ECP-2008-DILI-528001

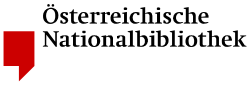
EuropeanaConnect

Catalogue of User Requirements

Deliverable number/name	*D3.4.1 Catalogue of User Requirements*
Dissemination level	*Public*
Delivery date	*08.12.2009*
Status	*Final*
Author(s)	*Tobias Hesselmann, Dennis Heine* *OFFIS institute for Information Technology* *Editors: Lars Svensson, Olaf Janssen*

e*Content*plus

This project is funded under the *e*Content*plus* programme,
a multiannual Community programme to make digital content in Europe more accessible, usable and exploitable.



EuropeanaConnect is coordinated by the Austrian National Library

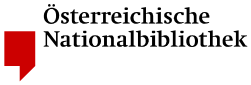
D3.4.1 Catalogue of User Requirements

This deliverable summarizes the requirements for the implementation of mobile access to Europeana as part of work package 3.4.

co-funded by the European Union

The project is co-funded by the European Union, through the **eContent*plus*** programme

http://ec.europa.eu/econtentplus



EuropeanaConnect is coordinated by the Austrian National Library

Summary

This deliverable summarizes the requirements for the implementation of mobile access to Europeana as part of work package 3.4. We start with the presentation of the approach used to derive the user requirements of this deliverable. We then describe the human-centred design process, which will be used for the development of the Europeana mobile client, and identify the sources of information used to derive the actual user requirements: User profiles identified in previous user surveys, personas identified in a personas workshop of EuropeanaConnect work package 3.3, a user survey we conducted with representatives of staff members from our project partners, and discussion sessions with mobile interaction and usability experts at our institute. To better understand the context of mobile access to Europeana, we will continue with the identification of the stakeholders for mobile access to Europeana. After that, we will present the current technical state-of-the-art in mobile computing and the mobile web, laying the technical base for the developments of the Europeana mobile client. This includes the comparison of the technical capabilities of today's mobile devices, including screen resolution, operating systems and mobile browsers used. We also give a technological outlook for the future to ensure the developments of task 3.4 can keep up with the technological developments in the next years. What follows is the actual requirements analysis. We will start with the presentation of results from the conducted user survey. Based on that, we will derive functional requirements, describing the behaviour of the mobile client to be produced. Qualitative aspects will be covered by describing non-functional requirements. Aspects like scalability and platform compatibility play a key role in this context. Constraint requirements from external stakeholders complete the requirements definition.

Table of Contents

1. Introduction

The popularity of the mobile web is ever increasing. People use many sorts of mobile devices, in particular mobile phones, to connect to the internet and gather information. In our mobile world, they can access information on the go, without needing to use fixed internet terminals or landline connections.

The importance of mobile access to services on the internet is supported by several recent surveys. In late 2007, the mobile phone penetration rate in Europe reached more than 100% (see Fig. 1): Virtually every European possessed a mobile phone, some even more than one. Also, demands on mobile internet usage continue to grow. A recent study by (Nielsen Company, Q1, 2008) shows that approx. 10% of the inhabitants of the most populated European countries use their mobile device for connecting to the internet, even without counting web based email services or instant messaging traffic (see Table 1). In 2008, the number of world-wide mobile web users even grew past the number of PC based internet users (Tomi Ahonen Consulting, 2009). It is therefore essential that any online service considers the recent growth in mobile computing to react to the demands of its users.

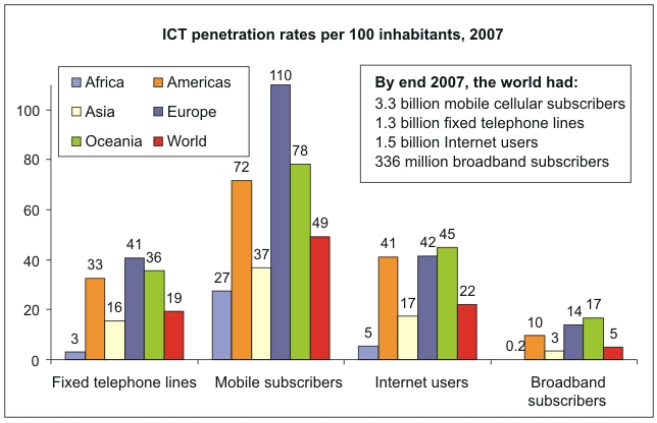


Figure 1. ICT penetration rates in 2007 (ITU, 2007)

