Improving Usability and Accessibility

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Abstract: There are significant barriers preventing many users, often disadvantaged citizens such as people with disabilities and elderly people, from accessing many services and information provided by e-solutions, especially governmental and commercial web sites and public access systems. Tenuta is a project funded by the European Union (EU) that is helping improve the usability and accessibility of e-services supported by the EU eTEN programme, by providing guidance on how to produce e-services that are not only accessible, but also easy to use. The paper explains why usability and accessibility are important and the economic and social benefits that can be obtained from improved usability and accessibility. Tenuta has supported projects in the use of well established but pragmatic usability and accessibility methods and techniques. Projects are reviewed, e-solutions evaluated and improvements to both process and product recommended. Few projects have existing expertise in this area, which presents a major risk to the successful uptake of the project results.

Keywords: usability, accessibility, validation

1. Introduction

There is a significant barrier preventing a large number of citizens from making effective use of the e-services provided by governmental and commercial web sites and public access systems. The usability and accessibility of e-services must be improved so that they are easy to use and accessible to people with disabilities and elderly people and other emerging groups such as people who have immigrated from one country or culture to another.

Tenuta is a project funded by the European Union (EU) from 2005 to 2007 that is helping improve the usability and accessibility of e-services supported by the EU eTEN programme [11], which supports the roll-out of e-services across Europe. Tenuta runs training courses and can provide projects with assistance either on-site or remotely.

This paper summarises the potential benefits of usability and accessibility, and explains the approach that Tenuta has taken to providing EU projects with support.

2. Benefits of Usability and Accessibility

One of the strategic objectives of eTEN is: "To enable citizens to derive full benefit from the single market [in the EU] and the information society" [11]. This can only be achieved if e-services are both usable and accessible.

Many web developers know that web accessibility is important, but many do not understand the intricacies of the Web Content Accessibility Guidelines [8] developed by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium, or know how to apply them. For example, a recent investigation for the British Disability Rights Commission [8] found that only 9% of web developers surveyed claimed any expertise in accessibility issues

2.1   eInclusion

The objectives of eInclusion in eTEN are "to address the specific needs of people with disabilities, the elderly and the socially disadvantaged, to contribute to overcoming socio-economic, educational, geographic, cultural and gender barriers and to favour the prevention of new risks of 'digital exclusion'" and "the promotion of independence and the assistance of participation in society for the widest possible range of users" ([11]).

At the launch of the European Year of People with Disabilities in 2003, the European Commission [10] estimated that there were 37 million people with disabilities within the Union; to this must be added those from the countries that have since joined the EU. Any inclusive policy must also pay particular attention to the needs of the rapidly expanding population of older people of the European Community. Thus people with disabilities and elderly people represent a substantial force within the European Union, both in numbers and a political force.

The Special European Council of Lisbon on the Information Society (March 2000) took special account of the needs of people with disabilities in drawing up the New Regulatory Framework for Electronic Communications [10] that came into force in July 2003. The Framework in particular covers access to the World Wide Web, as well as other aspects of the information society.

Accessibility has been a central plank since the launch of the Information Society initiative in 1996 [12]. The EU and its Member states have underlined their commitment to access to the Information Society by people with disabilities through establishing a special Group on Inclusive Communication (InCom) under the auspices of the Communications Committee which is responsible for implementing the New Regulatory Framework.

The Formal Investigation into Web accessibility for the Disability Rights Commission of Great Britain [8] found that most websites (81%) fail to satisfy the most basic Web Content Accessibility Guidelines category. In addition, the results of the evaluations undertaken by people with disabilities show that websites generally have characteristics that make it very difficult, for people with certain impairments, especially those who are blind, to make use of the services provided.

2.2   Matching technology to African needs

Usability has an important role to play in helping adapt technologies from the developed world and services to African cultural needs. For example, in Africa many people rely on using a mobile phone for services such as banking and health information services [9].

