter category, a sound is played once an alert or exception in this category is displayed at the highest zoom level within the non-distorted central region of the perspective wall (e.g. category "Locking" of "Database 1" in Figure 2).

This indicator can be used in conjunction with tilt navigation to explore the information space without needing to watch the device's display all the time. Hence, the indicator not only lowers the need to pay attention to the running application for sighted users, but also gives an idea of how to support visually impaired and blind users. However, it is obvious that acoustic feedback may be inappropriate in silent places (e.g. libraries) or noisy environments (train stations, for instance), we decided to make use of an audible indicator for testing purposes and for power saving reasons. Using the vibration control of the iPhone for indicating problems within the Health Summary may lead to decreased battery life when the application is used every day. Even though the creation of an interface for blind users was not the focus of this work, the evaluation results provide insight into further ideas on how to better support both user groups (sighted and blind).

EVALUATION OF MULTISTATES

We conducted a summative evaluation with six participants in total. Although database administrators are the intended target user group of MultiStates, it was not possible to have DBAs evaluate the system. Instead, we decided to compare three inexperienced users with no professional IT- or database management-related background (Comparison group) with three IT professionals (Expert group: IBM DB2 Performance Expert developer, tester and user experience professional). All members of both groups did not have relevant experience in using an iPhone or other touch-based devices and are sighted.

Each participant was interviewed separately, while being watched by one evaluator. The evaluation was based on two questionnaires: First, a sheet containing tasks to perform using the Health Summary and its filter options. Some tasks were timed and users had to justify why they chose a certain interaction technique while the number of errors made during interaction was counted. Second, a questionnaire focusing on each participant's usage experience by providing scales to rate the satisfaction and acceptance of application parts (such as the perspective wall, interaction techniques or the complexity of MultiStates compared to a desktop product). Besides the questionnaires, the participants were asked to "think aloud" while they worked with the application. All comments given were transcribed and used for further analysis and interpretation of the questionnaire results.

Evaluation Findings

To offer a better overview of the results of both groups, we first had a look at each group, before we directly analyzed similarities and differences of both groups. Specific results are shown for each group, while more general results are presented when both groups are compared. Numbers presented in brackets refer to the group's mean value and the best possible value. Standard deviation is not given due to the small number of evaluation participants (except for the number of corrections needed per group and task).

Comparison Group

Generally speaking, the Comparison Group provided only high-level feedback. This may be due to the general lack of experience with electronic handheld devices. However, this feedback is especially important for e-Government applications, since these are mostly intended to be used be the "average end user", who is not familiar with technological details.

Knowledge in the field of the application domain needed

The inexperienced users were neither able to judge the capabilities of MultiStates, nor to compare the information available to the depth of information of a desktop product.

Experience in using the provided platform is helpful

Some participants had problems interpreting the meaning of system icons on the iPhone platform, since they had not used such a system before. However, not only icons were misinterpreted, but also users were unsure of how to interact with the touch-based device. Participants often

asked for help on what they are able to do when performing tasks.

Pinch and shake are the preferred interaction methods

Although the overall acceptance of the interaction techniques was high (4.33/5.0) and all techniques were described as intuitive, users did not like the tap hold/tilt gesture and the tilt control. They found both to be too imprecise to work with the Health Summary.

Expert Group

In contrast to the Comparison Group, the experts were able to provide more detailed feedback on usability problems and interaction methods.

The perspective wall is suitable for displaying database states

The expert users showed a high acceptance rate (4.00/5.0) for the perspective wall and mentioned that the availability of context information was helpful when zooming in closely.

Single-handed use is preferable

A key criterion of the expert user group was the ability to use the application single-handed. As a result, they preferred the utilization of tap hold/tilt interaction in combination with tilt interaction to quickly switch between scrolling and zooming. Unlike the Comparison Group, the experts described swipe and pinch interactions as precise but too slow to be useful. However, all interaction techniques were described as intuitive to use.

Complexity requirements have been met

The results for the question whether MultiStates is a good combination of a complex desktop solution and a mobile application are good (4.33/5.0). Furthermore, the users stated that neither more nor less detailed data is required to be usable for them.

Comparison

Finally, we looked at similarities and differences between both groups. The most important findings are as follows.

Speed and accuracy tradeoff

Looking at more general results, it turns out that all users agreed on the diversion of "slow but precise" input (swipe and pinch) and "fast but imprecise" (tilt and tap hold/tilt). Experts tended to prefer the faster input methods, whereas the inexperienced users liked the more precise techniques better.

Experts are faster and need fewer corrections

It turned out that the Expert Group users performed timed tasks faster (Figure 3) and needed fewer corrections than participants of the Comparison Group (CG: 31, EG: 23 corrections – Figure 4).

Training effect

Although the Comparison Group needed more corrections than the Expert Group, the number of corrections decreased constantly, except for two peaks in tasks four and six, from task three to task seven. Nevertheless the experts show a more constant number of corrections (based on the lower standard deviation).

Tilt and shake interaction does not distract from the screen

Even though some users complained about reflections on the display while tilting the phone, the Expert Group and Comparison Group both did not think that tilting and shaking the phone distracted from working with the application. Especially when shaking the phone, users argued that they knew the result of the action (reset) and therefore did not need to see what happened on the display.

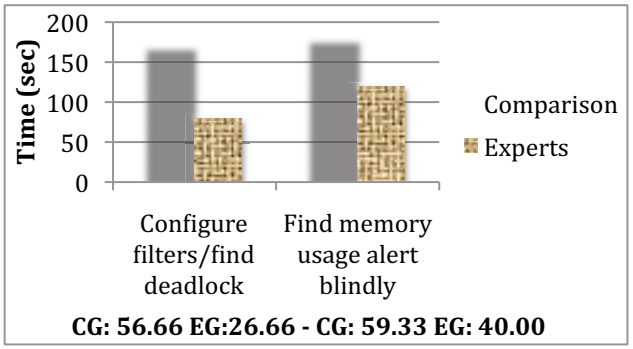

Figure 3. The results of the timed tasks (CG: Comparison Group; EG: Expert Group). Average values for both groups are shown below the graph.

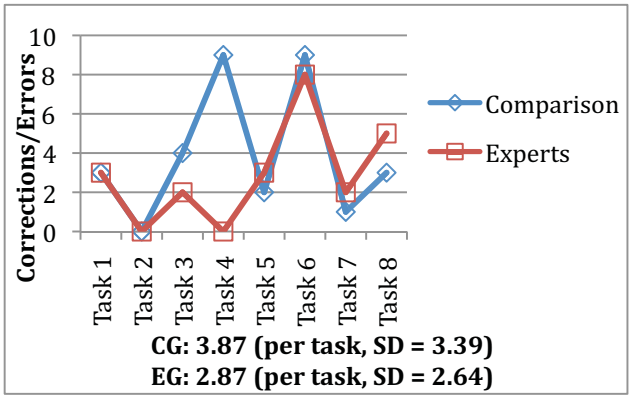

Figure 4. The number of corrections needed during interaction. Average values per task are shown below the graph. SD is the standard deviation per task/group.