Country	Mobile Internet Penetration (%)
UK	12,9
Italy	11,9
Russia	11,2
Spain	10,8
France	9,6
Germany	7,4

Table 1. Mobile internet penetration in Europe, excluding web based email and instant messaging (Nielsen Company, Q1, 2008)

Unfortunately, ordinary web sites are generally not optimized for the use by mobile devices. However, these devices suffer from many limitations. The available screen resolution and colour depth is often limited, as is the support of many modern features of the ordinary web, like AJAX, CSS 2 or JavaScript. Mobile devices usually also do not offer full-size keyboards and mice, making the interaction with the various contents of websites awkward in many cases.

This is why major web sites like Google, eBay or Wikipedia are already offering specialized mobile web sites that are optimized for the use by the heterogeneous mobile devices on the market. It is therefore only natural for Europeana to take the next step and react to the demands of the European users when it comes to the mobile use of its services. With the increasing popularity of smartphones, netbooks and other mobile devices, mobile access to Europeana is likely to become a true alternative to the access from fixed internet terminals in the future.

Thus, the overall goal of EuropeanaConnect Task 3.4 is to make the rich cultural content of Europeana available to a broad spectrum of users in mobile scenarios. With the development of mobile access channels for Europeana, we will enable users to access the material inside the Europeana database and benefit from the cultural content inside Europeana using their mobile clients, when the use of stationary PCs is either impossible or unwanted. We will also turn the alleged drawbacks of mobile phones into an advantage by implementing services into Europeana that enable users to access information inside the database based on their current location. For reading convenience, we will refer to the Europeana mobile client application as *eMobile* in the following.

The remainder of this document is structured as follows: In chapter 2, we will briefly describe our approach for the developments of Task 3.4, including the used process model and sources of information for this requirements definition. We will also put the requirements in the context of the process. In Chapter 3, we will identify and describe the context of use for the Europeana mobile client that the following requirements in this document are based on. Chapter 3.4 contains an overview about the current state of the art in mobile devices. We will analyse the current market situation regarding operating systems, mobile browsers and the capabilities of various mobile devices. Based on this, we will make a prediction for the time after the end of the EuropeanaConnect project. Chapter 5 contains the actual requirements analysis, split in functional and non-functional requirements, as well as external constraints. Use cases are presented to further detail the requirements on the mobile client. We will conclude with a summary and present the next necessary steps in the development of the mobile client in chapter 5.

2. Approach

In this chapter we describe the approach we used to define the requirements for the development of *eMobile,* the mobile access client for Europeana.

2.1. Process Model

The design of an interactive system, in this case a mobile web application, is no trivial task. To ensure the development of a highly usable system that is efficient, effective and satisfying, which are the three main criteria for usability as defined in ISO 9241-11 (ISO, 1998), the application design needs to follow a defined process model. The document at hand is the result of the application of the HCD process, as specified in ISO 13407 (ISO, 1999). It is particularly well suited for the design of interactive systems, as it incorporates user feedback in all stages of development, which can be considered one of the most crucial aspects in software engineering.

