Usability for Memory Institutions: Experience of CALIMERA project

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Abstract. Libraries, museums and archives offer a growing number of ICT-based services to a wide spectrum of citizens with diverse abilities, knowledge and needs. Social mission, information policy oriented to provide maximum benefits for users of electronic services, new requirements for quality management encourage memory institutions to involve usability concerns into their daily activities. Increasing significance of usability is also related to the new roles of cultural heritage institutions either as customers of digital products to support their own services or as members of design teams developing new ICT-based systems. The aim of this article is to provide an overview of current achievements in the field of usability and delineate the emergent challenges and perspectives for the future research to adopt these principles in memory institutions. This article summarizes the experience gained participating in CALIMERA (Cultural Applications: Local Institutions Mediating Electronic Resource Access, http://www.calimera.org) project funded under the European Commission Information Society Technology Programme and is based on the findings of research report "Usability of ICT-based systems: state-of-the-art review" and observations made during CALIMERA usability events – Usability Workshop in Vilnius (Lithuania) and Usability Testing Forum in Szentendre (Hungary).

In the information age, the essential function of preservation and dissemination of cultural heritage by archives, museums and libraries is performed in the digital environment by the means of modern information and communication technologies (ICT). Advanced technologies provide memory institutions with multiple opportunities for representation of cultural heritage, creating an interactive environment for communication and cultivating memories of diverse communities united by common experiences. However, digital services are a new and challenging area for museums, libraries and archives which requires collaboration both within the sector of memory institutions and private partners. Consumption of technology-mediated services may become a challenge both for memory institutions and their patrons because of different level of skills, knowledge, ability to use technologies and other important factors that limit initial advantages offered by digital tools. Growing demands to digital services and successful human-computer interaction as an important quality factor bring the field of usability to the memory institutions professional agenda.

The aim of this paper is to define the main directions and emerging challenges in adoption of general usability principles by the memory institutions. This article is intended to share experience and knowledge gained participating in CALIMERA (*Cultural Applications: Local Institutions Mediating Electronic Resource Access*) project funded under the European Commission Information Society Programme (Sixth Framework Programme, 2003-2005).

CALIMERA: a brief introduction

CALIMERA is a co-ordination action (2003-2005), aiming to assist and promote innovative application and development of ICT in the local libraries, museums and archives across Europe, enabling them to provide quality access to the electronic resources for the benefit of all citizens. Local libraries, museums and archives are an important part of European knowledge infrastructure that enables to share experience and information embedded in the memories of local communities across Europe. Exchange of knowledge and benefits gained from the use of cultural heritage materials increasingly depends on the ICT applications, therefore, the project aims to 'equip' local memory institutions with relevant knowledge reflected in guidelines, recommendations and best practices. Thus, the project contributes to the implementation of the vision 'anywhere, anytime, natural access to IST services for all' formulated in the workprogramme of Information Society Technologies.

The main goal of the project is achieved by implementation the following objectives:

- **Identification of new ICT-based solutions and research demands** to offer citizens new opportunities to benefit from local cultural heritage services and participate in the knowledge society.

- **Sensitization of national, regional and local authorities** across Europe to ensure that local memory institutions are able to adopt and implement key research outputs and technical innovation in delivering digital services, corresponding to their policy agendas, covering such areas as social inclusion, e-learning etc.

- **Integration of technological solutions within cultural heritage sector with user needs and requirements** in order to ensure effective, efficient and satisfactory user interaction with ICT-based system, or in other words, usability.

- **Dissemination, networking and training** activities to ensure benefits from the project results for local memory institutions, to bring up together and co-ordinate activities of various players in community memory, including authorities, professional bodies, industry players.

In the context of CALIMERA usability-related activities are performed under *Workpackage 3: The end-user experience: a usable community memory* that intends to set European usability framework for local memory institutions in order to improve user experience and benefits gained from interaction with cultural heritage technology-based systems. Research and consultation efforts will result in *Usability guidelines*, grounded on the findings of scientific report *"Usability of ICT-based systems: state-of-the-art review"*, experience gained during the expert workshop on usability in Vilnius and user testing and discussion forum held in Hungary (CALIMERA, 2005).