Blind navigation feedback

Both groups had to discover an alert or exception in the "Memory Usage" category. To achieve this, they were allowed to configure the preferences menu normally (e.g. activate the audio indicator and set the category filter to "Memory Usage"). As the next step, they had to zoom in and navigate through the databases having their eyes closed. Both Expert and Comparison Group found it neither easy nor difficult to solve this task (CG: 3.33/5.0 EG: 2.66/5.0) although the experts needed significantly less time to complete this task (see Figure 3).

Furthermore, both groups used the tap hold/tilt gesture to quickly zoom in, since it was difficult for them to

coordinate two fingers on the phone without being able to see to perform a pinch gesture. Once they managed to zoom in close enough to make use of the audio focus, they just lifted their finger, which was used for tap-hold-zoom, and thus started to scroll through the Health Summary.

NON-VISUAL EXLORATION: LESSONS LEARNED

All users completed the non-visual exploration and discovery task successfully. However, they suggested improvements for the support of visually impaired people using the perspective wall. Using tap hold/tilt to zoom in and out turned out to be very easy for the users (in this case even for the Comparison Group). But the level of magnification is hidden from the user. As shown in Figure 2, four main levels of information depth are available. Using speech or different sounds as output, these levels may be announced to the user.

Furthermore, the borders of the perspective wall cannot be recognized by blind(-folded) users. They know when they discover a problem they adjusted the filter settings for, but they do not recognize when they reach the edges of the wall when they scroll by tilting the phone.

In addition to the acoustic representation of the current position within the perspective wall, an indicator for the initial position could enhance the feedback. As tilt control may be sensible for slight movements of the phone, it is important at least to know when the phone is held correctly in a way that no action results.

DISCUSSION

Besides the characteristics of each group described above, it is clear to see that the overall error rate is not optimal, yet. None of the users complained about frustration during the use of MultiStates. Nonetheless, the Expert Group performed significantly better than the Comparison Group in terms of corrections and speed. Independently from the preferred interaction technique of each user, all techniques have been described as intuitive.

Additionally, the acceptance of the perspective wall is high among both groups (CG: 3.33/5.0, EG: 4.0/5.0). Nevertheless, some expert users pointed out that the screen becomes slightly cluttered with all the state information once they zoomed out completely. Creating more visible grids between each database and its states could lessen the cluttering effect.

Errors through accidently tapping the screen have not been counted since the cost of these errors (activating other features or performing different actions) is low. This relates to the definition of mostly tap-independent gestures.

Nevertheless, errors in MultiStates sometimes forced users to repeat an action or to reset the view. The resulting actions have not been added to the number of user corrections.

In the end we were satisfied with the overall acceptance of MultiStates. Especially since none of the users had experience in using touch-based devices before and all of them were able to work with the system after a short demonstration of the interface and the available input techniques

CONCLUSION

As the introduction described, e-Government is highly dependent on a working IT infrastructure. MultiStates provides support for maintaining this infrastructure. Looking at the main aim of this work, the construction of a mobile and easy-to-use database performance monitoring solution, we can say, that the work was a success. The overall acceptance of it, especially within the Expert Group, was very good and no user failed to complete a certain task.

But the most interesting finding was that even through a simple acoustic indicator, non-visual exploration of an information space can be supported. Even though this is not sufficient to serve as a solution for visually impaired and blind users, it lays out the foundation for further work with touch-based devices.

A platform like the iPhone offers a considerable degree of freedom in creating user interfaces. In particular it offers to integrate the proven scalability of the perspective wall with application-specific set of gestures and allows the display of large datasets on a mobile platform. By offering scroll actions along both X- and Y-axis, we were able to display even more information in combination with geometric and semantic zoom. The flexibility of creating graphical user interface elements independently from hardware buttons and switches is a major advantage and may outweigh missing haptic feedback and lower hit accuracy to some degree.

FUTURE WORK

Based on the evaluation with IT amateurs and experts we were able to discover leveraging points for the further improvement of the user experience. Most of these points indicate that a longer study with more and different evaluation participants would be helpful in order to improve the usable access of this application.

Real database administrators for evaluation

To get more detailed feedback on the MultiStates it would be feasible to have DBAs instead of amateurs and experts evaluate the system.

Increase the usability for visually impaired and blind users

By providing more acoustic or tactile feedback, in particular a screen reader or screen magnifier, visually impaired and blind users can be further supported in using MultiStates.

Refine the display according to accessibility guidelines

By ensuring a high compliance to accessibility guidelines, such as the Web Content Accessibility Guidelines (WCAG) [22], the user experience of MultiStates may be increased further.

Prepare MultiStates for iPhone OS 3.0 and higher

As mentioned above the use of a screen reader (e.g. VoiceOver [23]) and the availability of high contrast graphics are useful features. They are part of the latest iPhone OS, allowing better support for visually impaired and blind users.

Visually impaired and blind users for evaluation

Once the enhancements mentioned previously have been incorporated into MultiStates, it would make sense to have blind users evaluate the system and to compare these results to the existing ones.

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Advanced Quality Tools for eGovernment Services*

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ABSTRACT

eGovernment QoS can be investigated either indirectly, by inspecting citizens satisfaction, or directly, by monitoring appropriate technical indicators. To this extent, we based our developments on the eGovernment Inquiry Framework for the management of questionnaire campaigns, which is now a standard component in the Regione Veneto eGovernment platform. We then completed the QoS picture through an eGovernment Technical Monitor, which provides administrators a close and flexible control to key performance indicators. Both tools are Java-based, make use of open source libraries and native XML-dbms and are exposed as standard WSDL-defined web services. They adopt an extensible architecture with an associative memory core connecting to higher level statistical variables and can be seen as the first components of an eGovernment QoS architecture with semantic capabilities.

Keywords

eGovernment, QoS, Semantic Web, Key Performance Indicators, Citizen Satisfaction

Introduction

Quality, along with its several instances, *quality control*, *quality assurance*, *quality management*, *total quality*, shows a long and successful history, started in the production, organization and engineering fields. Subsequently, quality models for process improvement were defined, like *lean production* [34], *six sigma* [16], *total quality* [11]; this evolution was consolidated with the 2000 edition of the widely adopted ISO 9001 standard [19]. These quality models are increasingly applied also to *immaterial* services, where *Quality of Service* (QoS) has to be measured and established contractually through *Service Level Agreements* (SLA). Given the eGovernment service focus, there is a significant interest for the application of quality methodologies to (*e*-)Government, as a coherent adoption of QoS methodologies can help Public Bodies to better satisfy citizens needs.

As eGovernment services are knowledge-intensive and operating over complex processes and organizations, *semantic web* technology can also be an useful element to add in order to improve the offered QoS. Semantic Web has been defined as [6] "an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation". The baseline data model for the semantic web architecture has been identified as the *Resource Description Framework* (RDF) [21, 25], an highly flexible XML language where statements are *triples* composed of *subject*, *predicate*, *object*, represented graphically as two nodes connected by an edge. Languages like RDFS [7] and OWL [26, 1] offer even more expressivity allowing for a better knowledge exchange in eGovernment environments [24].

