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# Usability of e-Government web sites: the good, the bad and the ugly

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## Introduction

As part of the Government's "UK Online" initiative, public services provided by local authorities should be accessible over the internet by 2005. This e-government initiative aims at improving the quality, accessibility and cost effectiveness of public services through the use of information and communication technology. This presents a great opportunity for an efficient delivery of services anytime and anywhere. True, it might not be everyone's dream to submit a planning application at 2am, but e-government is offering genuinely exciting ways to deliver a variety of public services. As a local service, the potential to use place-based information is wide and it is not surprising to discover that spatial information and GIS are expected to play a role in many e-government applications.

If the take-up of e-government services is high and many of the repetitive tasks of citizens' interactions with their local authority is automated, the latter will be able to redirect its limited human resources to tasks that require human decision making. At the same time, local residents will enjoy improved access and delivery of public services as they will be able to use them around the clock.

Therefore, it is crucial to fulfil this vision and to ensure that e-government projects do not turn into white cyber-elephants. This requires that the first goal is fulfilled—high take up. We will argue here that Usability Engineering can provide a key ingredient to achieving this goal. Usability Engineering is a field that provides empirical mechanisms to ensure that a computer application is easy, safe, functional, effective and enjoyable to use (Preece, 1994). Our interest here is to focus on Usability Engineering and its implications for geographic information applications within e-government projects. But before we turn to this, we will provide a brief review of Usability Engineering.

### Usability Engineering as a field of Human-Computer Interaction

Usability Engineering is a part of Human-Computer Interaction (HCI), a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and the physical, organisational and social environment surrounding them. HCI aims at meeting the requirements of all users so that they can carry out their tasks effectively and efficiently. J. Nielsen, one of the leading experts in Usability Engineering, defines usability as the field that deals with these aspects and the question of how well users can interact with the functionality provided by a computerized system.

The origins of HCI are commonly traced back to the 1940s when the first devices for individual use that could speed up routine tasks and time consuming calculations were proposed. Since then many fields and disciplines, such as computer science and graphics, psychology, operating systems, human factors, ergonomics, cognitive science and anthropology, among others, have contributed to HCI's interest of augmenting the potential of computers for aiding human problem solving and creativity. In this sense, HCI is based on knowledge about computing technology, as well as the people that interact with it.

HCI has been influenced by the technological developments that have made the computers sitting on our desks faster, smaller, more powerful and affordable, as well as by the implications of human perception, attention, memory, learning and problem solving in computer system design. Today, there is an avenue of research in HCI concerned also with social issues, such as improving the access to computers by larger and

more diverse user groups that include disadvantaged and disabled users. When these users interact with a computer system, it is the role of Usability Engineering to improve the system's interface in a way that facilitates the human-computer communication (Preece, 1993; Nielsen, 1993).

A system's usability can be defined in terms of its learnability, efficiency, memorability, error rate, flexibility and user satisfaction (Nielsen, 1993), and it is the concern of Usability Engineering to evaluate or measure these attributes. The ease of learning of a product is measured as the time it takes a person to attain some level of proficiency in using it. Efficiency refers to the level of productivity that the user can achieve once the system has been learned. Memorability measures how easily a system is remembered either after a period of disuse or casual use. Measuring the error rate in the context of Usability Engineering involves quantifying and understanding the actions that do not accomplish a desired goal. Flexibility refers to the extent to which a system can accommodate tasks or environments for which it was not originally planned. Finally, satisfaction refers to how pleasant the system is to use.

Addressing these usability issues can greatly improve an application in terms of ifs efficacy for supporting user tasks and experience. Information and communication technology enables us to provide sophisticated applications and services that can be accessed by increasingly large audiences. However, they are ineffectual if they are not used. In this sense, assuring a system's usability can contribute significantly to its take-up.

### Usability and Geographic Information

Usability is also addressed in the field of Geographic Information Systems (GIS) particularly after functionality such as map production, display and spatial data analysis were established as commonly provided features. Concerns about increasing processing speed and storage requirements broadened to include how GIS were used and how they could accommodate users who are not necessarily experts in GIS but only wish to take advantage of the technology to get their work done. This has prompted interest, not only in interface design, but also in cognitive issues of geographic information, such as understanding user behaviour and the type of tasks different users need to accomplish when using spatial information. Research on these issues has provided insights and guidelines as to how geographic information should be presented. Combined with research on web usability, this knowledge offers guidance on how to build web applications with mapping components that are more effective, enjoyable and understandable for particular user groups.

