Interaction Design in eGov systems: challenges for a developing country

Heiko Hornung[1], M. Cecília C. Baranauskas[1]

[1]Instituto de Computação (IC) – Universidade Estadual de Campinas (Unicamp)
Caixa Posta 6176 – 13083-970 – Campinas – SP – Brazil

`heiko.hornung@students.ic.unicamp.br, cecilia@ic.unicamp.br`

Abstract. *Electronic government (eGov) systems can be fundamental instruments of citizens' access to knowledge. The term eGov emerged from the use of the internet, and – although not limited to it – constitutes an area of research and development whose practitioners face the challenges of the internet as a means of creative implementation of new systems and relationships between government and citizens. Today, we are facing a situation in Brazil that is characterized by vast differences with regard to socio-economics, culture, geographical region differences as well as access to technology and knowledge. The big challenge to change this reality lies in the search for methods and system designs that facilitate access and support the formation of a digital culture that respects the diversity of our society. Starting from results of a literature research, this article investigates interaction design in eGov systems, pointing out some lessons learned as recommendations for the Brazilian context.*

Keywords: eGov, Human-Computer Interaction, interaction design.

1. Introduction

The way public administration executes its various actions has a direct influence on the well-being of the citizens. Public projects are experiencing a constant change due to evolution in various areas such as organisational learning, technological developments, realignment of government policies etc. The role of public managers must therefore include responsibility for innovation management in public initiatives and projects. However, this responsibility is not limited to public managers. Researchers and the academic sector can and must contribute by systemizing the subject and innovating practices. Furthermore they must contest beliefs that clearly express visions of political authorities, in which good practices or the rearrangement of established structures are sufficient for innovation to happen (Barzelay 2005). Thus, the acceptance of responsibility of each sector of society for the collective well-being, the participation of an active community of public managers and multidisciplinary basis of investigations are fundamental ingredients for innovation. The Brazilian Computer Society (*Sociedade Brasileira de Computação, SBC*) has accepted its responsibility and assumed its active role in constructing the society we want by proposing the Brazilian citizen's participatory and universal access to knowledge (*Acesso Participativo e Universal do Cidadão Brasileiro ao Conhecimento*) as one of the current grand challenges of

computer science research in Brazil (*Grandes Desafios de Pesquisa em Computação no Brasil 2006-2016*; SBC 2006).

To our understanding, electronic government (eGov) systems can be fundamental instruments of citizens' access to knowledge. The terms "electronic government", "electronic governance" or "eGov" appeared in the late 1990s, although the use of information systems in governmental organisations follows the history of computer science since its early beginnings. The term eGov emerged from the use of the internet, and – although not limited to it – constitutes an area of research and development whose practitioners face the challenges of the internet as a means of creative implementation of new systems and relationships between government and citizens.

The federal government of Brazil has proposed eGov projects to combine forces of state- and municipality-level projects. The report "Relatório Consolidado de Planejamento Estratégico do Comitê Executivo do Governo Eletrônico" (RC 2004) points out that eGov has to focus on the demands of the citizens, promoting the access to and the consolidation of citizenship, in particular: the right to the access to public services, the right to information, the right to save time and distance; the right to be listened; the right to a social control of the public agent actions, and finally, the right to political participation. EGov has to be treated as an instrument for profound transformation of the Brazilian society. Moreover, the same report makes clear that this transformation cannot be achieved by simply making more services available in the internet, but by offering services that benefit all citizens, promoting the process of dissemination of information and communication technology (ICT) and contributing to the socio-economic and cultural development of the country.

Nowadays, we are facing a situation in Brazil that is characterized by vast differences with regard to socio-economics, culture, geographical region differences as well as access to technology and knowledge (Baranauskas e Souza, 2006); unnecessary to cite statistics that picture this scenario. The big challenge of Computer Science to change this reality lies in the search for methods and system designs that facilitate access and support the formation of a digital culture that respects the diversity of our society. Starting from results of a literature research regarding human-computer interaction (HCI) issues, this article investigates interaction design in eGov systems using the following questions as a frame of reference:

- What can we learn from eGov experiences of developed and developing countries? Since Brazil is a heterogeneous country with some highly developed regions and many still developing regions, is it sufficient to cherry-pick the most promising strategies of developed and developing countries and try to avoid errors or learn from them, or is it required to adopt a more holistic approach?
- Which results from the international literature are valid for Brazil and which are not? E.g. is there a tendency from national to local eGov?
- How can concepts and methods be localized for Brazil? E.g. can methods of participatory design applied in European projects be re-used or adapted?

The paper is organized as follows: Section 2 presents basic concepts on electronic government and eGov systems; Section 3 synthesizes the main findings from literature on interaction design for eGov systems; Section 4 sets lessons learned regarding interaction design situated in the Brazilian context and concludes.