QoS for the specific domain of eGovernment has been investigated in [22], where has been defined a specific *Quality of eGovernment Service* (QeGS) ontology. A structured analysis of eGovernment experiences can be found in [28], while a thoughtful list of requirements for a comprehensive semantic web architecture has been identified in [31], where also are listed several eGovernment projects, like German SAGA [13] and UK eGIF [33]. It has to be noted that the application of quality models to eGovernment is part of a definite Italian strategy [23].

As suggested in [20], processes are to be defined according to the different user roles; ruling out the "electronic agents" case (which is supposed to operate in a mature semantic web services scenario like the one analyzed in [14]), we can map their two other processes to *front*- and *back*-side of eGovernment.

The front-side is the *government-to-citizen* (G2C) domain, where web publishing is used to give information to citizens, to report news regarding tax procedures, laws as well as local informations about events; citizens browse the web searching for specific information but have to know in advance the government *context* where the information is located. Following National guidelines for the eGovernment support in small municipalities [32], the Italian Regione Veneto *myPortal* project, launched in 2003, addressed this field by offering local (province, comuni, comunità montane) governments

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free use of a common portal platform. By using the characteristic location-independence of web, it has been possible to active a single technological center (managed by the regional staff and providers) where portals are technically maintained, leaving the content management to the local government. The myPortal platform unifies at the moment a hundred local public administrations (in Veneto there are seven "province", 19 "comunità montane", 581 "comuni").

The back-side is the *government-to-government* (G2G) domain, where up-to-date information is circulated internally for service requirements and structured information is transferred/processed between employees; an extension of this case occurs with cross-agency group collaborations that involve complex multi-level government processes. The Regione Veneto *myIntranet* project addressed this field by selecting the appropriate technology (web services and semantic web) in a service oriented architecture to better support internal collaborations.

The myPortal/myIntranet (dual) framework represents an interesting applied research environment for semantic web technologies. Comparable research experiences can be found in [4] (Germany, Schleswig-Holstein), [5] (The Netherlands), in [10] (Italy, Regione Marche) and [17] (Finland). A review of applicable quality models for eGovernment can be found in [29], where a classification for quality measurements has been also identified: a) customer satisfaction, b) eGovernment portal quality and c) "technical" QoS.

Leaving out eGovernment portal quality (to be addressed in future projects aiming to further improve online services, more considerations near the end of the article), in our research we mapped the remaining classes to *eGif*, for multichannel citizen satisfaction surveys and to *eMon*, for technical- and performance-related portal measurements.

These Quality Tools represent our strategy cornerstones to introduce objective measurements in eGovernment projects, giving also the opportunity to introduce semantic web technology capabilities to better address citizen's needs. The tool *eGovernment Inquiry Framework* (eGif) has been realized [8] to create survey campaigns, submit through different media channels, retrieve the answers, elaborate and report the results.[1] The second tool we present, still under development, is eMon, which follows eGif for collecting, monitoring and reporting a wide set of key technical, user-related and performance indicators to enhance eGovernment technical staff quality control in G2C portal services.

The paper is organized as follows. In the next section we present the eGif framework, its relation with quality-related models, the advantages offered by an appropriate use of statistical variables and the semantic web model for questionnaires. In the following section, the eMon model is explained and the implications of the extensive plug-in architecture for the system are shown. The integration between the tools is then deepened, and in the last section an outline of our vision for the semantic web QoS eGovernment architecture is presented.

[1]Documentation and source code for eGif is available at `http://grifo.dsi.unive.it/egif/`.

A QoS Inquiry Framework

User satisfaction analysis is a required ingredient in service quality management, where there is the need to compare *internal* measurements with *external* measurements. Structured methodologies exist:

a) quality-related models like SERVQUAL [30] and subsequents, mainly applied in the business domain to measure *customer satisfaction* through the use of suggested indicator classes and an analytical comparison of perceived Vs believed quality;

b) social research [27], where more emphasis is given to a right survey definition and to the social models of interaction, with questionnaires based on quantitative as well as *qualitative* variables.

Surveys emerged in an historical context where questionnaires were designed to fit in paper forms and computers were mainly used for (post-)elaboration purposes; submission of questionnaires through the web/email channels rendered then surveys popular and easy to manage. New interaction channels, like digital TV handsets, cellular phone interfaces, instant messengers (IM), are currently experimented, and asymmetric combinations of different channels for submission of questionnaires and for acquisition of the responses from the users help to raise the percentage of returns.

Technology interfaces can indeed facilitate the users and simplify the collection of data, reducing the costs of surveys and improving the whole effectiveness of the process. On the other side, not all the citizens can be reached via the technology channels, even with the simpler web & email, and identification/authentication processes has to be considered with attention.

With these considerations in mind, an effort was done to design a more "intelligent" survey tool by linking the statistical knowledge of the variables inspected with the questionnaire design process – mainly working on answer *constraints* and submission channels *capabilities*. By knowing *in advance* the statistical properties of the variables (being *nominal*, *ordinal*, *cardinal*, in ranges, etc), the survey tool is able to constrain its user acquisition, has a better control on the submission channels and can coherently elaborate/report the results.

Semantic-web techniques were then experimented to ease the sharing of the surveys between the social researchers: an associative memory of common [question + predefined answers] blocks is built on-top of a variables library containing their statistical properties, social semantics, and its relations with other variables.

An Extensible and Service Oriented Architecture

eGif exhibits a dual interface towards (a) the G2C local eGovernment Portal *myPortal* and (b) the G2G local eGovernment web-based collaboration tool *myIntranet*. Written

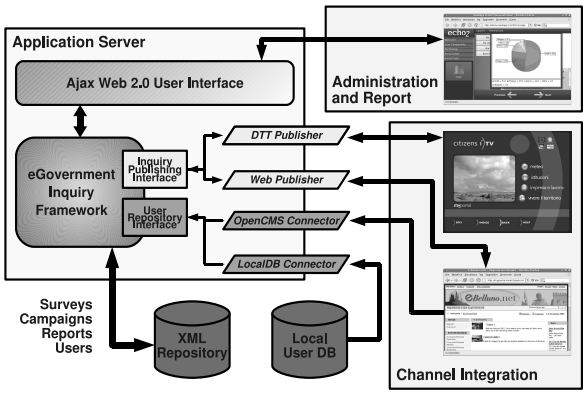

Figure 1: The eGif architecture.

in Java, it has been based upon a *web service* (WS) architecture: eGif exposes a WSDL-compliant interface, communicates through SOAP envelopes and can be listed through UDDI compliant registry. Given the guarantee role assumed by Regione Veneto for local government portals, the UDDI register model could indeed find fully appropriate use in this framework; adoption of semantic annotation standards (the simpler WSDL-S and the more complete OWL-S) are currently under evaluation; with this respect, in [31] there are some interesting hints about the model to be identified.

Several key requirements, both technical and practical, have been taken into account during the design of the eGif tool. As one of the main goals of the system is to serve as an abstract survey platform to many and diverse frontends, a standard service interface and a plugin-oriented architecture are both mandatory features. The service interface is used by a wide number of external applications, such as the analysis and reporting tools and the presentation layer of each of the several channel frontends and user interfaces (see Fig. 1).