### Why are e-government projects challenging?

So what has all this got to do with e-government projects? Quite a lot, as it turns out. When considering the special issues that confront e-government projects, three challenges emerge. First, the challenge posed to the application's design due to the diversity of users that may access it. Second, the varied nature of the tasks the users may want to perform, most of which maybe relatively complex, but done rarely or even only once. Finally, the challenge posed by accommodating users that may access the services from a variety of locations and access devices. Each of these topics poses special problems that need to be taken into account when designing and deploying e-government applications. In the following discussion, we look at each of these in more detail.

Users of e-government public services can be very diverse. Services may be demanded by the young or elderly, by people with varied levels of computer literacy—from the novice to an expert—as well as a variety of socio-economic and ethnic backgrounds, educational attainments and even levels of proficiency with the English language. This heterogeneity of users can be challenging and must be addressed. Lessons learned from Usability Engineering and other web applications—as in the case of web portals or search engines—can aid us in dealing with accommodating diverse users of e-government applications.

The concept of structuring many of the services around 'life events' (i.e. tailoring a set of services that are adequate for people who are looking to enroll their children in the education system, move in or out from the local authority area) is an excellent one. It fits very well with the HCI principle of user centred design (UCD)–-providing applications according to the ways in which users think and which address their requirements and needs. However, the 'life events' metaphor highlights the second challenge of some e-government applications—dealing with events that happen rarely or even once in a lifetime. From the user's perspective, the application should be self understood without any training, the very first time they access

it. Making an application easy-to-use can conflict with the amount of detail that users may be required to fill-in and enter. For example, filling-in an online planning application is a relatively complex process. While some professionals will use such a system on a regular basis and therefore will be willing to persevere in learning an application, many users will use it only rarely. Thus, there is a need to account for different tasks and design the system's interface in such a way as to also support a successful once-only or infrequent use.

Finally, there are technical and social aspects that must be taken into account. Two significant aspects are the location from which users will access e-government services and the access device. In terms of location, e-government services may be used from home where narrow bandwidth is a limiting factor on the amount of graphics, or from cyber-cafés where issues of privacy and data protection are important. The location, combined with the access device, presents specific challenges that must be considered carefully.

Taken together, the challenges are formidable. However, the knowledge gathered in the last decade, especially within the area of commercial Internet applications, can be used to make e-government services accessible and useful.

## Serving GIS in e-government: what's good and bad and why it doesn't need to be ugly

Some examples can put the concepts of usability engineering into practical terms. The selection here is from two projects that provide examples of how different aspects of usability can be improved by the collection of empirical data and using relatively simple tests. We start with an example from the mapping interface of Wandsworth's Pathfinder project, which demonstrates how a simple aspect such as labelling can contribute to the usability of an application. The second example is from the Office of the Deputy Prime Minister (ODPM) initiative for developing statistical boundaries for town centres and demonstrates how the software can be altered in a way that will facilitate improvements while it is being used.

### Making things easy to use …

In the recent Wandsworth Pathfinder project, a mapping interface was developed as part of an online planning application. The map in the application, however, was also designed to support more complex tasks, such as the designation of an area of interest (so called "my community"), or receiving updates on issues that related to that area, such as new planning constrains. Usability considerations, particularly user requirements, were integrated in the design of the interface from its early stages of design. The final interface is presented in Figure 1. The four tags point to elements of the interface that were altered during the design to improve its usability.

It is important to note that a beta version of this interface was tested by a group of potential users. The testing session was carried out by asking the participants to perform typical tasks with the system that involved the use of the map, such as navigating on the map to a specific location, finding out information about a site, and querying information from the Unitary Development Plan. All the actions of the participants where recorded and analysed and a report was prepared with recommendations for interface improvements. The application was designed and developed by MVM Consultants plc, while we performed the usability study that provided recommendations for its improvement. Two simple examples can illustrate this point further.