2. Electronic Government

E-government (or eGov, from electronic Government) means the usage of information and communication technology (ICT) for executing business processes in the public sector. There exist various definitions in the literature that – depending on the author – differ slightly or stress certain aspects (Misra 2007; Müller 2004). However, those definitions share a common denominator: all define eGov as the use of ICT in public institutions to improve public services or the government as a whole. To illustrate we present the definitions of the European Commission's Information Society and Media Directorate-General and the Organisation for Economic Co-operation and Development (OECD). The OECD is an international organisation of 30 developed countries that share "a commitment to democratic government and the market economy" (OECD 2007). We chose to present those two definitions because the member states of the European Union and the OECD constitute 19 of the 20 top-rated countries in the United Nations Global E-government Readiness Report 2004 (United Nations, Dep. of Economic and Social Affairs 2004).

The eGovernment unit of the European Commission´s Information Society and Media Directorate-General defines eGov as "the use of information and communication technology in public administrations combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies" (European Commission, Information Society and Media Directorate-General 2007).

The OECD defines eGov generally as "the use of information and communication technologies, and particularly the Internet, as a tool to achieve better government" (OECD 2003).

Many authors see eGov as a promising way of modernizing organisation and administration of governmental institutions yielding more and better services and transparency as well as communication with and active participation of citizens and private enterprises (Müller 2004). From this view, the definitions above and other definitions encountered (Tambouris et al. 2001) the main goals of eGov can be deduced, namely: efficiency, effectiveness, transparency, accountability and e-democracy. It should be noted that e-democracy is not a necessary requirement of successful eGov. One can easily imagine a non-democratic government that offers certain services electronically, efficiently, effectively, transparently and with full accountability. However, in democratic governments, e-democracy often is seen as the ultimate level of eGov. This is also reflected in the definitions of the European Union and the OECD above. In the following subsections we take a closer look at eGov services, service categories, interaction types and specific eGov challenges.

2.1. eGov services

To define the scope of eGov services, we use the eGov application layers defined by Wimmer (2001). On the abstraction level defined by political and strategic dimensions, strategies are developed from visions. On the implementation layer these strategies are implemented in initiatives which then are implemented in projects. Finally on the operational level, projects implement applications (cf. Figure 1).
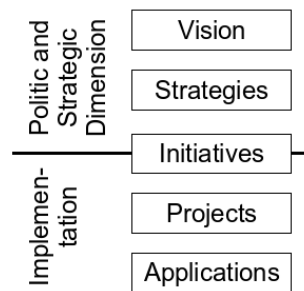
Figure 1. eGov application layers. Adapted from Wimmer (2001)

In the context of this paper we take this operational perspective and define eGov services as applications that make use of electronic media in order to accomplish the eGov goals listed above, i.e. we use the terms "service" and "application" as synonyms, although one might argue that a service has a finer granularity than an application and applications are composed of services. The following are some examples of eGov services (Tambouris et al. 2001): certificates applications, tax payment, governmental portals, tele-consulting and tele-consultation, e-procurement, e-forms, online opinion polls, online job vacancies, online statistical data, traffic information, e-forums etc.

This list is far from comprehensive but should give an idea of the variety of possible eGov services. Those services can be categorized in different ways. Some authors identify different categories of eGov according to the content that is actually provided (Tambouris et al. 2001 cited in Garcia et al. 2005):

- Information acquisition: provides access to information about government directives and decisions;
- Service access: allows online transactions of government products and services;
- Participation: enables citizens to participate in the decision making process.

Other authors use different criteria to define different service categories (e.g. Lee et al. (2005), Tambouris et al. (2001) or Gil-Garcia and Martinez-Moyano (2006)). However, regardless of the criteria used, the resulting categories define stages of eGov evolution. We observe that the definitions of the stages we encountered in literature can be mapped to the dimension "degree of interactivity". Usually services in early eGov stages don't provide any form of interaction but the possibility to browse static information. Later stages introduce simple interactions with few interaction cycles like filling out simple forms. More advanced stages offer a broader spectrum of interactivity like online discussions or so called "one-stop government" portals, i.e. governmental portals that deliver services considering users needs (Tambouris et al. 2001).

Although different authors define slightly different stages, all authors agree that a transition of one stage to the next happens by adding technological and organisational sophistication. This progress does not necessarily follow a linear path. Some agencies might skip some stages or offer services from different stages simultaneously in a single initiative. Furthermore, Gil-Garcia and Martinez-Moyano (2006) have found a trend at the aggregate level of eGov initiatives that seems to go from national to state, and to local governments. They state that even in countries with highly developed eGov initiatives on the national level, many local governments are still in very initial stages of eGov. Although they admit that there are exceptions, it must be questioned if these are

exceptions or maybe elements of a general pattern. In the context of developing countries we can observe that some highly sophisticated local eGov initiatives are under way while the national or state-wide level of sophistication is relatively low (as a Brazilian example confer the service offering of the municipality of São Paulo (http://www.prefeitura.sp.gov.br)).

