Temporal Accessibility of e-Services

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Abstract: Most European governments offer electronic self-services to citizens and businesses on a 365/7/24-basis. e-Services are *available*. In addition to availability, e-Services also have to be *accessible* in order to be successful. A number of accessibility standards and design guidelines exist and are widely applied on websites offering e-Services. Increasingly, e-Services are designed to be carried out in "batches", within time-slots that suit the end-user. This *temporal dimension* plays an essential role in accessibility of e-Services. In this paper, we present seven design guidelines that will add temporal accessibility to e-Services that are being used repeatedly, over time. These are: 1. Overview and general information. 2. Targeted and relevant information. 3. Safety and trust. 4. Support to multi-channel platform and "family resemblance". 5. Logical process and progression. 6. Storage and retrieval of information. 7. Timeline. The design objective is that it must be easy for the user to find, learn, recognise and recall e-Services as well as use-related events and transactions connected to these. We show how existing design principles from established sets of guidelines support the implementation of these principles, and thus increase the temporal accessibility of e-Services.

1. Introduction

During the last decade, European governments have taken quantum leaps towards the implementation of continuously available e-Services to citizens and businesses. The e-Society strategies such as the i2010 of the European Union [1], the growth of internet access in general, and the development of e-Government implementation plans have had a remarkable impact on this development. European governments are offering a rapidly increasing number of on-line services to citizens and businesses on the 365/7/24-basis.

Currently, most e-Services are implemented as web-based solutions, neatly realising the 365/7/24-goal of *availability*. Another important development is the *accessibility requirement*. Basically, this means the ease of use of ICTs by people with different disabilities (motor, sensor or cognitive). In the end, accessibility benefits all users. Basically, the accessibility requirement manifests that websites and web-based electronic services must be presented so that disabled users can access the information and utilise the functionality of the website or the web-based e-Service. The European Union has developed a policy of accessibility and usability of ICT-based products and services for all [2].

A general understanding is that approximately 20 % of the population has some kind of disability. Many, although not all of these people, have disabilities that make it difficult for them to use ICTs in general or web-based e-Services in particular. The major categories of disability, frequently used as a frame of reference for accessibility guidelines, are: Sensory impairments (visual, hearing), motor impairments and cognitive impairments (problems connected to learning, reading, writing, memory, concentration, focus, problem solving etc.). Each of these categories of disabilities must be taken into account in the design and implementation of web-based electronic services (i.e., the content and the functionality).

Usability and accessibility of e-Services are, of course, of great importance to all citizens, but of crucial importance to people with special needs and requirements. Elderly people and people with cognitive disabilities are examples of users who depend on excel-

lent usability and high *accessibility* of the service. During the last years, a number of accessibility standards, guidelines, practices, as well as accessibility measurement methods and monitors, have emerged. Most European governments seem to follow common accessibility standards and guidelines [3] when implementing new e-Services.

According to our research and practice in two current projects on e-Government and e-Accessibility [4, 5], accessibility is insufficiently addressed in the context of e-Services which are used over time, thus gradually forming a "continuum". Accessibility standards and guidelines are designed to increase the accessibility of situated e-Services, or in other words, e-Services that are used and completely executed "here and now". However, more and more often the user is allowed to exit the service, and to return to the task later. We call these *sustained* e-Services. Examples of these are income tax declaration (Figure 1) and starting a new business (Figure 2). In our view, the new "batch-orientation" of electronic services is a complicating factor, and it is inadequately treated by accessibility guidelines. In particular, users suffering from cognitive impairments, such as problems connected to memory, concentration, focus, problem solving etc. (cognitive disabilities) may experience additional accessibility challenges connected to the batch-orientation of e-Services.