Defining usability: main concepts and approaches

Usability is an important research field in Human-Computer Interaction (HCI) that emerged after WWII and flourished in the 1980s as personal computers became pervasive in multiple areas of human activities. HCI's focus is on the communication between human and machine where both are interpreted as information processing systems. In this context, usability contributes to understanding what factors lead to successful interaction between users and computers (Hartson, 1998).

The need for user-centred design of systems emerged with the widening use of systems by users without specific education in computer science. The broad scope of human context relating to computer-based systems determined the interdisciplinary nature of HCI, embracing a wide range of

disciplines such as cognitive psychology, ergonomics, computer science, systems engineering and so on. Despite increased focus on usability in the professional HCI community, there is no common agreement between HCI professionals on a definition of the concept. Several widespread approaches to usability are introduced below.

Initially, usability referred to such terms as **ease of use**, user-friendliness, and ease of learning that implied providing users with systems *requiring minimum cognitive and physical effort* (Karat and Karat, 2003) to accomplish their tasks successfully. Understanding of usability as ease of use that contributes to quality of products is still widely accepted in the personal computing and consumer electronics industries, since the correlation between rates of purchases and user parameters became critical to product sales. However, in most cases user interaction processes and outcomes are affected by a broader context of user goals, tasks, and user environment – aspects that are not reflected in the notion of easy-to-use technology.

Pioneers of usability research, B. Shackel and J. Nielsen, included **usability** in their models of general user acceptance of the computer-based system and presented it **as a set of attributes** (e.g. learnability, memorability, efficiency, effectiveness, user satisfaction etc.) required designing a technology that would be accepted by the user. Many of these attributes identified features that can be placed in different hierarchical levels, with some overlaps; and some of them emphasize specific aspects (Folmer and Bosch, 2004).

By raising the issue of technology as a universally accepted mediator in any field of human activity in the information age and migration of public and commercial services to digital space, B. Shneiderman suggests a concept of **universal usability** that would guarantee successful utilisation of technology by any citizen. In this context, he offers not a description of usability components but a broad research agenda. It is important to note that universal usability should not be understood as universal access, which by itself does not assure usable technologies. B. Shneiderman grounds the model of universal usability on three main issues, or challenges: technology diversity, user diversity and gaps in user knowledge. Diversity of technologies covers issues of rapid technology change and challenge of compatibility. User diversity addresses issues of individual user differences (e.g. culture, personal traits, physical ability etc.). And finally, gaps in user knowledge indicate that users can differ in level of skills of manipulating technology-based system (Shneiderman, 2000, Shneiderman and Hochheiser, 2001).