Many African countries also have a low level of development [29] and their consumers may not have the technical aptitude or specialised skills to use complex systems and services. The design of easier to use systems that more closely match local user needs is an important way to bridge the gap between the technologically advantaged and disadvantaged.

2.3   Special needs: accessibility and Design for All

User centred design provides a framework for achieving accessibility and Design for All. The Design for All philosophy emphasises the need to provide access to information systems for the widest possible range of users, particularly young and older people, and those with physical, sensory and cognitive limitations. User centred design provides a framework within which to identify and understand the needs of such diverse user groups, and plan for how to integrate those needs into the development process [1]. Tenuta also has access to specific information on how to design for groups with special needs.

2.4 Special needs: elderly citizens

Another issue which deserves attention for the design of information applications is the increasing proportion of elderly people in developed societies. As people grow older, their physical, visually, auditory and cognitive abilities decline. The proportion of elderly people is expected to almost double in Europe by the year 2025. By the year 2030, a third of the population will be over 60 years of age [13]. This increase in the population of elderly people needs to be considered in the light of the corresponding shrinkage in more recent generations. The number of people of working age per older person is currently 2.75, but by 2020 this will drop to 1.99 [5]. This substantial decline in person power means that older people will need to increasingly rely on technology to care for themselves.

While many people are now connected to the internet, the number of older or retired people using it is still quite small. For example, in France the internet is only used by 12% of over 55s, compared to 92% of 18-29 year olds [23]. This raises the question of whether older people will be able to enjoy the benefits of the connected future, with information available electronically on tap, and convenient and inexpensive shopping on-line. With the growing average age of the population in developed countries, systems have to take this factor into account both concerning the functional needs of this group as well as concerning the actual user interface of the system. It is also becoming a requirement in law as non-discriminative legislation is being discussed in Europe, both within separate countries and in the European Union.

2.5 Special needs: people with disabilities

Providing e-services which are more accessible and more usable will have a considerable impact on the daily lives of people with disabilities.

For people with disabilities, the accessibility and usability of both mainstream and specialist technologies is currently very poor. People with disabilities are currently very frustrated by the poor usability of their technologies and of the Internet [22], [16]. There is a very high rate of discarding assistive technology [25] that is undoubtedly related to poor accessibility and usability issues. Yet technologies can transform the lives of people with disabilities if they are designed appropriately.

Assistive technology can allow people to do things they could not previously do (e.g. non-speaking people can communicate with Augmentative and Alternative Communication devices in ways which were simply impossible before computer technology) and do things far more effectively. Access to mainstream technologies is also extremely important for people with disabilities. As able-bodied people rely increasingly on technologies such as mobile phones and digital television, there is a fundamental need to ensure that these technologies are also accessible to and usable by people with disabilities. Thus there is a great need to consider both accessibility and usability issues in technology for people with disabilities.

2.6 Industrial competitiveness

Usability for all should be the major design objective for an interactive product or system: that it can be used for its intended purpose by the intended users. Increased usability and accessibility will bring significant benefits to European industrial competitiveness.

Most existing approaches to software and systems quality focus exclusively on adherence to technical and process requirements. Insufficient consideration of user needs and consequent poor usability has been one of the major reasons why systems are either partially used, misused, abused, not used at all or have failed to gain broad acceptance. This problem is being aggravated as public users become an increasingly relevant target group for the information market. Especially for public users, applications have to be easy to use

and must address usability aspects such as enjoyability that are usually neglected in professional applications.

2.7   Reducing risk of failure

The Standish Group [26] found that only 34% of IT projects completed were on time, on budget, and delivering the functionality required; 51% of IT project were "challenged"—meaning that they were not on time, not on budget, or not delivering the functionality required; and 15% of IT projects failed or were abandoned. One of the major causes is inadequate user requirements. User centred design is a very cost-effective means of identifying user requirements and reducing the financial risk of releasing a system which will fail to meet its objectives in use [20].