At least three different types of interrelations can be distinguished in eGov (Lee et al. 2005; Müller 2004): government-to-government (GCG), government-to-business (G2B) and its reverse, and government-to-citizen (G2C) and its reverse. GCG sometimes is referred to as "internal eGov" and is concerned with processes within or between public institutions, whereas G2B and G2C are referred to as "external eGov". G2C sometimes is also referred to as "government-to-customer". Furthermore some authors describe additional types of electronic interaction. Müller (2004) describes "G2N" as the interaction between government and non-profit or non-governmental organisations. Lee et al. (2005) define "IEE" (government internal efficiency and effectiveness) and "overarching infrastructure". IEE – which is comparable to e-business-like ERP (enterprise resource planning) applications – can also be seen as a subcategory of G2G, whereas "overarching infrastructure" summarizes initiatives that add technological sophistication to G2G, G2B and G2C services (e.g. public-key infrastructure interoperability, e-authentication across different eGov initiatives). Although Lee et al. (2005) stress the technological character of the category "overarching infrastructure" and compare it to e-business' EAI (enterprise application integration), those services can also have effects on HCI-driven approaches.

2.2. Specific eGov challenges

Public service information system development projects have some characteristics that differ from private sector projects and that among others provide a motivation to employ different techniques of user involvement in eGov projects (Følstad et al. 2004):

- The number of stakeholders in public IS is often high, and important stakeholders may be found in several departments of government.
- There may be political attention on and control of the development process.
- Users may include government administration, citizens and non-governmental enterprises.
- EGov services are expected or required to adhere to the principles of Universal Design.
- Since eGov services are typically of a non-commercial nature, customer satisfaction and service production are most important indicators of service effect.
- There might be challenging combinations of requirements, e.g. eGov services have to serve all users and at the same time increase efficiency.
- Public sector projects of a certain monetary volume are often subject to fair vendor competition. Følstead et al. (2004) state that thus, often waterfall-like development processes are employed, since the developing contractor might not be involved in the requirements phase of the project.

There exist various reports that list other organisational and structural challenges and try to address problems implied by the characteristics mentioned (e.g. OECD (2001) and OECD (2003)). Most of the reports state that end-user involvement should be

increased. Unlike many e-business projects, target users of eGov services include the whole spectrum of society comprising users with disadvantages (European Commission, Information Society and Media Directorate-General 2006):

- Physiological/mental disadvantage: including short/long term health problems;
- Behavioural disadvantage: criminal behaviour (+ victims), substance abuse;
- Socio-economic disadvantage: low income/poverty, worklessness, homelessness, educational under-achievement including low literacy;
- Demographic disadvantage: gender, age (old, child/youth);
- Ethnic and cultural disadvantage: ethnic/racial minorities, language minorities, cultural minorities, religious minorities;
- Geographic disadvantage: rural areas, peripheral/remote/island, inner-city, etc.;

In the country context of Brazil the diversity of society is even higher. Besides the fact that the claim for participatory involvement emerged from the context of nordic countries who already have a tradition in this area, we believe that also in Brazil, such a broad spectrum of competencies can only be considered appropriately if inclusive and participatory HCI methods and techniques are applied throughout the whole project.

Another aspect that should be explored are the challenges developing countries face. Hugo and Day (2001) as well as Singh and Kotzé (2002) illustrate the challenges that arise in South Africa, a country that is currently being shaped by indigenous socio-economic forces and cultural practices as well as by the forces of globalization. Their findings can probably be projected to other countries in similar situations.

Hugo and Day (2001) state that the cultural, economical and educational diversity in South Africa is especially widespread. Therefore they argue that human factors have a crucial role to play. However, the status of HCI in South Africa can be compared to the status of HCI in more developed countries during the earlier years of this discipline. Another challenge lies in the lack of expertise and resources of the South African government to execute eGov projects. This implies that the government has to rely on academia and industry to execute initiatives promoted by the government, bearing the risk of top-down instead of user-centred designs. On the other hand, the South African government can equally become a powerful sponsor of user-centred design.

Both Hugo and Day (2001) as well as Singh and Kotzé (2002) stress the conflict between globalization and the urge of quickly adapting imported products and technologies to be able to fully participate in global development on the one hand and the danger of thereby excluding various sectors of society from access to and benefiting from ICT. This conflict is due to the importance of cultural values that possibly collide with imported technologies and products.

This special situation in development countries seems to be so extreme that a high rate of failures can be observed (Dada 2006). Heeks (2003) divides eGov projects into three categories, "total failures", "partial failures" and "successes". Projects that result in a "total failure" have not been implemented or the use of implemented applications has been immediately suspended after implementation. "Partial failures" are characterized by the non-achievement of major goals or the occurrence of unwanted side-effects. Projects that resulted in a "success" achieved most of the major goals

without unwanted side-effects. Heeks (2003) then estimates that 35% of eGov projects in developing countries are "total failures", 50% are "partial failures" and 15% are "successes". To explain the reasons for those failures, he conducts a gap analysis between the current state and the targets to be achieved by an eGov project. Based on this analysis, he identifies three archetypes of eGov failure, hard-soft gaps, private-public gaps and country context gaps. Hard-soft gaps relate to the problem that many eGov projects are designed in a rational, objective and engineering-driven way while government organisations are dominated by "soft factors" like people, politics, emotions and culture. Private-public gaps arise because of differences between the public and the private sector, country context gaps appear when solutions already successfully employed in developed countries are applied to developing countries.