Access form	Edit personal details	File income Register property	Edit income	Submit final form
February	**March**	**March**	**April**	**April**

Figure 1. "Batch-Oriented" Income Tax Declaration

Figure 2. The Swedish Site www.verksamt.se for Managing the Life Cycle of Businesses

www.eChallenges.org

The remainder of this paper will treat this matter. Firstly, we propose seven design principles that will add *temporal accessibility* to e-Services that are being used repeatedly and over time, i.e., accessibility design that focuses on the management of the time dimension. Secondly, we will promote timeline as a fundamental design principle to increase the temporal accessibility of sustained e-Services.

Accessibility Guidelines for Sustained e-Services

Citizens and businesses meet electronic services in a number of different situations while these are delivered on a number of different platforms – most often on the web, but also on self-service kiosks, digital TV and mobile phones. At the same time, e-Services for citizens and businesses become increasingly sophisticated. Some of these are used only once in a lifetime (e.g., acquiring the social security number), while others are used a number of times during a person's lifetime. Similarly, e-Services for the life cycle of businesses are commonly available. Some e-Services are based on legal provision, and thus "unavoidable". Other e-Services are voluntary to use. For both citizens and businesses, there are e-Services in the following categories:

    A. Mandatory, (semi-)automatically initiated services on an once-in-a-lifetime basis.

    B. Mandatory, cyclic services on regular basis (e.g., yearly).

    C. Mandatory services on an irregular basis (occasionally).

    D. Voluntary services on a regular basis.

    E. Voluntary, cyclic services.

    F. Voluntary services on an irregular basis.

As we can see, the time dimension is an essential attribute of e-Services. Some services are used repeatedly although irregularly, while others are cyclic in nature. When these basic services are implemented as e-Services, accessibility will be challenged. We claim that the current accessibility standards and guidelines mainly focus on situated use, whilst they are weak in treating the temporal accessibility.

In order to increase the temporal accessibility of the user dialogue with sustained e-Services (i.e., those that are accessed and used even at years' intervals), we propose a set of principles to be considered together with other elements of established accessibility guidelines. These classes of guidelines are:

    1. Overview and general information.

    2. Targeted and relevant information.

    3. Safety and trust.

    4. Support for multi-channel platform and "family resemblance".

    5. Logical process and progression.

    6. Storage and retrieval of information.

    7. Timeline.

We assert that careful consideration and application of guidelines that support these principles will increase the accessibility of sustained e-Services. The design objective is that it must be easy for the user to *find, learn, recognise and recall* e-Services as well as use-related events and transactions connected to these.

Below, we give a short account of each of the guideline classes. In order to approach a concrete implementation of these principles, we have departed from existing accessibility

and usability guidelines [6, 7, 8, 9, 10, 11]. We have surveyed these and other guidelines and extracted pieces of advice that support the principles above.

2.1 Overview and General Information

The first step of using any e-Service is locating the service. For this purpose, information about available services should be collected and disseminated so that easy access is possible. Citizen portal and business portal solutions seem obvious. This information should also include information about the scope and purpose of the e-Service(s), and about access methods (username, password etc.).

2.2 Targeted and Relevant Information

Users of e-Services should get updated information about the service, descriptions of the service itself, and the methods of use of the service. In particular, if e-Services are accessed rarely, such as those in category B or E (cyclic services), it is important to ensure that the user – to begin with - finds the service, and that s/he recalls the method of use.
- Give necessary guidance to the user immediately, and also make the guidance available globally in the service.
- Assist the user appropriately. Contextual help should be adjusted to the actual request: Short answers to short questions, and more voluminous answers to more complicated questions. So-called "screen-casts" for user guidance represent a good alternative in many cases.
- Provide quick access to different parts of the service. Alphabetic lists or detailed site-maps are appropriate alternatives.
- Pay special attention to clear and understandable language.

2.3 Security and Trust

Security and privacy are central themes in the context of accessibility. Security and trust are also essential for sustained e-Services. In particular, storing information for years in a secure manner is crucial. Users need to trust that personal information is safe and that relevant processes can be accessed again. Both the presentation of security and the actual security and privacy mechanisms have to correspond with the users' expectations. Examples of principles that promote security of and trust in sustained electronic services are:
- Provide sufficient authentication mechanisms.
- Provide possibility to print documents, web pages and so on.
- Provide contact information to user support.
- Provide clear, understandable information on security needs and risks all over the service or the site.
- Provide status information throughout the work process and also in latent periods, and provide an overview (receipt) of completed work.