Management perspective: practical issues of usability and user-centred design

Nowadays most memory institutions are providers of technology-based services and are often involved in the production of systems supporting their initiatives. When aiming to satisfy user needs and guarantee acceptable tools and environment for consuming the assets of memory institutions, it is necessary to be familiar with the main standards regulating usability. Guidance for usability management in practice is provided by ISO standards that can be differentiated into two blocks according to their approaches to usability: product- and process-oriented standards (see Table 1).
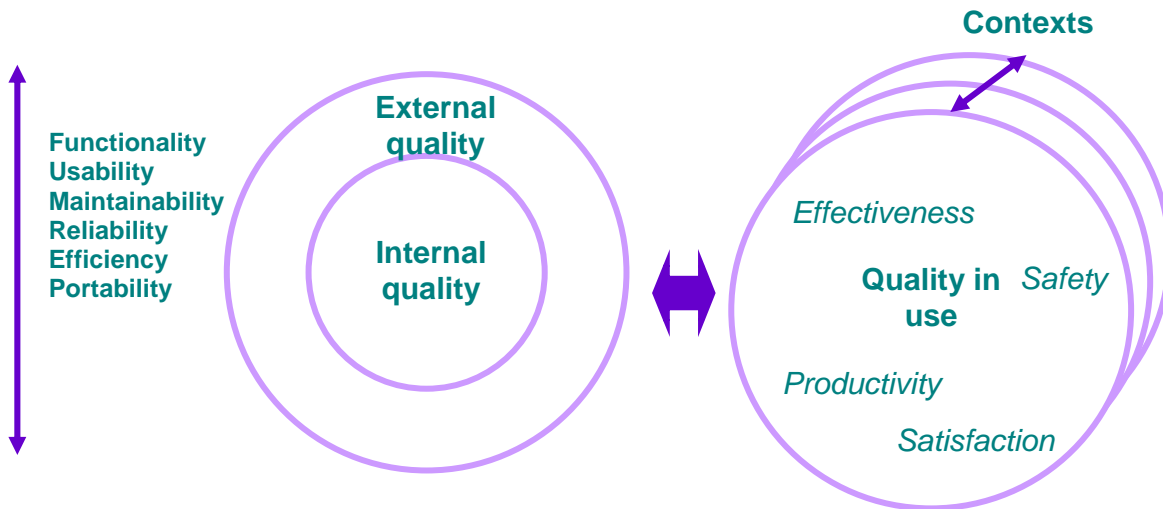
Table 1. Product- and process-oriented usability approaches in ISO standards

Product-oriented approach	Process-oriented approach

ISO/IEC 9126-1: Software engineering – Product quality. Part 1: Quality model (2001), ISO, Geneva, 25 p.	ISO 9241-11: Ergonomic requirements for office work with visual display terminals (VDTs) – Part 11: Guidance on usability (1998), ISO, Geneva, 22 p.
ISO/IEC 9126-2: Software engineering – Product quality. Part 2: External metrics (2003), ISO, Geneva, 86 p.	ISO 13407: Human-centred design processes for interactive systems (1999), ISO, Geneva, 26 p.
ISO/IEC 9126-3: Software engineering – Product quality. Part 3: Internal metrics (2003), ISO, Geneva, 62 p.	ISO/TR 18529: Ergonomics – Ergonomics of human-system interaction – Human-centred lifecycle process descriptions (2000), ISO, Geneva, 28 p.
ISO/IEC 9126-4: Software engineering – Product quality. Part 4: Quality in use metrics (2004), ISO, Geneva, 59 p.	ISO/TR 16982: Ergonomics of human-system interaction – Usability methods supporting user-centred design (2002), ISO, Geneva, 44 p.

Product-oriented approach treats usability as a set of requirements that software or hardware products (ISO standards concentrate only on software issues, though a general framework both for hardware and software should be established) should meet in order to become usable. This approach is useful as it provides a framework for what should be achieved in order to develop usable products and facilitates management of contractual agreements between developers and customers of technology. An important advantage of product-based view is that standards define the relationship of usability to product quality.

Standards ground their rigorous metrics on three interdependent features: internal and external attributes and quality in use (see Scheme 1 below). A software product contains internal and external attributes that are interdependent. External attributes point to the way a system interacts with a potential user; internal characteristics are a necessary prerequisite to implement this interaction. Thus, if there are deviations in the internal parameters they will pre-condition anomalies in system responses during the interaction process that is determined by a set of external attributes. The third level – quality in use – describes the diversity of contexts in which a system can be exploited and a variety of user expectations based on specific conditions and intentions. Quality in use parameters are affected by overall software internal and external quality characteristics that provide a certain level of quality in user experience while exploiting the system. This allows treating **usability as a quality management activity** (Bevan, 2001, ISO/IEC 9126-1, 2001).

Scheme 1. Usability in the context of software product quality[1]

Process-oriented approach puts a focus on the integration of usability issues into the process of development of ICT-based products. This approach balances the significant weakness of orientation to independent sets of features, as any specified attributes cannot predict user behaviour, the way users reach their specific goals in a certain working context. Therefore, **usability is achieved when the design process is user-centric and encompasses specific context characteristics, such as user, tasks and environment attributes**.