The findings of Heeks (2003), Hugo and Day (2001) and Singh and Kotzé (2002) and the strong need for HCI methods pointed out above could be an interesting starting point for further research.

3. Literature research

Our findings from literature research show that the majority of publications on eGov is based on surveys and case studies (Lee et. al 2005). The selection of publications we present in this section does not claim to be exhaustive, but we think it represents an outline of the current state-of-the-art in interaction design and eGov. The collection of papers was compiled searching relevant scientific databases (e.g. The ACM Digital Library (http://portal.acm.org), IEEE Xplore (http://ieeexplore.ieee.org), SpringerLink (http://www.springerlink.com) and Elsevier (http://www.elsevier.com)) as well as the conference proceedings of the Brazilian "Simpósio sobre Fatores Humanos em Sistemas Computacionais" of the last 5 years (i.e. IHC2002 to IHC2006). Furthermore we followed relevant references inside the encountered documents and also conducted searches using regular internet search engines (e.g. http://scholar.google.com). For database and internet searches we used different combinations of the keywords "egov", "e-gov", "electronic government", "government", "HCI", "CHI", "interaction", "design", "interface", "interactive". We limited the selection to papers that are related to eGov as well as to HCI. Exceptions are some eGov-related papers that have no relation to HCI at first sight, but have at least a relation to computer science in general or a direct or indirect effect on HCI (e.g. OECD recommendations for conducting eGov projects (OECD 2003)). The papers retrieved from this search can be categorized in:

- design methods – papers in this category treat aspects and problems that arise during different stages of the process of interaction design;
- evaluation methods – papers in this category propose new or show the application of existing user interface evaluation methods;
- HCI practice – papers in this category present case studies that demonstrate the use of HCI methods and techniques in eGov;
- meta level – papers in this category treat problems that arise on higher levels of the aforementioned eGov application layers, e.g. HCI-related success factors of eGov projects and initiatives.

Besides general guidelines and tools related to accessibility and usability (examples are (W3C Web Accessibility Initiative 2006a), WebXACT (formerly known

as "Bobby", (WebXACT 2004)), (DaSilva 2006)) we didn't find any that cover HCI aspects specific to eGov services. Regarding national laws and policies, the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) provides an overview (W3C Web Accessibility Initiative 2006b). One of the best known national laws is the U.S. Rehabilitation Act Section 508 (U.S. General Services Administration 2007), an example for the country context of Brazil is the Lei de acessibilidade - Decreto lei 5296 (Acessobrasil 2006)

In total, 29 documents where reviewed, 9 of which fall into the category "design methods", 8 into "evaluation methods", 5 into "HCI practice", and 7 into "meta level". Almost all papers in the category "HCI practice" and some papers in the category "meta" also deal with design and evaluation methods, but do have no focus on them. Almost all articles in the category "design methods" deal with participatory or at least user-centred design. Table 1 summarizes the findings in this category.

Table 1. Papers in the category "design methods"

Reference	Commentary

Dawes et al. (2004)	• identification of design dimensions of electronic access programs:
	  • dimensions related to users, uses, suppliers and content (e.g. predictability and homogeneity of users, sensitivity of content, status of metadata)
	  • dimensions related to organizational structure and context of the access program (e.g. relationship with information users and suppliers, suitability of existing technology)
	• analysis of interdependencies between different dimensions

Dearden et al. (2006)	• pastiche scenarios, e-inclusion, participatory design of eGov services • introduction of "pastiche scenarios", a participatory design method that is based on scenario writing • pastiche scenarios augment "normal" scenarios by using well-known "real characters" from TV, movies, etc.

Filgueiras et al. (2005)	• personas as user models in eGov services
	  • collection of statistical data by means of analyzing questionnaires
	  • data mining and clustering
	  • creation of personas based on clustering

Kavanaugh et al. (2005)	• political online participation of citizens in local governance • two-page paper, no later results could be found yet
Maciel and Garcia (2006)	• e-inclusion; e-democracy • map contents provided by government to a simple language accepted by citizens • language and interaction patterns modelled on TV reality shows like big brother • two-page paper, no later results could be found yet
Martin et al. (2002)	• ethnographic studies • identification of two examples of the interaction pattern "working with interruptions" in a (non-)computer-supported working scenarios • how to facilitate the (re-)use of patterns in work (re-)design • relation to eGov: business process in which the pattern occurs (planning process) has characteristics that differ from private enterprises
Oostveen and van den Besselaar (2004)	• what methods of participatory design can be used in large scale network eGov systems • focus on multi-national projects with high distribution (network and organization) • no focus on large scale user participation
Vassilakis et al. (2003)	• software engineering perspective • no relation to HCI
Zappen et al. (2006)	• "from user-centred design to user-designer collaboration" • organizational users use software to create content for end-users (children, youths and parents) • organizational users collaborate with designer (software producer), end-users do not collaborate in this example

The papers that fall into the category "evaluation methods" (Table 2) are mostly

concerned with accessibility and usability evaluations. Singh and Kotzé (2002) furthermore illustrate an example of the application of participatory design methods.