According to the best practices about services oriented architectures, the services can be exposed through an UDDI registry and their semantic is explained through WSDL descriptors. In this way, third party applications or eGif extensions are able to connect to the eGif backend and take advantage of the function they require in a fully decoupled and well documented fashion. The services exposed belong to the domain of user authentication, survey repository access (both for publication or analysis purposes), survey campaign creation and so on.

The service oriented interface exposed by eGif can be used in order to exploit all the functions of the system, including the uploading and retrieval of surveys. Nevertheless, for the sake of ease of use, a fully working web-based frontend has been included in the system. This frontend offers a modern and practical interface to perform tasks such as user access profiles creation, plugin management and system monitoring. An effort was also done to make eGif capable of managing complex multi-indented questionnaire forms. Standard social research commonly uses dependency links between questions to be activated upon specific answers of the interviewed, posing serious difficulties to standard survey tools.

Operational Classes		Property States	Operating Procedure	Admissible Operations	Central Trend Measure	Dispersion Measures
qualitative ("mutables")	nominal	*separated*	*classification*	$= \neq$	mode	homogeneity index
	ordinal	*ordered*	*ordering*	$> <$	median	interquartile difference
quantitative ("variables")	cardinal	*discrete*	*counting*	+ -	mean	standard deviation
		continuous	*measurement*	x :		

Figure 2: Operational (variable) classes.

A full-fledged *survey editor* has been developed, allowing designers to build an arbitrary complex survey structure, including multiple choices, indented questions and different choices for statistical variables. eGif exploits a web *user interface* to allow survey designers to manage questionnaires with ease and flexibility. A graphics interface where the symbols "**?**" for *questions* and "**!**" for *answers* allows a dense and clear packing of the information on the screen and facilitates the users in the creation of questionnaires. The interface is based on server-side Echo2 Open Source (OS) GUI libraries.

A plugin-based multichannel engine makes eGif also capable to deal with a wide array of different media channels; different plugin types are available for the different tasks needed to reach true independence from the publication media. Plugins for web, email, digital TV set-top boxes and mobile phones were experimented. Authentication plugins are also provided to ease interoperability with the media channels by exchanging demographic variables, such as the age or sex of the respondents.

The Data Model

The questionnaires are built as sequences of *questions* to be submitted to the users in order to have an instance of the variables inspected; depending on the designer's choice, we can have open- or closed-format *answers*, the latter being preferred for quantitative research; depending on the choice, a variable can be inspected in different ways through different sets of answers. Descriptive statistics is used to (pre-)classify the variables in: a) *nominal*, classifiable, b) *ordinal*, ordinable, c) *cardinal*, computable. This operational variable classification has effects on the subsequent manipulations by restricting the allowed statistical computations and on the graphics representations that can be used (see Fig. 2).

Depending on the properties they describe, three semantical classes of variables are defined in social research (see Fig. 3):

1. *demographic/census data*, like age, sex, name, location and other fixed attributes of the respondent. These are standard independent variables required for classification purposes;
2. *objective data* (variables linked to actions), like common habits or information about past events/experiences, where variability is narrower, being data related to

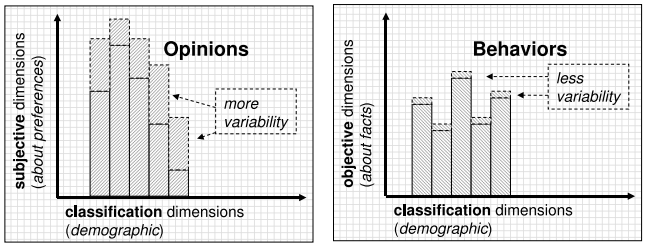

Figure 3: Different (dimension) roles assumed by the different semantical classes of variables.

facts. These can be used as (model-specific) independent variables;

3. *subjective data* (variables linked to preferences), like religious or political preferences, taste, interests, motivations, judgements, where variability is wider, being data related to *opinions*. These are commonly the (model-specific) dependent variables.

This high-level classification and the previous, more operational, is at the base of variable ontologies. Commonly used variables can then be defined and their relations stored in appropriate ontologies easing to questionnaire designers the task of identifying the appropriate dimensions of the surveys through the independent variables and the dimensions of the searched dependent variables. Further ontology attributions can be applied by using higher-level domain-related information pertaining to Local Government areas like Education, Health, Transports, Administration and so on.

eGif stores all its data in XML files through the eXist Open Source XML-native database. The role of XML is not limited to the surveys serialization: user profiles, configurations and all the other data are also stored in hierarchical structured repositories. The flexible *data structure* in XML, that can be validated and remains consistent between changes, is fully consistent with the semantic data models adopted.

A Technical-level Monitor for QoS Portal Measurements

In order to address our quality of service program, a different kind of measurement is needed to keep key performance indicators under close control. Our choice has been to design a comprehensive architecture around the atomic eMon "indicator unit" by giving eGovernment technical staff full knowledge for operation, performance and responsiveness of portal services and applications. To reach this goal, the quality tool eMon was designed (see Fig. 4):

- by identifying a set of strategies to insert low level key performance indicators in eGovernment portals and applications,
- by structuring a real time information flux feed model of the resulting indicators for system administrators via a messaging subsystem (using email, sms, IM and portlets),

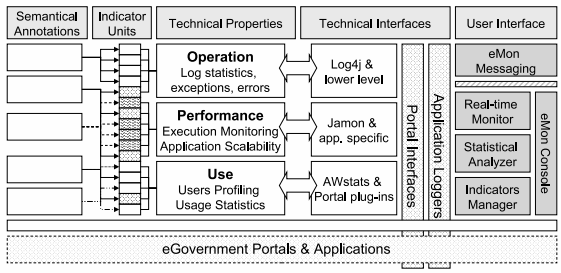

Figure 4: The eMon model.

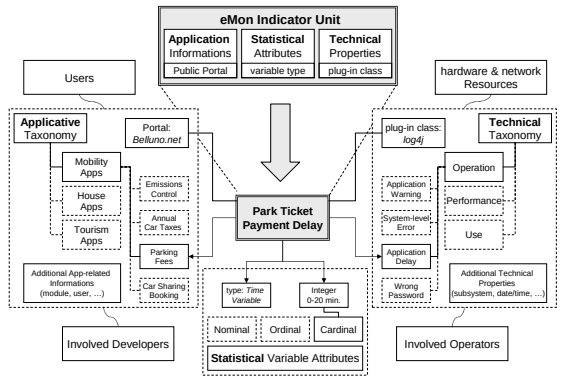

Figure 5: Indicators in the eMon model: an example for the indicator "Park Ticket Payment Delay".

- by including a statistical analyzer to elaborate and report the evolution of the indicators and the correlation between them; finally,
- by making indicators manageable via a dedicated user interface.

The eMon technology innovation is the semantical coupling of the indicator technical interfaces and sensors with structured information about the related applicative, statistical and technical taxonomies. For example, a "Park Ticket Payment Delay" indicator warning, along with the technical facts behind the event, will bring knowledge about the parking fees application, about the "application delay" indicator classes and the statistical attributes needed by the eMon statistical engine for the computation of appropriate indexes and correlators (see Fig. 5). The gained eGovernment monitoring self-assessment could help in the realization of smarter, more careful and reactive G2C models.