A process-oriented usability framework is grounded on user goals and context of use components (see Scheme 2 below). **User goals** of interaction with technology-based products are crucial to determine system boundaries and even more concrete functions matching user needs. **Context of use** implies user, task and environment components. Appropriate user characteristics such as physical attributes, knowledge, experience, education, age and others are necessary to distinguish different types of individuals interacting with the system and to predict their behaviour. Tasks show a sequence of specific actions necessary to reach user goals. Description and analysis of user tasks helps to map the ways users achieve goals and provides valuable information for defining overall system requirements. Environment encompasses external factors surrounding the user and system interaction that may affect usability. User goals and context of use are evaluated against effectiveness, efficiency and satisfaction criteria and appropriate measures.

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[1] Adopted from ... engineering – Product quality. Part 1: Quality model (2001), ISO, Geneva, 25 p.
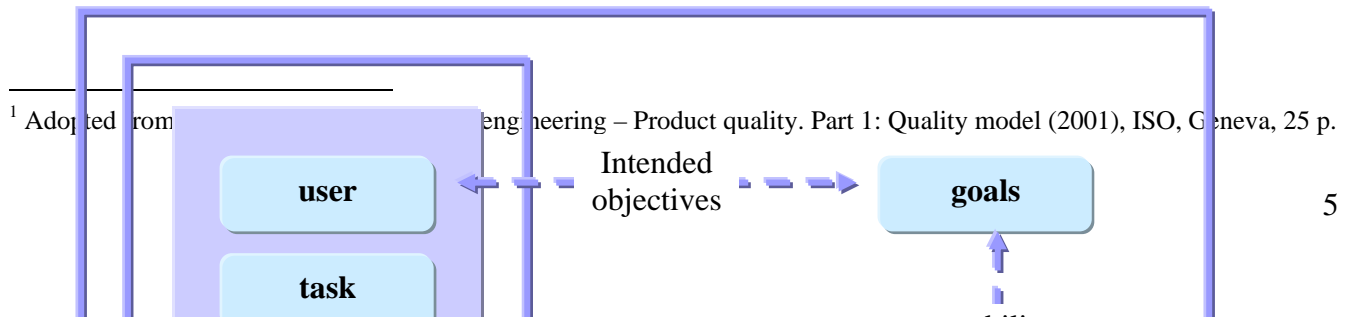
Scheme 2. Process-oriented usability framework[1]

Despite its value and flexibility, the main weakness of process-oriented approach is too general and abstract guidance that offers some hints helping to manage usability as a process but mentions nothing about what usability consists of (ISO 9241-11: Ergonomic requirements for office work with visual display terminals (VDTs) – Part 11: Guidance on usability, 1998).

The product and process-oriented approaches are complementary and should both be exploited in all stages of development. However, analysis of ISO standards shows that despite valuable guidance on the management of usability initiatives, their application is a challenge for practitioners who may find themselves confused by the massive amounts of information available, multiple connections between various standards, and unexplained overlaps.

Nowadays only few memory institutions, especially smaller ones, implement usability management in practice. However, user testing experiment and two-day discussions with local memory institution professionals during *Usability Testing Forum* in Hungary revealed an increasing demand for usability guidance and consultation, especially for local memory institutions. Usability forum in Szentendre (Hungary) was one of three CALIMERA events aimed at bringing together experts, memory institution practitioners and users to stimulate discussions and raise usability awareness in libraries, museums and archives. The event was held at the Pest County Library and attracted practitioners from library,

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[1] Adopted from: ISO 9241-11: Ergonomic requirements for office work with visual display terminals (VDTs) – Part 11: Guidance on usability (1998), ISO, Geneva, 22 p.

museum, archival, and academic community. Usability forum involved testing of three Hungarian websites of memory institutions and round-table discussions. Users and practitioners from memory institutions were involved in testing series. After taking part in usability testing experiment practitioners were asked to discuss what strategic activities are necessary to encourage usability practices in memory institutions. Participants noted that guidance on usability methods and procedures is of crucial importance. During the discussion, several participants expressed a wish for an online consultancy service, which would provide guidance and advice on implementation of user tests. Practitioners also highlighted a need for more intensive collaboration and exchange of experience between library, museum and archive specialists.