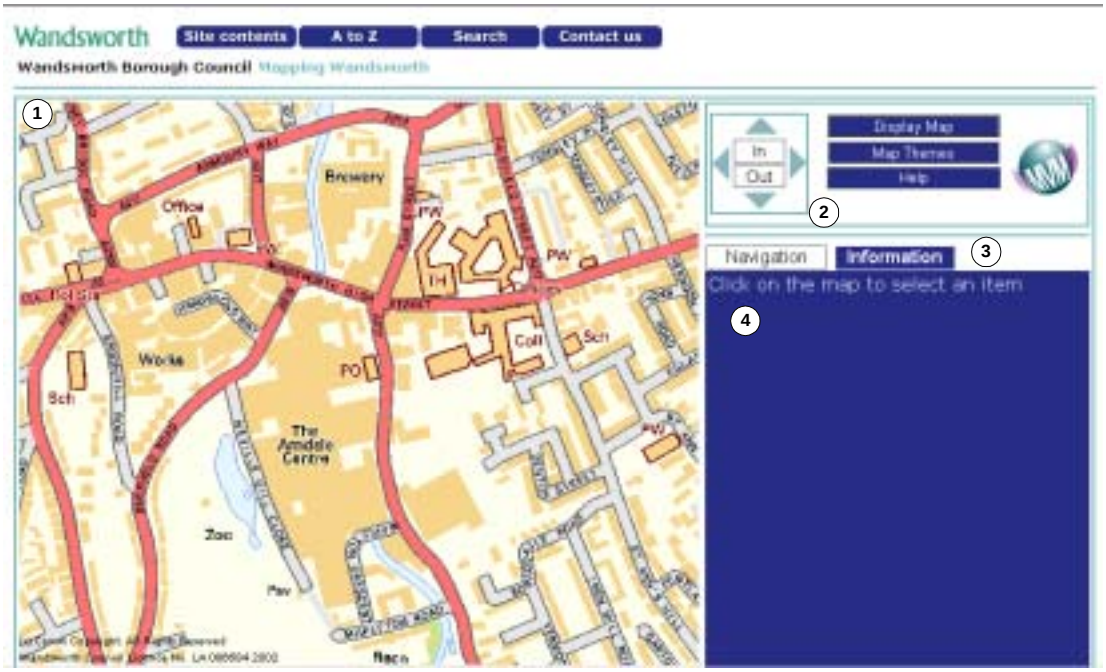


*Figure 1 The mapping interface for Wandsworth Pathfinder project*

The area assigned to the map and marked with a (1) in Figure1, is the part of the application with which the users mostly interact to obtain information. When the map area is small, as in the case of the Environment Agency site shown in Figure 2, the user has to constantly pan or zoom-in and out, easily loosing spatial context. More importantly, if working from a slow connection, users can find the application too slow to be useful or effective. For this reason, the map area in the Wandsworth's online planning application was given priority in terms of the space it occupies on the user's screen.


*Figure 2 Environment Agency web site*

After testing the interface with actual users, the control buttons of the interface (area (2) in Figure1) were grouped into logical sets. The main navigation buttons occupy a relatively small space and enable the user to zoom in and out and pan the map. Other functionality (areas (3) and (4) in Figure1) such as other navigation operations and information about features on the map, were broken into two distinctive sets of operations. The area with information about a selected object (area (4) in Figure1) provides an example of how clear labelling can improve the understanding of the interface. Originally, the default message of 'no item selected' did not provide users with any information about operating the application but appeared unrelated to it. This was a source of confusion and hence was replaced in the final version with a more meaningful label such as 'click on the map to select an item', which made the interface somehow clearer and gave an indication of how to operate the application.

To summarise, within the Pathfinder project, it was possible to integrate usability elements to the design and to test it before releasing the application. Testing the beta interface on real users provided good empirical guidance on the issues of the interface that required improvements.

### Finding out what the users do

Within the ODPM project for developing statistical boundaries for town centres, a dedicated internet application was developed to enable local authorities to validate the datasets used in the town centres boundary determination. The application itself relied on the extensive use of maps delivered by a server. Since most of the interaction between end-users and the system was dedicated to the delivery of maps, download speed of the maps was a main limiting factor. To improve the usability of this application, we used web server logs to collect information about the spatial extent of the map that the users interacted with during the regular operation of the application. A web server is a program that serves the files that form web pages to web users. A web server's access log, or the list of all the requests for individual files from the website, can therefore provide rich information to reconstruct a users' interaction with the application. Every time the users requested a map in our application, the scale and extent was recorded in a dedicated table. After testing the application on a selected group of users, it was possible to identify the scale that was used most of the time. This in turn, enabled us to add a dedicated button on the interface to bring the users into the preferred zoom scale by clicking on the map only once (see circled button in Figure 3). This saved users considerable time that was initially spent in zooming and panning the map and allowed them to concentrate in their data analysis task.