Table 2. Papers in the category "evaluation methods"

Author	Commentary
Becker and Nowak (2003)	• web accessibility assessment; older adults; eGov web sites • presentation of "Dottie", a tool for automated accessibility assessment which resembles "WebXACT"/"Bobby" • paper does not make clear, if Dottie uses guidelines or heuristics that differ from those used by Bobby
Garcia et al. (2005)	• assessment of 127 Brazilian eGov web sites • presentation of "g-quality", an extension of Nielsen's heuristic evaluation (Nielsen 1993) • identification of special eGov usability requirements ("Trust: Demonstrating reliability and credibility, guaranteeing security in the information exchange and in the site navigation.")
Jaeger (2003)	• why many case studies don't measure accessibility accurately • how to measure accessibility more accurately
Jaeger (2004)	• overview of accessibility related laws and regulations in the U.S. • many of the accessibility related laws and regulations that have been identified in this paper have been defined before the widespread use of computers and the internet and don't contain any guidelines, etc. • however, the author shows that many public institutions are legally required to provide accessible web sites even if Section 508 does not apply to them
Pimenta et al. (2002)	• accessibility evaluation of Brazilian eGov sites using tools for automated accessibility assessment and the Web Content Accessibility Guidelines of the W3C-WAI.
Robertson et al. (2005)	• comparative study of using paper based vs. electronically presented information and tools to prepare and execute a voting decision • subject of analysis: navigation on paper vs. computer, ballot metaphor • students as participants
Singh and Kotzé (2002)	• eGov and HCI in developing countries • cultural identity • example of participatory methods for web usability assessment • ABCD method (atmosphere, build-up, communication, discipline)
Tangarife and Mont'Alvão (2005)	• comparative study of the accessibility recommendations of the W3C/WAI and the Brazilian NGO "Acessibilidade Brasil" using the tool "da Silva"

The papers in the category "HCI practice" (Table 3) show how HCI principles are applied to real world eGov projects (Kossak et al. 2001; Marchionini and Levi 2003) or to organizational structures (Hugo and Day 2001; Halstead-Nussloch et al. 2003).

Table 3. Papers in the category "HCI practice"

Author	Commentary
Halstead-Nussloch et al. (2003)	• how to build a HCI community across organizational borders • focus on organizational matters • no focus on users or interaction design • two-page paper
Hugo and Day (2001)	• current state of HCI in South Africa • challenges of developing countries • no direct focus on eGov services
Kossak et al. (2001)	• report of typical HCI related problems in large systems (in this case: Austrian health insurance)
Marchionini (2003)	• invitation to discuss how HCI principles can be applied in eGov projects • two-page paper
Marchionini and Levi (2003)	• description of how HCI principles and practices are applied by the U.S. Bureau of Labour Statistics

The articles in the category "meta level" (Table 4) are of a more conceptual nature and describe different organisational aspects of eGov.

Table 4. Papers in the category "meta level"

Author	Commentary
Følstad et al. (2004)	• analysis of eGov projects • which methods of universal design and user involvement are applied • what kinds of users are involved and to which extent are they involved
Gil-Garcia and Martinez-Moyano (2006)	• eGov evolution in stages with increasing technical and organizational sophistication • evolution from national to state to local eGov • public manager's vs. citizens' and other stakeholders' goals • shift of decision-making power from public manager to citizens and other stakeholders and how to influence this shift • paper not directly HCI related
Lee et al. (2005)	• description of eGov stages and categories • assignment of business metaphors (CRM, SCM, ERP, EAI) to eGov categories • examples of eGov initiatives and activities in selected countries
OECD (2001)	• description of challenges eGov projects have to face and recommendations how they can be overcome • no direct relation to HCI
OECD (2003)	• guiding principles and recommendations how eGov can be successfully implemented and its benefits maximized • no direct relation to HCI
Scholl (2006)	• invitation to examine the differences and the similarities of eGov end e-commerce • two-page paper
United Nations, Dep. of Economic and Social Affairs (2004)	• comparative study of eGov readiness and sophistication in different countries worldwide

This literature review has shown, that many papers are concerned with design and evaluation methods. However, as mentioned by Jaeger (2003), those evaluations often use inappropriate measures and often apply a mere "report card mentality" and thus often don't yield meaningful results. Often check-lists and other tools are used that yield results that offer no information about for whom a web site is accessible in what way or why a web site is not accessible. Furthermore, papers on design methods demonstrated the practical use of such methods, but often lacked the direct collaboration of real users. Instead, students or members of the authors' research groups took part in those studies (e.g. (Robertson et al. 2005)), or collaboration was not achieved directly but by means of intermediaries (e.g. (Oostveen and van den Besselaar 2004)). Finally, although there are papers that present different methods and techniques of interaction design, the special aspects that are induced by the eGov context and the special requirements that arise in the context of a developing country are often neglected. Only one paper (Dearden et al. 2006) particularly discusses participatory and inclusive design methods in the context of eGov services, however, not in the context of a developing country. We found papers that pointed out that the simple one-to-one adoption of methods and best practices established in developed countries is one of the reasons why projects fail in developing countries. We didn't encounter literature about how those methods could be adapted to the context of eGov projects in developing countries.