3.   Providing guidance to EU-funded projects

In many organisations accessibility and usability are the responsibility of people with different skills: technical design of the user interface and human issues. Neither approach alone is sufficient. Only by integrating these approaches during development (see for example [17]) can people with disabilities and older people be given increased autonomy and the potential to play a full role in society.

Also guidance must be made easier to implement. Many organisations pay lip service to ease-of-use without employing any specific methods to ensure that it is achieved. Many web developers know that web accessibility is important, but admit they do not fully understand relevant guidelines such as the Web Content Accessibility Guidelines (WCAG) ([28]) or how to apply them. More importantly, it is clear from our experience of working with a wide range of organisations, that the rationales underlying many accessibility guidelines are not understood. A key aspect of the accessibility work within Tenuta has been supporting the use of WAI recommendations.

Projects without previous experience of using usability/accessibility methods generally have great difficulty understanding how to apply the methods until they have been given some personal assistance. For example, one author's experience in training web developers in accessibility has been that developers need practical experience of seeing people with disabilities attempt to interact with web pages with examples of WAI compliant and non-compliant code before they really grasp the importance of conforming to the guidelines. This is in spite of the fact that they often initially say they are aware of the guidelines and know what assistive technologies people with disabilities use in accessing the Web (e.g. screen readers for blind people, screen magnification programs for partially sighted people).

Tenuta only has resources to give each eTEN project supported between 3 and 10 person days assistance. The challenge has been to use this effort effectively. Usability is not common sense, and it is not easy for amateurs to make use of usability methods [4]. But Bevan [2] has shown that with hands-on training, existing design and development staff can learn to use simple usability methods. Tenuta provides projects with basic training in the use of simple methods. The typical sequence of activities is:

- An audit of any prior activities undertaken by the project to achieve usability and accessibility.
- A review of how much is known about the intended context of use (intended user groups and user characteristics, main user tasks and usage environment) and user scenarios. This is an essential pre-requisite for prioritising subsequent work on usability and accessibility, but in our experience, this information is rarely defined in sufficient detail (cf ISO 13407 [18]). The resulting concrete descriptions of the types of users and their tasks helps create awareness of usability and accessibility issues in the development organisation.

- Carry out a detailed expert evaluation of the usability of the prototype from the user's perspective, and a detailed expert accessibility audit, make appropriate recommendations and discuss how they could be implemented.
- The information from these activities provides the basis for discussing the extent to which usability and accessibility are prerequisites for successful implementation of the system being developed, and the risks to success of the project if at least minimal usability and accessibility is not achieved.
- Agree the future activities needed to achieve the usability and accessibility objectives, and the degree of training and support required to carry out these activities.
- Provide training and support as necessary. This could include basic training in usability and accessibility methods, and/or hands-on training to assist existing staff in adopting simple design and evaluation techniques.
- Obtain feedback from the projects on the extent to which the usability and accessibility targets are met.

The objective is to achieve a major improvement in usability and accessibility as a result of providing each project with this support, followed by telephone and email back-up.

4. Results

The eTEN programme management expected that offering free usability and accessibility support would be in great demand by eTEN projects, but the first announcement of our services by eTEN met with no response. What we gradually learned was that most projects had little or no experience of usability and accessibility, and they were reluctant to invite an unknown third party to assist them, even one endorsed by the eTEN project management. Most projects that we have assisted initially had prior personal contact or personal recommendation.

We therefore modified our marketing strategy and focused on meeting projects, by attending EU meetings and workshops, and organising training courses. Projects were much more willing to initially commit to sending people to a two or three day training course, than committing to one or two days on site support. Following attendance at the course, many projects then requested more specific support.

Tenuta has provided support for projects in a variety of application domains.