2.4 Support to Multi-Channel Platform and "Family Resemblance"

Sustained e-Services for citizens will in the future be delivered on several technology platforms. Already today, web-based applications can often be accessed from a PC or a mobile phone. This supports the idea of platform independency; the user may start the work process on one platform, quit, and continue on the other, such as switching between PC and mobile phone. Here it is important that the user can recognise the application on all relevant platforms, i.e., that a certain "family resemblance" exists. In order to do this:

- Take care of consistency of appearance; that is how objects in the user interface etc. look (colour scheme, icons etc.).
- Take care of a minimum level of design conventions, e.g., placement of visual elements (such as logo), functionality (search field), navigation, contact information etc.

2.5 Logical Process and Progression

Logical process and progression means that the user's work process is organised and supported so that s/he has the opportunity to make real progress, know where in the work process s/he is, receive acknowledgements of successful actions, and finally to receive meaningful, process-related notifications of failure. These requirements should apply also for e-Services which are used at longer intervals, or when the current use session can be ended and continued later. In order to realise this principle, existing accessibility and usability guidelines can be used as a point of departure. Examples of such are:

- Acknowledge completed task or process.
- Keep status information up to date and easy to view for the user.
- Track the user's activities.
- Provide bookmarking.
- Provide shortcuts to frequent or expert users.

2.6 Easy Storage and Retrieval of Information

During work processes, users usually need to find, retrieve and save information. Mechanisms that facilitate the management of information and enable the user to return to the task or process later on should be provided. Examples of accessibility and usability guidelines that can be used as a point of departure for the implementation of this principle are:

- Provide mechanisms that make it possible for the user to save documents (including interactive forms) permanently or temporarily, in different formats (e.g., html, doc, pdf). Also, it should be possible for the user to save unfinished work locally. The service should also take care of saving the user's work often enough in order to survive technical or other breakdowns.
- Use hypertext or links which bring the user to the intended document, web-page or task in the work process.
- Use time stamps in order to ease identification of updated information.
- Provide search functionality and adequate metadata to facilitate this.

2.7 Timeline

Last, but not least, visualising temporal data and time-based events in the work process is essential for sustained electronic user dialogues. Since many services are used repeatedly, it is important to add an illustration of time to the accessibility framework for e-Services. Here, a timeline appears appropriate. In the next chapter, we will look into this in more detail.

Timeline

Providing snapshots of historical events may be realised in a number of different ways. Timeline charts may be implemented as annotated lines which clearly visualise time and events on an axis, or the events may be ordered as lists (Figure 3). The main asset of a timeline must be that it is easy to read, it presents information in a logical manner, and that it supports the user in (re-)grasping the task or process even after a longer period of latency. As stated in Chapter 2, it should be easy for the user to *find, learn, recognise and recall*.

Visualisation of temporal data on a timeline has been approached in a number of projects. One example is the Simile-project which basically addresses semantic interoperability [12]. The Timeline-widget allows the user create an interactive timeline with temporal events, thus letting the user understand the time dimension of data and events.

Another application is GapMinder [13] which visualises statistical data within e.g., environment, health and economy by playing a "gap-cast" on a timeline.

The Google news timeline [14] allows the user to search for news articles which are organised on a timeline on daily basis.

Last but not least, the LongRec-project [15, 16] has developed a pilot application which provides an information service in which information from the public registry is related to other external sources of data and presented along a temporal dimension. The graphical user interface is split into several parts, including a timeline. The primary objective of the Long-Rec-project was the persistent, reliable and trustworthy long-term archival of digital information records with emphasis on availability and use of the information.