The technical-level plug-in interface model is created as an abstraction layered out on-top of well known, widely used Open Source tools for monitoring, helping to further decouple the model from language- or system-level details, as well as over more portal- and system-specific interfaces. Three main areas for the deployment of the technical sensors were identified (see again Fig. 4):

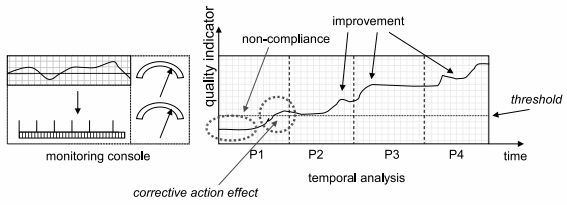

Figure 6: eMon visual interface – quality improvement implications for a specific indicator.

- the *operation* area, to maintain information about the state of the services. In addition to other lower-level interfaces, the OS tool log4j [3, 15] has been identified as a useful and flexible tool to feed eMon (through *appenders*) with informations at various levels of severity (debug, info, warn, error and fatal) that the *loggers* can transmit – a form of generalization for language-specific exceptions. Java[2] application developers only have to place in key positions of the source code these loggers; the level of logging can be then easily managed outside the application, by instructing log4j to ignore messages with lower level of severity;

- the *performance* area, to maintain information about the performance in production, to identify possible execution bottlenecks and to verify service scalability and application user responsivity. For this task, the OS tool Java Application Monitor (Jamon) [18] was identified; appropriate methods are invoked in the applications to start, measure, then stop the monitors, without the need to manage eGovernment administrative rights for distributed multi-portal services. Like log4j, Jamon limits by design the impact of the monitors on the application performance and can be externally configured;

- the *user-related* area, to collect informations about users accessing the portals: hits, views, robots and worms accesses, search keywords to reach the sites, etc. Again, a mature OS tool was identified, AWStats [12], capable of interacting with the main web-, mail- and ftp-server platforms and with the relative log files, by decoupling the model from the server technology.

These listed are the selected information sources. The resulting data flow is then enclosed in semantically annotated eMon indicator units, sent when required over the messaging subsystem and stored in a main XML repository for statistical and evolution analysis. The eMon user interface exposes a management console for eGovernment technical staff that can inspect the indicators sensed (see Fig. 6). eMon shares with eGif the same technology choices: the eXist OS XML-native dbms for the eMon repository and the server-side Echo2 web GUI framework for the eMon management console.

[2]Similar tools are available for other development frameworks, see [2].

Integration with eGif

Apart from the common technology choices, the performance and technical monitoring tool eMon shares with the inquiry framework eGif some parts of its higher-level features. In particular, the statistical approach is the same for both tools, bringing to a knowledge library for commonly used variables and their statistical properties. Also, (eGif managed) citizen feedbacks on specific online services can be supplemented by corresponding (eMon managed) effective performance information, supporting technical staff in their service improvement tasks. eMon trails can be acknowledged to belong to known users profiles by allowing deeper analysis on citizen classes application usage frequency. Like eGif, eMon exhibits a dual interface, collecting data from the G2C *myPortal* and exposing it to authorized staff through the internal G2G *myIntranet*. The UDDI register model should then provide eMon with additional sources of higher level information for surveyed services; semantic web service annotations would even better match with the semantic model of the eMon unit indicators.

The quality tools eGif and eMon have a key role in the Regione Veneto service oriented eGovernment architecture – they are a forefront for its progressive semantic web technology adoptions. A planned third tool to directly manage citizen feedbacks *inside* eGovernment services and processes should then follow to complete the whole picture of the Advanced Quality Tools for eGovernment Services.

Conclusions

A quality-oriented eGovernment research program involving also ontology- and semantic-based technologies has been conducted. The project has been developed on-top of a common web platform named "myPortal" based on Open Source technologies. The Inquiry Tool eGif is now available in all *myPortal*-served local administrations in Veneto. The Technical-level Monitor eMon will soon follow. Both are part of a wider quality measurement strategy for Local Government Portals in Regione Veneto.

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Using human language technology to support the handling officers at the Swedish Social Insurance Agency

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ABSTRACT

The Swedish Social Insurance Agency, (Försäkringskassan) receives 40 000 e-mails per month as well as phone calls from the citizens that are handled by almost 500 handling officers. To initiate the process to make their work more efficient we carried out two user-centered design workshops with the handling officers at Försäkringskassan with the objective of finding in what ways human language technology might facilitate their work. One of the outcomes from the workshops was that the handling officers required a support tool for handling and answering e-mails from their customers. Three main requirements were identified namely to find the correct template to be used in the e-mail answers, a support to automatically create templates and finally an automatic e-mail answering function. We will during two years focus on these design challenges within the IMAIL-project.

Keywords

Human language technology, Swedish, automatic e-mail answering, user centered design

INTRODUCTION

The Swedish Social Insurance Agency, is one of the largest paying agents in Sweden, with 1 billion SEK (approximately 100 million Euro) payment per day. The agency handles a large amount of e-mail and phone calls every day. The handling officers have a large amount of knowledge on what and how to answer citizens. Nevertheless, they are in need of assistance to cope with the great amount of e-mails and telephone calls they get daily; to allocate and coordinate their work better and, to capitalize and update their competence and knowledge on the domain of social insurance. For this purpose, e-services based on human language technology seem to be appropriated to introduce into the handling officers' work, as the bulk of the e-mail arriving to the Swedish Social Insurance Agency might be answered by providing citizens with automatic or semi-automatic responses. IMAIL [1] is the research project within we will study how to introduce language technology into the handling officers' work.

RELATED RESEARCH

During the last decade, many countries have put a lot of efforts in developing and introducing e-services into the public sector. Sweden, for example, is one of the countries that together with US and Denmark shared the third position (see Grundén, [2]). Indeed, according to the Swedish government, public organizations are considered as precursors in the introduction and propagation of e-services and information into the society. For instance, it has been suggested that public authorities should be stimulated to develop "the 24hours authority" (Statskontoret,

[3].). "The 24hours authority" is a term that introduces the idea that public service and information should be available to the citizens at any time through the use of Information Technology. For an overview of the different levels of e-Government see Krogstie [4]. This particular vision of e-government puts thus high demands on both employees and citizens. Grundén [2], for example, showed in her surveys that important implementation aspects of e-Government are closely interrelated with the competence and knowledge development of the civil servants conducting their work with new electronic tools.

In the same sense, Cajander & Ericsson [5] argues that e-Government will make civil servants ill-healthy since they can not affect their working situation since they are captured in the way their computer system work and they therefore will not able to make creative solutions. Fully aware of these risks, our work intends to provide both, employees and thus citizens with usable and quality–based language technology e-services.

The vision of the IMAIL project is that human language technology can play an important role in the development of user-centred services for e-government. Human language technology (HLT) includes all algorithms and tools that deal with human speech and writing. The technology is basically based on the analysis, filtering or generation of human language, but the applications are far more sophisticated and useful (e.g. machine translation, predictive text, speech interfaces, search engines). HLT has a clear potential not only to support human-machine interaction but also to support human-human interaction.