4.1 eGovernment

In the UK there is a growing awareness of accessibility and usability problems with government web sites. The government e-Envoy recently said that "UK government web sites tend to be boring and inaccessible, ie useless in many respects". The UK government has issued its own guidance on user centred design [21]. However, this has been criticised as too complex and difficult to follow [14].

The Swedish National Audit Office has investigated the usability and accessibility of 92 Swedish public sector and governmental agency web sites [24]. Not one site conformed to WCAG guidelines. There was very little consistency, and users were forced to learn new structures, navigation techniques, menus, link locations and functions for each web site they visited. This challenged all users, but particularly people with disabilities and elderly people and those with little or no computer experience. Other common problems were poor navigation, which did not support the task at hand, or a structure that did not reflect user expectations. People with learning disabilities and those with reading and writing problems were particularly affected. Link names, graphics and pictures were not adapted to technical aids for the visually impaired (such as screen readers). Information was published in a format that could not be used by people with disabilities.

4.1.1 Tenuta eGovernment Case Study

Tenuta worked with an eTEN project that is creating a European service to assist Local Authorities in the effective use of multimedia and webcasting to create and deliver audiovisual content that really makes an impact in local communities.

To assess the accessibility of the webcasting eService, it was decided that testing by users with disabilities who use assistive technology was vital, because of the use of an embedded media player in the service. Such a service can (and has) been made accessible in other projects we have advised, but to assess the real accessibility of the solution goes far beyond the specificity of the current WCAG accessibility guidelines. The particularly difficult case is whether the solution will be accessible to screenreader users.

Therefore two highly experienced screenreader users were recruited to test the solution, who could make most use of the functionality of their screenreader, and possibly try different methods for accessing the webcasts. If these users could successfully use the solution then it could subsequently be tested by less experienced screenreader users and users of other assistive technologies.

A testing protocol was established by Tenuta in collaboration with the eParticipate team, to ensure that all the key functionalities of the solution would be assessed for accessibility. This took the form of a scenario of five tasks that the users would work through, trying different tasks with the webcasting system.

Two highly experienced users, one who uses the JAWS screen reader and one who uses WindowEyes were recruited to take part in this initial testing. The JAWS user worked through the scenario, but could not access the webcast at all. Neither could he access some of the information in the titles to the webcast which the team had thought might be accessible. The WindowEyes user had to cancel his session due to family problems, but given the problems by the JAWS user, it was decided to postpone the session with the WindowEyes user until more work has been done on the accessibility of the solution based on the results so far.

4.2 eLearning

In an analysis of three commercial eLearning packages, Frontend [15] found that serious usability problems were common, including:
• Counter-intuitive reading order of on-screen material
• Failure to relate to the real-world experience of the user
• Poor presentation of key information
• Lack of accessibility, even in the most basic sense

Bevan and Kincla [3] have produced specific HCI design guidelines for eLearning, based on a review of research and good practice.

eLearning also poses severe accessibility problems for students with disabilities. In the UK, commercial eLearning training programmes, which claim to be accessible (and compliant to Section 508, the accessibility-enabling procurement legislation in the USA), were found to be completely inaccessible and unusable to blind and partially sighted students. This was a result of incomplete and inappropriate use of Section 508 [7].

4.2.1 Tenuta eLearning Case Study

Tenuta assisted a project that supports educational use of robotic telescopes.

A usability review noted that the site has an attractive graphical design, and contains a wide range of useful information and facilities. But as with many project web sites, the dual function of project and e-service needs to be resolved.

The innovative design imposes some constraints on screen layout that affect usability. It requires a 1024 x 768 screen resolution, separates the main and submenus, and does not provide room for an explanation of the site or news items. But feedback from user testing

would be needed to prioritise any changes, which would be expensive to implement at this late stage.

The organisation of menus should be reviewed to make items easier to find, and a consistent convention adopted to indicate clickability.

An accessibility review found many changes that would be needed to make the site accessible: missing alt tags on images, links with no labels, text that could not be zoomed, pages that could only be used with Javascript and ActiveX, and moving content that could not be frozen.