4. Lessons Learned for eGov in the context of Brazil – Conclusion

In the previous sections we presented different aspects of eGov in relation to interaction design as well as a synthesis of what literature says regarding our subject matter. Most of the articles focused their investigations on projects and initiatives in highly developed industrial nations; however a few contributions also considered special aspects of

developing countries.

Regarding the motivating questions put forward in the introductory section, it has become clear that those cannot be fully elaborated in the scope of this paper. However the preceding sections provided an indication of the direction of future research. In particular, the lessons learned from the literature review point out three fundamental aspects to be considered regarding interaction in eGov systems, especially in the Brazilian context:

1. *Bridging the country context gap:*
   Based on the archetypes of eGov project failures (Heeks 2003) the three gaps (hard-soft, private-public, country context) have to be alleviated with a focus on the "country context" gap. This means we should not incur in the mistake of adhering to methods designed for other country contexts. Established methods and techniques have to be checked for suitability or adaptability to our context.
   Possible reasons for adaptation are that methods have been designed on another cultural background, without taking into account socially/digitally excluded or impaired/non-alphabetized people (e.g. how to do BrainWriting, if people can't read/write, how to test a paper prototype with a visually impaired person)

2. *Involving users:*
   Another key factor is "user involvement"; this has been identified as being crucial by many authors and participatory methods have been recommended; considering the large diversity of the Brazilian society, the methods also have to be inclusive to adhere to the Universal Design principles and to deal with the diversity of disadvantages of our population, especially the massive number of non alphabetized people.
   Can a participatory method always be executed in an inclusive way? Is it sufficient to just "ask" socially/digitally excluded persons to participate? Certainly not; new methods should be proposed for design and evaluation of interaction in eGov for our context.

3. *Providing interactivity in new ways:*
   Considering the two previous aspects, the degree of interactivity is not only dependent on the category of eGov services (information access, service access and participation), but will depend on our ability to design solutions reachable by people with the diversity of competencies we have in our population. In doing that we will be bridging the hard-soft gap, as the rational, objective and engineering driven ways taken in isolation can not cope with this challenge.

In summary, literature analysis in the preceding section evidenced that HCI methods and principles can contribute to improve eGov services in various ways. It has furthermore become clear that eGov is not simply "e-business of the government". EGov projects and applications have many particularities that make it even more important to thoroughly apply HCI methods and principles. We have shown that public institutions differ significantly from private enterprises, and that therefore the goals that have to be realized by implementing eGov services are different as well.

Since e-democracy is one of the most important goals of eGov, the target users of eGov services are not solely economically attractive users that rise sales volumes and

profits, but the whole spectrum of the population (except maybe children) within the scope of an eGov service. This means that all possible demographic dimensions (e.g. age, education, deficiencies, etc.) with all possible characteristics have to be considered. Thus, eGov services can only be successful if HCI plays a role from the very beginning throughout all phases of the whole project.

References

Acessobrasil (2004). Lei de acessibilidade - Decreto lei 5296. Available at: http://www.acessobrasil.org.br/index.php?itemid=43. Last accessed 28/03/2007.

Baranauskas, M.C.C.; Souza, C.S. (2006) Desafio 4 Acesso Participativo e Universal do Cidadão Brasileiro ao Conhecimento. Computação Brasil, Ano VII, n. 23 Setembro/Outubro e Novembro.

Barzelay, M. (2005). Gestão pública na Prática. Entrevista concedida a Cristina Penz em sp.gov, ano 2, número 6, p. 6-11.

Becker, S. A. and Nowak, L. L. (2003). Automated support for older adult accessibility of e-government web sites. In dg.o '03: Proceedings of the 2003 annual national conference on Digital government research, pages 1-4. Digital Government Research Center.

Dada, D. (2006). The failure of e-government in developing countries: a literature review. The Electronic Journal on Information Systems in Developing Countries, 26(1):1-10.

DaSilva (2006). DaSilva – O Primeiro Avaliador de Acessibilidade em Portugûes para Websites. Available at: http://www.dasilva.org.br/. Last accessed 28/03/2007.

Dawes, S. S., Pardo, T. A., and Cresswell, A. M. (2004). Designing electronic government information access programs: a holistic approach. Government Information Quarterly, 21(1):3-23.