There exist several examples of the usage of human language technology in e-Government including for example e-mail classification for automatic routing to appropriate official see Segev & Gal [6], human language technology as an aid in rule-making processes in Cardie et al [7], and crime information extraction based on language technology based extraction techniques from police reports and witness narrative reports, see Ku et al [8]. Scheffer [9] have analyzed incoming e-mail to a European education provider, and he found that 42 percent of the incoming e-mails could be answered with nine different standard answers. In Busemann et al [10] there is an overview on automatic e-mail answering.

DEVELOPING AND DESIGNING HUMAN LANGUAGE TECHNOLOGY FOR HANDLING OFFICERS

We have carried out two user centered design workshops with handling officers at the Swedish Social Insurance Agency in Stockholm to find out in what ways human language technology based services might support handling officers in their daily tasks. The first workshop was a so-called future workshop, see Löwgren & Stolterman [11], and focused on the design of a future system for e-mail handling at the Swedish Social Insurance Agency. In the second workshop the handling officers created scenarios, storyboards and sketches based on design themes from the future workshop.

One of the outcomes from the design workshops was that handling officers need a support system for assisting them with answering e-mails. More concretely, they need a tool helping them to find the correct templates to be used in the e-mail-answers as well as support able to automatically create templates for them. When it comes to the fully automatic answering of the e-mails, the handling officers like the idea of getting rid of the frequent short questions, but at the same time they are very concern with how the messages should be designed and written. The opinions of the officers were that the messages should clearly indicate that they are answers from a machine; they should include a disclaimer, and always give a reference for how to get personal service from a real person. What kind of questions that are suitable for automatic answering was also an important issue.

In this sense, this position paper proposes a system based on human language technology that is expected to answer as many as 30 percent of the e-mail flow received by the handling officers. More specifically, the research questions at the core of our project are the following:

i) How should such a system be designed to support the handling officers in their work in the best way?
ii) How can we assist the handling officers to capitalize on (reuse) and update the answers already sent?
iii) How should the introduction of a new tool be integrated into the current electronic practices shared by handling officers?
iv) Which are the new tasks that such a new tool may generate in the daily handling officers' work?

QUESTIONS FOR DISCUSSION

- Will the handling officer really gain of having a system that assists them in answering the questions?
- How large percentage of the e-mail questions to the Swedish Social Insurance Agency can be answered automatically?
- Is it possibly to automatically or at least semi-automatically create templates for answering e-mails?
- What types of citizens' requests are suitable to get an automatic or semiautomatic answer?
- How should we balance efficiency and quality when developing e-services based on language technology?
- Is it possibly to automatically or at least semi-automatically create templates for answering e-mails?

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E-government HCI: a genuine research field?

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ABSTRACT
This papers aims at surveying current issues regarding e-government through the literature in order to assess current state and research avenues concerning e-government HCI research as a genuine research field. Included are the needs for efficient software tools for mass-production of e-government software, for security and trust, for personal information management, and for internationalization.

Keywords
E-government, HCI, usability, research

INTRODUCTION

The goal of this paper is to establish some grounds, after looking at available scientific literature, to discuss the question: is e-government HCI a genuine and specific research field? This attempt being in the form of a position paper, the opinions presented are to be viewed as material for stimulating the discussions, and, hopefully, for helping to establish a research agenda for e-gov. HCI research. For assessing whether e-gov. HCI is a field of research or another application domain, a number of issues should be discussed, including:

- What are the characteristics of e-gov.?
- What are the specifics of e-gov. HCI, particularly for research?
- Which salient topics can be selected in e-gov. HCI as part of a genuine and specific research domain?
- And what are potential specific research topics for the future?

This paper, after looking at definitions of e-gov., attempts to provide initial answers to these questions, and discusses implications for future research.

DEFINITIONS OF E.GOV.

"e-Government (short for electronic government, also known as e-gov, digital government, online government or transformational government) is a diffused neologism used to refer to the use of information and communication technology to provide and improve government services, transactions and interactions with citizens, businesses, and other arms of government". http://en.wikipedia.org/wiki/E-Government .

"**e-Government:** refers to the use of new information and communication technologies (ICTs) by governments as applied to the full range of government functions. In particular, the networking potential offered by the Internet and related technologies has the potential to transform the structures and operation of government" http://web.worldbank.org/.

So far, it sounds very much like an application domain for existing technologies. However, let us look further at what are the main characteristics of e-gov. studies.

It must be also noted that, even though current applications are mainly on internet, further developments may be envisioned for a larger set of devices including phones (with or without "smart cards"), kiosks, interactive voice response, etc.

CHARACTERISTICS OF E.GOV. IN THE LITERATURE

When surveying the topic "e-gov" on internet, on bibliographical databases, and in papers co-referencing, the domain appears to be rather recent (< 10 years), but also the contributions seem multifaceted (e.g. http://www.1105govinfo.com/events/), crossing various scientific topics. However, some dedicated conferences do exist (e.g., EGOV which has its 8th. Conference in 2009; ePart - International Conference on eParticipation; International Conference on Electronic Democracy), as well as journals (e.g., International Journal of Electronic Governance (IJEG); Electronic Government, an International Journal (EG); International Journal of Electronic Government Research (IJEGR) ; Journal of

Information Technology & Politics ; Electronic Journal of e-Government).

There are, of course, many studies on e-gov. that concern important topics beyond the purpose of this paper, for instance: legal and policy matters, democracy, governance, economics, social and organizational issues, etc.

On the more technical side, several topics are investigated, for instance: various statistics, software architectures, case studies, ontologies, digital preservation, etc. (e.g., [1] , [2], [3], [4]).

Often mentioned characteristics (e.g., [5]) are: lots of stakeholders (final users/ clients/ design team), as many jargons and viewpoints. While it may be true, it is not that specific compared to other domains in HCI.

What are the types of HCI-related studies in the literature?

Many "local" studies, focusing on a regional or national state of things regarding surveys, standards, successes and pitfalls of e-government, e.g. [6], [7], [8], [9], [10], [11], most of them in industrialized countries.

E-GOV. HCI STUDIES

Overall, (including local studies) very little is found specifically in HCI (for instance, only 20 papers retrieved when checking HCI bib: http://hcibib.org/).

HCI studies identified deal mainly with:

- User needs and accessibility, e.g. [12], [13], [14], [15], [16], [17], [18]. Accessibility seems indeed to be the main topic in current literature on e-gov. HCI, including studies on older people.
- The applicability of HCI results to e-gov., e.g. [19],
- Ad hoc interaction novelties, e.g. animated faces [20]; ad hoc methods, e.g. [21], [22], on document exchange and scenario planning.
- Overall user involvement, and requirements, e.g. [23], [24], [25], [26]; user acceptance, e.g. [27],
- Patterns, e.g. [28], [29].

DISCUSSION

Very little, so far, seems to be really specific to e-government HCI.

Indeed, from a technical point of view, this field shares a lot with other well-established fields.

A view is that e-government HCI may not constitute currently a specific field of HCI, but simply another domain of application. For instance:

- Security issues are also key in other areas such as e-commerce or safety-critical systems;
- Safety issues are also key in other areas such as safety-critical systems, e.g., control rooms;
- HCI architectures, models are not very different from other areas of computer-based systems, including web.