Cultural heritage professionals lack comprehensive and clear guidance that would provide them with relevant knowledge and tools for managing usability. Absence of usability guidance, case studies of usability application in practice is the main challenge for memory institutions on the way of integrating usability in their daily practices.

Usability approach for memory institutions: an invitation for discussion

Variety of usability approaches proves that there is no universal "recipe" for all situations and institutional contexts. An institution intending to develop a usable system should formulate its own set of usability priorities and criteria that are usually prompted by its role and core functions in society. What are important usability areas and attributes that should be considered by cultural heritage sector? What are usability needs and priorities in memory institutions: are they common or different? Can these usability demands be integrated into a generic usability model for cultural heritage sector? How not to get lost in numerous usability recommendations?

These issues became the main topic for discussions during an expert *Usability Workshop* held in Vilnius on July 2-3. A two-day event was attended by 18 usability experts from 11 European countries who shared their knowledge in presentations and discussions. Strategic issues covering the need for European usability consultancy network for memory institutions, the scope of main usability knowledge and the content of possible usability guidelines were discussed in groups. Experts emphasized the need to clarify the concept of "memory institutions" that goes beyond merely the sum of libraries, museums and archives. Issues of different communication traditions in archives, museums and libraries still remain under-investigated area. However, all experts highlighted that libraries, archives and museums by definition are social institutions that promote open access and equal conditions for all users in spite of their gender, age, race, religion, culture, physical ability and other differences. In this context, following **usability areas are of particular importance for memory institutions**:

- **Age-specific usability issues.** Differences in cognitive and physical abilities and needs associated with age affect the process of interaction with ICT-based systems. In professional community there is a long tradition of differentiating users by age and addressing some age-specific issues (e.g. referring to stages of children psychological development when designing services). Usability prompts to bring this experience into design of digital services and products (Druin, 2002, Kubitschke, 2002).

- **Cross-cultural usability.** As a consequence of globalization and ICT impact memory institutions are increasingly serving multicultural communities. The field of cultural factors in HCI is quite new even for usability professionals. But this does not diminish increasing interest in cultural usability which gains more importance for various players. In designing for different

cultures it is crucial to identify culturally sensitive elements of design that impact the interaction process and its effectiveness. These elements are often referred to as cultural attractors or markers that enable/disable a user to navigate and interact with the ICT based-system (e.g. colours, use of language and metaphors, structure of menus etc.) (Smith, 2004).

- **Human abilities as usability factor.** Diverse human abilities emerging due to illnesses, aging, accidents or those that are inherited significantly impact the quality of accessing, acquiring, processing or otherwise managing incoming information provided by ICT. Unfavourable environment conditions such as, for instance, noise or several activities being performed simultaneously, can also contribute to decreased accessibility. Usually limitations in human abilities are classified as following: 1) visual impairments, 2) hearing impairments; 3) cognitive impairments, and 4) mobility impairments (Story, Mueller, and Mace, 1998).

- **Socio-technological usability constraints.** Socio-technological constraints may be thought of as horizontal factors that influence any of the group of users discussed above. These factors were formulated by B. Shneiderman in universal usability approach and briefly discussed above (Shneiderman, 2000).

Memory institutions increasingly transfer their services to the internet environment; therefore, **web usability** problematic is relevant. During the *Usability workshop* experts noted that internet becomes a public space, thus bringing web usability agenda on the national and European arenas. Relevancy of web usability issues on the European level is reflected both in strategic documents and emerging research and recommendations in this field.