Dearden, A., Lauener, A., Slack, F., Roast, C., and Cassidy, S. (2006). Make it so! Jean-Luc Picard, Bart Simpson and the design of e-public services. In PDC '06: Proceedings of the ninth conference on Participatory design, pages 67-76, New York, NY, USA. ACM Press.

European Commission, Information Society and Media Directorate-General (2006). Analysis of European target groups related to inclusive eGovernment. Online available at: http://ec.europa.eu/information_society/activities/egovernment_research/doc/analysis_of_european_target_groups.pdf. Last accessed 07/02/2007.

European Commission, Information Society and Media Directorate-General (2007). About eGovernment. Available at: http://ec.europa.eu/information_society/activities/egovernment_research/about_us/index_en.htm. Last accessed 07/02/2007.

Filgueiras, L., Plinio Aquino, J., Sakai, R., Álvaro Gregório Filho, Torres, C., and Barbarian, I. (2005). Personas como modelo de usuários de serviços de governo eletrônico. In CLIHC '05: Proceedings of the 2005 Latin American conference on Human-computer interaction, pages 319–324, New York, NY, USA. ACM Press.

Følstad, A., Jørgensen, H. D., and Krogstie, J. (2004). User involvement in e-

government development projects. In NordiCHI '04: Proceedings of the third Nordic conference on Human-computer interaction, pages 217-224, New York, NY, USA. ACM Press.

Garcia, A. C. B., Maciel, C., and Pinto, F. B. (2005). A Quality Inspection Method to Evaluate E-Government Sites. In Electronic Government: Internacional Conference, EGOV2005, 4, Copenhagen, Denmark, August, 22-26, 2005. LNCS, Springer, Vol. 3591, pages 198-209.

Gil-Garcia, J. R. and Martinez-Moyano, I. J. (2006). Understanding the evolution of e-government: The influence of systems of rules on public sector dynamics. Government Information Quarterly, In Press, Corrected Proof.

Halstead-Nussloch, R., Konneh, D., and Woodruff, R. (2003). Communities of design practice in electronic government. In CHI '03: CHI '03 extended abstracts on Human factors in computing systems, pages 744-745, New York, NY, USA. ACM Press.

Heeks, R. (2003). Most eGovernment-for-Development Projects Fail: How can Risks be reduced? Available at: http://www.sed.manchester.ac.uk/idpm/publications/wp/igov /igov_wp14.pdf. Last acess: 26/03/2007.

Hugo, J. and Day, B. (2001). Business: government, business, HCI, and technological development in south Africa. interactions, 8(4):25-32.

Inglesant, P. and Sasse, M. A. (2005). Situating the transient user: overcoming challenges in the design of e-Government systems. In Proceedings of the INTERACT 2005 Workshop on User involvement in e-Government projects, Rome, September 2005.

Jaeger, P. T. (2003). The importance of accurately measuring the accessibility of the federal electronic government: developing the research agenda. Information Technology and Disabilities E-Journal, 9(1). Available at: http://www.rit.edu /~easi/itd/itdv09n1/jaeger.htm. Last accessed 19/03/2007.

Jaeger, P. T. (2004). Beyond Section 508: The spectrum of legal requirements for accessible e-government Web sites in the United States. Journal of Government Information, 30(4):518-533.

Kavanaugh, A., Isenhour, P., Pérez-Quiñones, M. A., and Dunlap, D. (2005). Modeling online participation in local governance. In dg.o2005: Proceedings of the 2005 national conference on Digital government research, pages 63-64. Digital Government Research Center.

Kossak, F., Eßmayr, W., and Winiwarter, W. (2001). Applicability of HCI research to e government applications. In ECIS 2001: Proceedings of the 9th European Conference on Information Systems, Global Co-operation in the New Millennium, Bled, Slovenia, June 27-29, 2001.

Lee, S. M., Tan, X., and Trimi, S. (2005). Current practices of leading e-government countries. Commun. ACM, 48(10):99-104.

Maciel, C. and Garcia, A. C. B. (2006). DemIL: an online interaction language between citizen and government. In WWW '06: Proceedings of the 15th international

conference on World Wide Web, pages 849-850, New York, NY, USA. ACM Press.

Marchionini, G. (2003). Birds of a feather session: HCI and usability. In dg.o '03: Proceedings of the 2003 annual national conference on Digital government research, pages 1-3. Digital Government Research Center.

Marchionini, G. and Levi, M. (2003). Digital government information services: the Bureau of Labor statistics case. interactions, 10(4):18-27.

Martin, D., Rouncefield, M., and Sommerville, I. (2002). Applying patterns of cooperative interaction to work (re)design: e-government and planning. In CHI '02: Proceedings of the SIGCHI conference on Human factors in computing systems, pages 235-242, New York, NY, USA. ACM Press.

Misra, D. C. (2007). Defining e-government: a citizen-centric criteria-based approach. In Proceedings of the 10th National Conference on e-Governance, February 2-3, 2007, Bhopal, Madhya Pradesh, India.