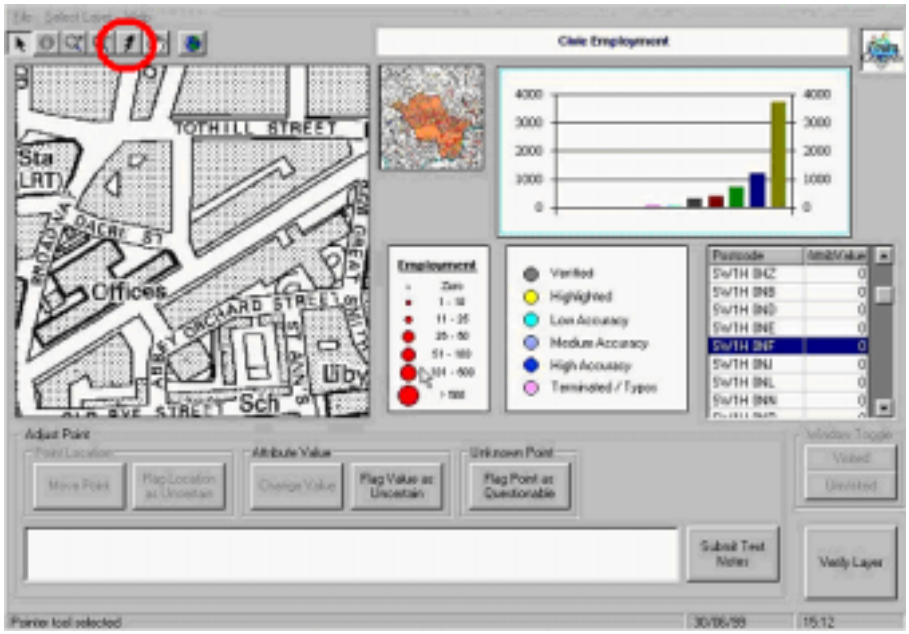


*Figure 3 Data Verification tool (indicated by red circled button)*

### Conclusions

To sum up, e-government projects are some of the most exciting and challenging projects that local authorities, GIS vendors, solution providers and their users will face in the near future. It is necessary to understand and evaluate the difficulties these projects pose and to use this knowledge as a source for a

better and more successful development. Usability Engineering provides a range of methods and techniques that will enable the development of successful applications. The use of these methods should be integrated in e-government projects from their early design stages, as this will reduce the overall costs of the development. It is also important to note that usability testing should not be a costly element of the project. The current practice supports the use of small testing groups (10-20 users) and one or two sessions. This can be accomplished within a limited time scale of a week or two, and when this is well integrated with the development cycle of the application, usability aspects can be solved.


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Preece, J., Rogers, Y., Sharp, H., Benyon, D., Holland, S. and Carey, T. (1994) Human-Computer Interaction (Harlow: Addison-Wesley).


## Further information

There are many books about usability engineering, but two of the more commonly cited are:

Landauer, T. K. (1995) The Trouble with Computers (Cambridge, MA: MIT press).

Norman, D. (1998) The Design of Everyday Things. (London, MIT press).

There are also a few books that are dedicated to HCI and GIS:

Nyerges, T. L., D. M. Mark, R. Laurini and M. J. Egenhofer (Eds.) (1995). Cognitive Aspects of Human-Computer Interaction for Geographic Information Systems. Dordrecht: Kluwer Academic Publishers, 435.

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Medyckyj-Scott, D. and Hearnshaw, H. M. (Eds.) (1993) Human Factors in Geographical Information Systems (London: Bellhaven Press).

**For web usability issues it is recommended to start with** www.useit.com, a web site developed and maintained by Dr. J.Nielsen.

**For a dedicated e-government usability web site, see** www.usability.gov

**For more information on the e-government initiative, see** http://www.ukonline.gov.uk/ or http://www.local-regions.odpm.gov.uk/consult/egov/pdf/lgo_main.pdf

**For more information on the Pathfinder projects, see** http://www.lgolpathfinder.gov.uk/

**For more information on the Town Centres Project, see** http://www.casa.ucl.ac.uk/towncentres/