Overall, it is similar for usability and accessibility issues:

- Usability for form-filling dialogues is well known, even standards do exist (see [30]; most ergonomic guidelines apply as well (e.g., Ergonomic Criteria [31], applied to a specific e-procedures tool: e-Citiz [32]).
- Accessibility is also well known and well documented (e.g., [33], [34]). Albeit issues may not be specific, they are crucial: not only such type of software will need to comply to national and international regulations, e.g. [35], especially for government web sites, even though conformance demonstration and enforcement varies a lot, from one country to another.

Having said that, there seems to be some topic areas that may be viewed as specific to e-gov HCI research. It may be an excellent field for applying, testing, and improving some ideas, knowledge, models, and tools, for instance:

- Providing fast, efficient, and usable (including for non-specialists) software tools that will allow mass-production of software design of e-government procedures applications, quickly, efficiently, and reliably, in order to face the very large demand of dematerialization of administration paper. This has to do with the effort of providing new software tools (see, for instance: http://genibeans.com/cgi-bin/twiki/view/MyCitizSpace/PresentationDuProjet).
- Ensuring data protection, security, privacy, which has a strong impact on the users trust and therefore willingness to interact with such systems. In [11, op. cit.], it is clearly stated that, (although only a national survey) internet is not seen as an accountable channel. « *Users feel less comfortable with internet-based transactions where accountability and formal response is required. Excluding online payments, users feel that form submissions often appear to go 'into the ether', especially as most provide no way to track the request.* ». Sometimes, ensuring good old usability may help, such as sending immediate email confirmations, and providing receipts and reference numbers upon submission of forms.
- Other topics can benefit from the combined characteristics of the e-government context, for instance:
    - Improving users minimal actions (reducing the redundancy of form-filling operations) through the use of micro-formats, an approach that allows information intended for end-users (such as contact information, geographic

coordinates, calendar events, etc.) to also be automatically processed by software applications, see for instance: http://knowledge.wharton.upenn.edu/article.cfm?articleid=1247;

- Providing new underlying models to allow combined modeling of tasks and workflow, e.g., [36];
- With the increasing development of new platforms, of mobility, of ubiquity, plasticity, i.e., the capacity of an interactive system to withstand variations of context of use while preserving usability, will be of prime importance in the future dissemination of e-gov. procedures, e.g. [37];
- With the widespread of e-gov services, (combined or not with non-government services), one can envision the possibility of creating personal citizen information spaces, which will require further progress on the personal information management systems (PIMs), term which refers to the research field addressing the way people manage their physical documents (books, notebooks, sheets, etc.) as well as their electronic documents (files, emails, Web pages, etc.) with the aim of designing tools that support the management of electronic documents (*PIM tools*), e.g., [38].
- The demand of dematerialization, which started first locally and nationally (e.g. regions, countries), will eventually spread internationally, which will require lots of effort in the area of internationalization. This area goes beyond the usual linguistic questions, and includes: nationality issues: language; laws and regulations; systems of units and usual formats; collective and cultural aspects: technological environments in place; conditions of use; professional and social traditions; type of work organization; conventions, symbols and practices; modes of reading and writing; personal and cultural aspects: users' characteristics, in particular anthropometry, education, values, preferences, expectations, etc. A particular topic of interest could also be the differences in HCI requirements for different cultures and countries; for instance, developing countries have a particular research agenda that include content management, plain language, personalization, low literacy users and universal access.
- Going further, software applications for e-gov. systems could be more pro-active, which may trigger interesting research on recommender systems (e.g. [39]), and suggest, for instance, procedures for detecting eligibility from citizen, for various e-gov. measures (e.g., social support).

In addition, for future research, our view is that the domain of e-government HCI has also some interesting research potential in the area of EUSI, acronym introduced here to mean End User Self Individualization. Indeed, it is not straight EUD or EUP (end-user design or programming) as the application types are sometimes quite simple and limited in their behavior, from the users' end. However, due to the extensive combinations resulting from both the large variations in e.gov. procedures (lots of different areas, administrations, taxes, health, education, professional, leisure, etc.) and the large variations in the users populations (age, skills, roles, etc.), one can forecast, in addition to system-generated users profiles, the possibility of user-driven individualization (also called tailoring, personalization, etc.), on limited aspects of the e-gov. user interfaces. This constitutes quite a challenge for future research to provide appropriate (i.e., useful, usable, and accessible) means for end users to perform their e-government interactions, with their own set-up. This will also make use of existing standards being developed, such as [40].

Another reason for that topic to be interesting and important is the view that sooner or later, end-users will own their personal data storage, shared partly with the providers (with, of course, the issues of privacy and trust). A complex issue will then concern the capability, for end-users, to ultimately being able to apply different roles in their interactions, in a "personal information space" context, for instance, dealing with several software applications with roles such as consumer, head of household, business transactions, leisure transactions, etc.

CONCLUSION

In this position paper, we have looked at existing literature on e-gov., focusing on HCI, with a user-centered perspective, attempting to answer the question: Is e-government HCI a genuine and specific research field?

In short, while many aspects are shared by other application domains, we feel e-gov. constitutes a genuine and specific HCI field as software application for e-gov. concentrate design and evaluation constraints, from a user-centered perspective, both concerning users population and software application characteristics.

- The potential e-gov. users will eventually be all citizens. This will include the so-called "average

user", but also span from a highly educated technical person to my grandmother in the countryside ... and other locations in developing countries. This is not a characteristic shared by all computer-based applications.

- The nature of e-gov. interactions is rather simpler than others, which makes it similar in some way to the consumer products field, including walk-and-use products (even though my grandmother has still trouble with her VCR user manual!).
- The potential market for e-gov software applications is huge, when considering eventually most governments and institutions will need support for their numerous requests towards the citizen. This advocates for efficient software tools that will allow mass-production of e-government procedures applications, quickly, efficiently, and reliably, in order to face the very large demand of dematerialization of administration paper.

Hopefully, these issues will stimulate workshop discussions. Another issue will also be to confront the various national and international experiences for a better understanding of both the practitioners' needs and the users' reported experiences in the area of e-government procedures.

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Accessibility of Mobile Phone Applications

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ABSTRACT
Applications on mobile phones are offering a new service quality for eGovernment applications. We discuss the development of access to electronic time table displays as an example for the difficulties of inclusive design. The mAIS system provides personalized presentation of such information on a mobile phone. It has been implemented in two iterations each followed by evaluation in a field study with more than 55 people having a large variety of specific and contradictory needs. The user-centered design process terminated successfully and usability has been confirmed for looking up time-table information remotely or locally by each user group. However, inclusive design requires a better understanding of the communication needs when design new applications.

Keywords
Mobile system, multimedia messaging, accessibility, public transportation

INTRODUCTION
Mobile phones are more and more accepted by people who rely on assistive technology. For example, blind people install a screenreader and gain access to applications using the GUI offered by Symbian operating system, similar to people with low vision who would install a screen magnifier but perceive as little as what is spoken out through speech synthesis or presented on a mobile Braille display. Hearing impaired people may avoid interferences with modern hearing aids when calling and some deaf people like the use of SMS for exchange of text messages. People relying on a wheelchair use it also to carry a mobile phone and gain some more independence. Moreover, mobile phones are more and more common among elderly people for similar reasons. Each of these groups uses public transportation often since driving a car is experienced as challenging if not impossible.