In the Read Thread [4] project that this research and development is part of, we have together with our partners [17, 18] designed and implemented a prototype which demonstrates the use of timeline as the fundamental design concept for sustained e-Services. In addition to common accessibility principles, such as visual clarity, alternative modalities, easy navigation etc., we have made an effort to show the user's e-Services on a timeline. This implementation, illustrated by an early paper-prototype in Figure 3, is built on following four corner stones:

I. The timeline represents the user's life cycle.

II. Mandatory services appear on the timeline, while voluntary services can be added by the user. User profiles can be used to modify access to services.

III. Each case can be represented as its own timeline with past, current and future events or transactions.

IV. e-Services on a user's timeline connect to real services delivered by established service providers.
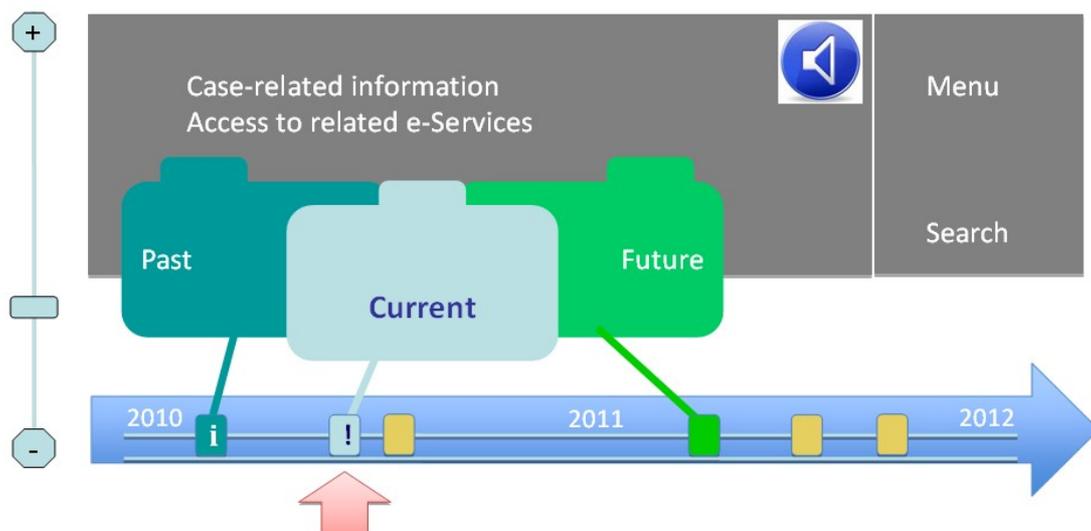

Figure 3. Concept for Implementation of e-Services on a Timeline

The functional prototype, of which we show two screen-shots in Figure 4, has been evaluated by an expert group. Their verdict is that the design supports the user in (re-)grasping the task or process even after a longer period of latency, and as intended, it should be easy for