4.3 eHealth

Usability is a critical factor for the success of eHealth applications. There do not appear to have been studies in Europe, but studies in the US have shown that most health web sites have low usability [6]. The US Department of Health and Human Services has funded comprehensive guidelines for website usability and accessibility [27]. Significant usability problems have also been found with medical information technology in patients' homes [19].

4.3.1 Tenuta eHealth case study

Tenuta reviewed the usability of a web service that provides information for doctors that is not easily available elsewhere. The project had demonstrated their web solution to doctors and incorporated some feedback. The project was visited by Tenuta shortly before a planned validation in several countries by 500 doctors.

The usability review suggested that it is unlikely that any experienced web user who makes the effort to familiarise themselves with the site will encounter any major problems. However, doctors are often busy and impatient, and may not devote the effort to become familiar with the site, and are unlikely to spend much time reading documentation. Users who have initial problems are unlikely to return. So the site should be as easy as possible for first time users.

In addition, the acceptability and usefulness of the site for doctors may depend on minor issues that can only be identified when doctors try using the site, so Tenuta strongly recommended initial in depth pilot testing with a few selected doctors.

The project had also prepared a very complex validation questionnaire. Tenuta recommended that it should be limited to about 10-15 simple questions, as additional questions or a complex questionnaire would significantly reduce the response rate.

Following the visit, Tenuta contacted a doctor by telephone, explained what the site was for, and asked them how they might use it. The doctor was invited to try carrying out their own tasks, and to explain their experiences over the phone. After only a few minutes the doctor commented: "It is so long winded that I would never in a million years use it". There were problems with the complexity of the interface, interpreting the results, and incomplete information in the underlying database. If these findings were replicated with other users, it would confirm the danger that validation trials using the existing version of the web site could be a complete disaster!

This highlights the risk of just relying on demonstrating a solution. The way the web site works may make sense to the audience at the time, but nevertheless leave them mystified if they sit down and try to use it unaided.

5. Conclusions

To our concern, none of the 20 projects that Tenuta has assisted so far through training or on-site support had previously employed any usability methods, and most have ignored accessibility. None of the projects contained any people qualified in usability or accessibility. Many of the e-services we evaluated had poor usability and most were not

accessible to people with visual disabilities. As a result, the potential commercial success of the project solutions was put at high risk.

Projects wanted on-site support mainly to obtain feedback on the usability and accessibility of draft web sites and applications. Correcting problems at this late stage can be very expensive and disruptive to project schedules. A better understanding of user requirements and iterative development of prototypes would ameliorate these risks.

In every case there was very positive feedback on the benefits provided by our support. Although we have been very successful in raising awareness, it is too early to know to what extent our original objective of transferring skills to the projects has been successful.

The challenge for the European Commission is to find effective ways to help projects build in usability and accessibility at the very early stages.

In future, the EU must be more demanding when vetting all types of proposal for funding, but particularly for near-market projects such as those in the eTEN programme. For example:

- Usability requirements must be derived from an in-depth understanding of user needs. The risk of product failure will be high in the absence of these requirements, and more emphasis must be given to project competence in defining usability requirements, and designing systems that meet these requirements.

- A common and serious misconception frequently encountered was that the best way to get user feedback on a service was to demonstrate it to potential users. This is not acceptable and projects working with potential users must be required to include tried and tested methods such as one-to-one usability testing as part of the validation activities.

- There is increasing emphasis within the EU on producing products and services that are accessible to users with disabilities and to older users. Legislation already exists in some member states, and a common EU position is likely in the future. It is essential that projects be required to take necessary steps to develop systems that are accessible.

Proper attention to usability and accessibility throughout the design process should be mandatory in this type of EU project. At a minimum, projects should be required to implement the fundamental principles of ISO 13407 [18] and to achieve at least WCAG AA conformance [28].

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