Some public transportation operators offer web-based access to real-time time table information, even suitable for mobile phones, but there are several limitations when trying to use browsers as a user interface. The identification of bus stops and trains station requires some expertise typically not available to the less frequent traveler. Route planning is not accomplished beforehand but adapted on the fly under real-time conditions depending on the available connections, other interests such as shopping and knowledge about transportation modes. It appears, quick lookup of time table information provide those displays found at bus stops and train station platforms and positioned at a considerable height to secure them from vandalism.

Such electronic time table displays are largely inaccessible to blind or visually impaired people. In addition, information is not listed about lowered floors allowing access by wheelchair to a vehicle. Commonly only numbers and final destinations are listed, adding little to improve orientation for all people.

Very common are SMS based services to look up the time table for some bus stop. They require learning to apply the syntax for a query, read the bus stop number posted somewhere, and interpret the response, which may be overwhelming for busy places. We found no train operator offering a SMS-based service, probably for this reason.

LOCATION-BASED LOOK-UP
The mAIS system consists of Bluetooth beacons mounted at bus stops to identify them appropriately [1]. Beacons operate independently and are plain transmitter boxes requiring no service and no network. A pedestrian requests from the mAIS server display information by a Bluetooth enabled mobile phone while implicitly providing the bus stop identification and a user profile. Beacons are detected by our client software when triggered upon user request. The transaction involves look-up of the transportation operator's database. In our study both real-time data and plain time table data were used.

Figure 1: Displays with time-table data in Flensburg

The system was implemented in three cities in Northern Germany: Kiel, Flensburg and Neumünster, each operated by different service provides and consisting of different data base systems deploying different types of electronic displays (see Figure 1). This technical demonstration also

allowed involvement of a considerable number of potential users.

Evaluation

The system personalizes the time table data. It takes multiple user profile into account and uses speech synthesis, provides color contrast and enhances the presentation. Users have confirmed this adaptability in field trials.

Initially there was no remote query planned. After the first trail most users have noted absence of such a feature. As the developers were themselves using public transportation not often and where well mobile, this major design flaw was only discovered in the field study.

Table 1 shows how the mAIS was used after the second trial. Remote requests were issued by all type of users.

Discussion

The mAIS system aims at one task: look-up data on electronic displays for public transportation. We have applied user-centered design and based the design on two user surveys [2]. The context of this system makes it necessary to include a considerable variety of people with different needs. Each type of message was designed with a particular user group in mind. Moreover, the concept of inclusive design [3] was applied in order to gain insight into the adaptability of such a system. Only user testing seemed to be possible as no expert was found to apply heuristic evaluation for this large variety of users. However, it appears the design process still needs further guidance in order to understand the number of iterations needed.

In particular in the early phases of design, which typically consist of mock-ups, it was difficult to include end users, as mock-up techniques for mobile phones could not be applied. In particular we found it very difficult to understand the type of accessibility problems we could encounter in mobile phone applications without implementing a sample application. Many participants had used mobile phones not as rich client but just for SMS and phone calls, thus had no experience relevant to our questions.

When designing for many types of users a more economic approach is needed. More indicators have to be developed in order to understand if each user group has to participate in parallel or if some user groups represent also others.

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	Control group	**Elderly**	**Blind People**	**People w. Low Vision**	**Hearing Impaired**	**Mobility Impaired (Wheelchair)**
Local request	2	1	7	3	1	4
Remote request	15	1	16	2	3	10
At bus stop	3	2	8	3	2	6
From within bus	0	0	2	0	1	0
From within a train	0	0	7	0	1	1
Other location	6	0	10	1	1	2
40 min in advance	2	0	5	0	1	4
20min in advance	2	0	11	0	2	4
10min in advance	2	1	11	1	1	6
3min in advance	2	0	10	1	2	4

Senior Web Surfer

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ABSTRACT
Lots of older people use the Internet and its services: they communicate with their friends and family by e-mail and instant messaging, manage their bank accounts, book travel, compare prices and sometimes even shop online. Around 2020, there will be more 60 year-olds than there are 20 year-olds. Senior citizens will be a preferred target for online services. European Legislation and Web Standardization Committees are already addressing this question. This video aims to educate the designers of tomorrow about the difficulties faced by seniors. Through testimonials, they will learn about the various aspects they must take into consideration to facilitate the use of their interfaces by older people.

Keywords
Accessibility, Elderly people, Web usage

INTRODUCTION

Everyone recognizes that the internet is being used by increasingly younger children. But the real challenge that the scientists of the 21st century will have to resolve, will be the use of computers by increasingly older people. According to reference [1], for the moment in Europe, there are 77 million senior citizens, demographers believe that in 2050, there will be 129 million, more than twice the number of 14 year-olds. Life expectancy for men will rise from 75 to 82 years and for women from 81 to 87 years. This will completely change the landscape of our society. In particular, to take just one example, online commerce's main target will be people over 65 or even over 70. They represent the largest number of potential purchasers.

LITTERATURE REVIEW

Our literature review (of references [2-14]), lead us to decline the difficulties of the elderly according to the sensory changes encountered : vision, hearing, motor skill and cognition are affected.

Failing eyesight affects all seniors and causes reading difficulties especially when small size and special fonts are used. Vision decline also raises problems while distinguishing clickable elements and catching message from animated elements. A lot of seniors also encounter color perception weakening so that they need high contrast ratio between text and background to read easily.

Hearing loss also affects a lot of seniors but raises fewer difficulties for surfing the web. However, catching message from audio resources may become challenging.

Motor skill diminishing affects a majority of the elderly, so that doing a precise aim with the mouse becomes arduous. Scrolling menu especially cause problems.

A lot of studies show that the ability to perform mental operations changes with age. The mental abilities affected by aging are essentially information processing, attention, memory, executive functioning, visiospatial abilities and language. While surfing the web, seniors trend to loose themselves virtually and encounter difficulties to detect and use the navigation mechanism. They slower process data and are therefore often overwhelmed by the information stream on a web page. Finally, cognitive decline also affects adaptability ability so that the elderly often refuse new techniques.

This literature review was widely helped by the interactions of Isabelle Motte in the W3C WAI-AGE working group [15] working on the second version of W3C accessibility guidelines [16].

THE VIDEO SCREENPLAY

The interviewed people are six seniors, a specialist in sociology of science and technology, a general practitioner and a voluntary trainer for a senior group. These different speakers alternate to introduce the major question of population aging, to present some activities of seniors on the web and to underline their specific difficulties. We tried to illustrate as much as possible the difficulties referred in our literature review trough sequences presenting testimonials with seniors.

CONCLUSION

Our aim was to make young designers aware of the question of population aging and of the specific accessibility difficulties of seniors. We studied literature and structured the seniors accessibility difficulties according to the sensory changes associated to aging. The final video implies different speakers among which seniors

filmed during web surf sessions. The film was produced by the SAVE (Service Audio-Visuel et électronique) of the University of Namur.

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