the user to find, learn, recognise and recall past events and transactions. Moreover, this timeline concept is applicable as well for citizens' as businesses' e-Services of type A-F (Chapter 2).
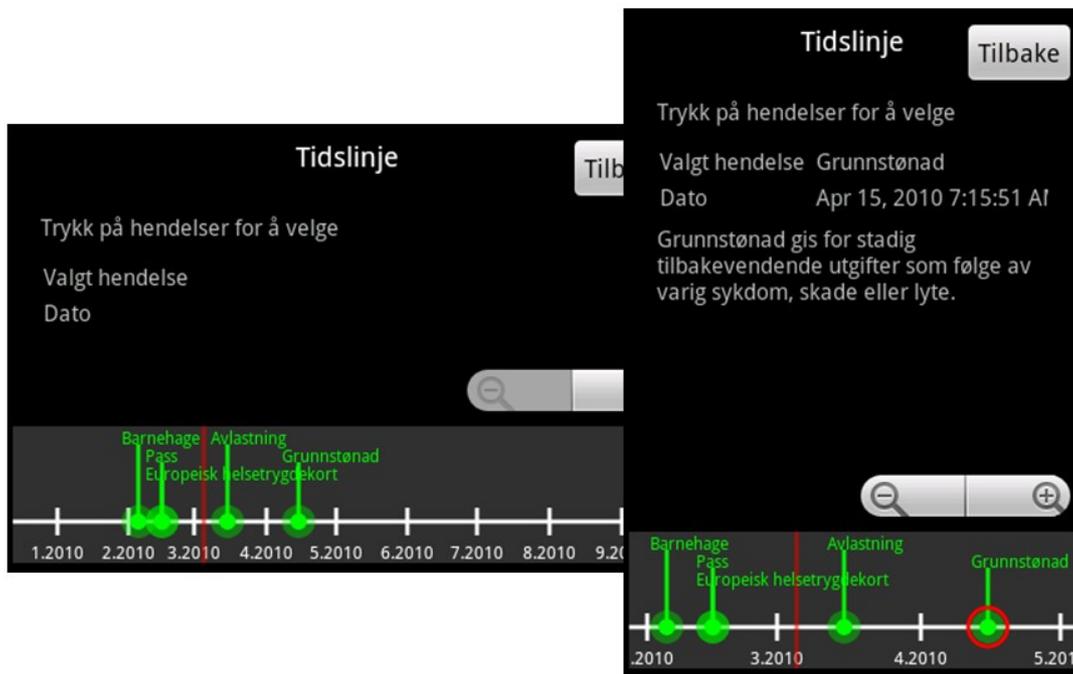

Figure 4. *Prototype Implementation of an e-Service Timeline*

4. Conclusion

Good, usable and accessible e-Services have many characteristics, as shown in Figure 4. They are secure, and they can be accessed on different technology platforms. They may be compound services provided by a number of collaborating organisations and service providers, and still render seamlessly in a uniform manner during the user dialogue.
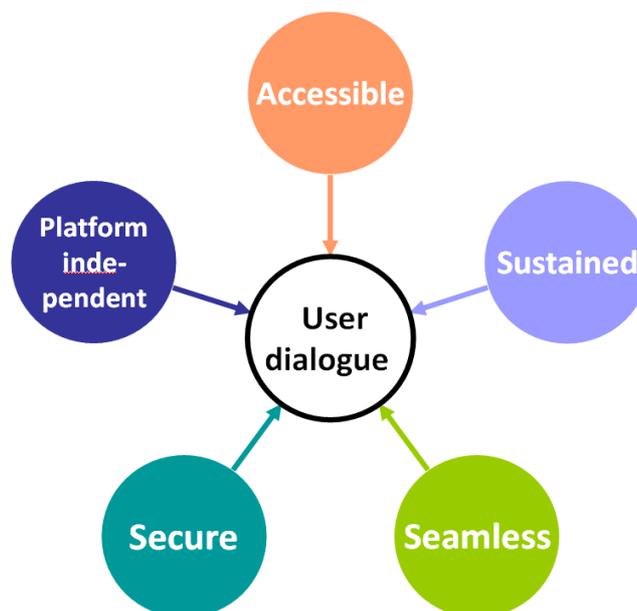

Figure 4. *Features of e-Services with good use quality.*

Governmental and other e-Services require careful accessibility design in order to be successful. In this paper we have proposed to add the dimension of time to accessibility considerations in an explicit manner, and we have shown how this can be approached. We regard the temporal dimension as central in the design of sustained e-Services. The list of principles is a first attempt to systematise accessibility guidelines so that the aspect of time becomes clearly visible and is treated explicitly.

As we have pointed out, the principles clearly focus on the cognitive aspects of accessibility, such as the ease for the user to *find, learn, recognise and recall* e-Services This, however, presupposes such activities as understanding and remembering the location, appearance and use of the e-Service over time – i.e., the sustained character of the e-Service and the user dialogue. This becomes more and more relevant as governments implement services not only for situated service needs, but also e-Services which build on the idea of continuous service dialogues. A set of guidelines to achieve this has been presented in this paper. Based on our research and development, timeline as a design concept is strongly recommended as an accessibility feature of sustained e-Services.

Acknowledgements

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