Conclusions

Vast research activities undertaken in usability field produced a lot of theoretical and practical material on implementation of usability principles. In order to launch usability initiatives and mechanisms in memory institutions and to utilize HCI experience there is a need for a **usability approach for cultural heritage sector**. Memory institutions can benefit from the existent generic HCI usability approaches. In the context of usability policy the view of B. Shneiderman is of particular value for memory institutions because it corresponds to the main statements of social responsibility that underlies any activity of archives, museums and libraries. However, it is necessary to consider limitations of term "memory institutions", which refers to a certain range of common activities for libraries, museums and archives. This concept shouldn't claim to create unified solutions for all areas of practice (that may differ by its objectives) in these institutions.

A vital pre-requisite for effective management of usability is existence of appropriate set of agreements, practices and measures that provides transparent means for all parties (end-users, customers of applications) to harmonize interests in the process of creation and usage of ICT-based products and services. ISO standards and corporate initiatives provide a model for usability management in libraries, museums and archives. However, further research is **necessary to establish the scope of usability recommendations for memory institutions**. Obviously, a usability framework for libraries, museums and archives should be mapped considering the types of services provided, potential audience and its context, characteristics of exploited technology and environment as it is stated in ISO standards. Current standards of service quality management in libraries, museums and archives should be complemented with usability-related activities. This implies revision of service quality model, identification of gaps and achievements in library, museum and archival sectors.

Currently, there is low usability awareness in memory institutions. Scattered initiatives and fragmented application of usability principles allow to assume that only part of memory institutions realize the importance of usability. Even the fact that usability is acknowledged as important activity in the institution doesn't guarantee that it is interpreted and implemented in appropriate ways. Successful implementation of usability principles in practice will require additional **education and information dissemination efforts** that will stimulate memory institutions response, active participation and equip them with necessary knowledge and skills to make their service usable thus raising the benefits of end-users.

References

Bevan, N. (2001) "International Standards for HCI and Usability", International Journal of Human Computer Studies, Vol 55, No 4, pp. 533–552.

CALIMERA (2005). Available http://www.calimera.org/

Druin, A. (2001) "The Role of Children in the Design of New Technology", Behaviour and Information Technology, Vol 21 (1), pp. 1–25. Available ftp://ftp.cs.umd.edu/pub/hcil/Reports-Abstracts-Bibliography/99-23html/99-23.html

Folmer, E. and Bosch, J. (2004) "Architecting for usability: a survey", The Journal of Systems and Software, Vol 70, pp. 61–78.

Hartson, R. H. (1998) "Human-computer interaction: Interdisciplinary roots and trends", The Journal of Systems and Software, Vol. 43, pp. 103-118.

ISO 9241-11: Ergonomic requirements for office work with visual display terminals (VDTs) – Part 11: Guidance on usability (1998), ISO, Geneva, 22 p.

ISO/IEC 9126-1: Software engineering – Product quality. Part 1: Quality model (2001), ISO, Geneva, 25 p.

Karat, J. and Karat, C. M. (2003) "The Evolution of User-centered Focus in the Human Computer Interaction Field", IBM Systems Journal, Vol 42, No 4, pp. 532–541.

Kubitschke, L. et al. (2002) Older people and Information Society Technology: factors facilitating or constraining uptake. Seniorwatch. Deliverable no. 5.3. Available http://www.empirica.biz/swa/reports/D5_3_final.pdf

Shneiderman, B. (2000) Universal Usability Guide. Available http://universalusability.org/index.html

Shneiderman, B.and Hochheiser, H. (2001) "Universal usability as a stimulus to advanced interface design", Behaviour & Information Technology, Vol 20, No 5, pp. 367–376.

Smith, A. et al. (2004) "A process model for developing usable cross-cultural websites", Interacting with computers, Vol 16, pp. 63–91.

Story, M. F., Mueller J. L., and Mace, R.L. (1998) The Universal Design File: Designing for People of All Ages and Abilities. Available http://www.design.ncsu.edu:8120/cud/pubs/center/books/ud_file/toc3b14.htm