Müller, H. (2004). eGovernment - Begrife, Stand, Perspektiven. Available at: http://www.fortmuehler.de/admac/mueller-akit04-web.pdf. Last accessed 07/02/2007.

Nielsen, J. (1993). Usability Engineering. Morgan Kaufmann, San Diego, CA, USA.

Oostveen, A.-M. and van den Besselaar, P. (2004). From small scale to large scale user participation: a case study of participatory design in e-government systems. In PDC 04: Proceedings of the eighth conference on Participatory design, pages 173-182, New York, NY, USA. ACM Press.

Organisation for Economic Cooperation & Development (2001). The Hidden Threat to e-Government (Policy Brief). Available at: http://webdomino1.oecd.org/COMNET /PUM/egovproweb.nsf/viewHtml/index/$FILE/TheHiddenThreattoEgov.pdf. Last accessed 07/02/2007.

Organisation for Economic Cooperation & Development (2003). The E-Government Imperative (OECD E-Government Studies). Available at: http://webdomino1.oecd.org/COMNET/PUM/egovproweb.nsf/viewHtml/index/$FIL E/E-Government%20Imperative%20Final().pdf. Last accessed 07/02/2007.

Organisation for Economic Cooperation & Development (2007). About OECD. Available at: http://www.oecd.org/about/0,2337,en_2649_201185_1_1_1_1_1,00.html Last accessed 15/02/2007.

Pimenta, M. S., Castro, T. L., Viero, D. M., Nakayama, L., Friguetto, M., Cavalheiro, A. P., Miletto, E. M., and Borges, R. C. M. (2002). A (in)acessibilidade de sites governamentais. In V Symposium on Human Factors in Computer Systems. Anais do Proceedings of IHC 2002, pages 336–347.

RC (2004). Relatório Consolidado de Oficinas de Planejamento Estratégico do Comitê Executivo do Governo Eletrônico. Gov.br

Robertson, S. P., Achananuparp, P., Goldman, J. L., Park, S. J., Zhou, N., and Clare, M. J. (2005). Voting and political information gathering on paper and online. In CHI '05: CHI '05 extended abstracts on Human factors in computing systems, pages 1753-1756, New York, NY, USA. ACM Press.

Sociedade Brasileira de Computação (2006). Grandes Desafios da Pesquisa em Computação no Brasil – 2006 – 2016. Relatório sobre o Seminário realizado em 8 e 9 de maio de 2006. Available at http://www.sbc.org.br/. Last accessed 19/02/2007.

Scholl, H. J. J. (2006). What can e-commerce and e-government learn from each other? In dg.o '06: Proceedings of the 2006 international conference on Digital government research, pages 454-455, New York, NY, USA. ACM Press.

Singh, S. and Kotzé, P. (2002). Towards a framework for e-commerce usability. In SAICSIT '02: Proceedings of the 2002 annual research conference of the South African institute of computer scientists and information technologists on Enablement through technology, pages 2-10, , Republic of South Africa. South African Institute for Computer Scientists and Information Technologists.

Tambouris, E., Gorilas, S. and Boukis, G. (2001). Investigation of Electronic Government. In Proc. of the 8 Panhellenic Conference on Informatics, pages 367-376.

Tangarife, T. and Mont'Alvão, C. (2005). Estudo comparativo utilizando uma ferramenta de avaliação de acessibilidade para web. In CLIHC '05: Proceedings of the 2005 Latin American conference on Human-computer interaction, pages 313–318, New York, NY, USA. ACM Press.

United Nations, Department of Economic and Social Affairs (2004). Global E-government Readiness Report 2004: Toward Access for Opportunity. Available at: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan019207.pdf. Last accessed 07/02/2007

United States General Services Administration (2007). Section 508: The Road to Accessibility. Available at: http://www.section508.gov/. Last accessed 28/03/2007.

Vassilakis, C., Laskaridis, G., Lepouras, G., Rouvas, S., and Georgiadis, P. (2003). A framework for managing the lifecycle of transactional e-government services. Telemat. Inf., 20(4):315-329.

W3C Web Accessibility Initiative (2006a). Web Content Accessibility Guidelines. Available at http://www.w3.org/WAI/intro/wcag.php. Last accessed 28/03/2007.

W3C Web Accessibility Initiative (2006b). Policies Relating to Web Accessibility. Available at http://www.w3.org/WAI/Policy/. Last accessed 28/03/2007.

WebXACT (2004). WebXACT a free online service that lets you test single pages of web content for quality, accessibility, and privacy issues. Available at http://webxact.watchfire.com/. Last accessed 28/03/2007.

Wimmer, M. (2001). European Development towards Online One-stop Government: The "eGOV" Project. In Proceedings of the ICEC2001 Conference.

Zappen, J. P., Adali, S., and Harrison, T. M. (2006). Developing a youth-services information system for city and county government: experiments in user-designer collaboration. In dg.o '06: Proceedings of the 2006 national conference on Digital government research, pages 259-264, New York, NY, USA. ACM Press.