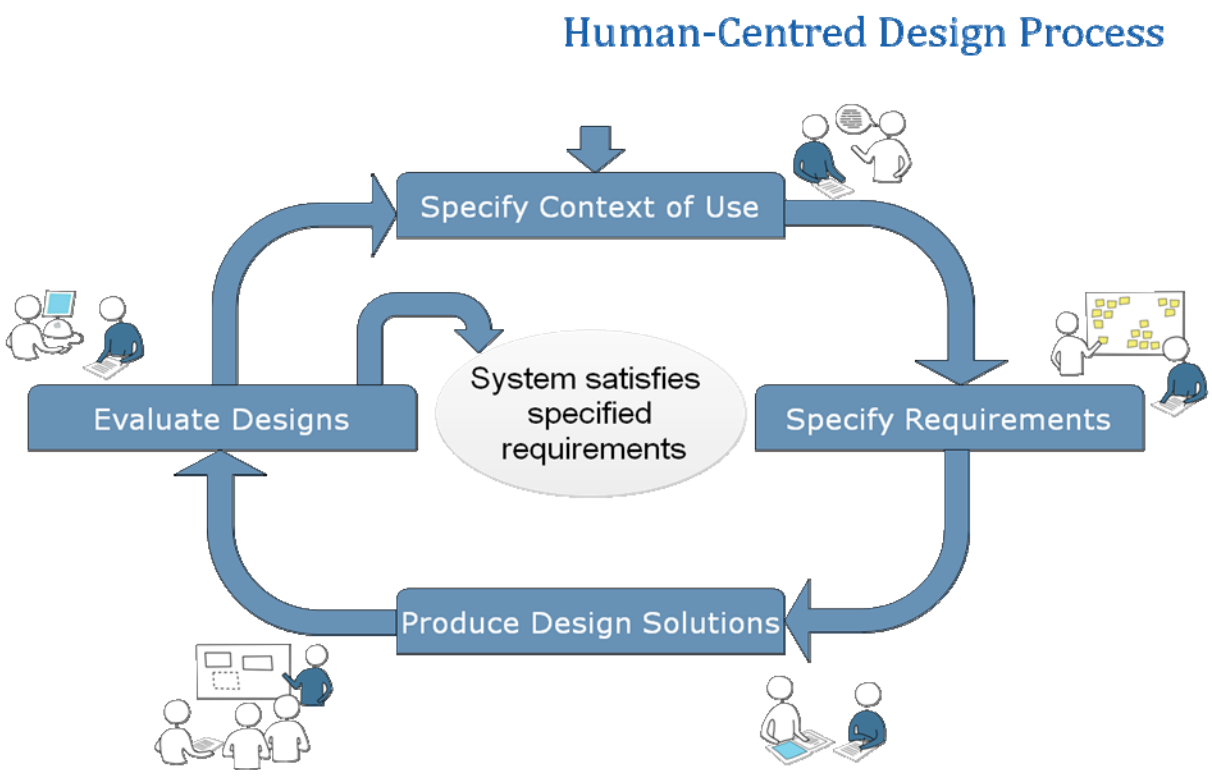


Figure 2. Human-Centred Design Process

The HCD process is illustrated in Figure 2. It consists of four steps:

1. *Specify Context of Use.* In this step, the stakeholders of the product are identified and the user environment is described. This step gives developers a “big picture” of the product and its users.
2. *Specify requirements.* The specification of requirements is the most essential step to create highly usable products. In this step, the goals of the product’s users will be gathered and described in a standardized format.

3. *Produce design solutions.* Based on the first steps, the development of the actual software version is carried out.
4. *Evaluate design.* A crucial step to measure the usability of a product and to improve the product usability-wise is to perform evaluations on the product, which are conducted in this step.

The process is then repeated until the developed system satisfies the formerly specified requirements.

This document spans two steps in the process: The specification of the context of use and the requirements specification. In EuropeanaConnect tasks 3.4.2 and 3.4.3, we will deal with the development of the mobile clients themselves. In 3.4.4, the developed prototypes will be evaluated according to the last section of the HCD process.

2.2. Sources of information

This requirements definition is based on several sources that are briefly described in the following:

1. We considered user profiles identified in previous user surveys by Europeana / EDL.NET. A summary of these can be found in the EuropeanaConnect Description of Work (DoW). We will put these in the context of mobile access to Europeana in chapter 3.2.
2. We used preliminary results of the Personas Workshop held as part of EuropeanaConnect WP 3.2 to identify *personas* that serve as a base for the development of the mobile client. Details on these can be found in chapter 3.3.
3. We conducted a user survey with staff from our cultural partner institutions that are experienced in terms of users' needs, either due to frequent customer contact or due to deep knowledge about the use of mobile devices and the mobile web. For the survey, we used a questionnaire containing 10 questions about mobile access to the Europeana database. The results are summarized in chapter 4.
4. Brainstorming and discussion sessions in a task-force with mobile interaction and usability experts from our institute were used to extend the space of possibilities and determine feasible features.

The combination of these four sources gives an accurate picture of the demands on mobile use of Europeana, which will be used to derive precise requirements in chapter 4. In the next chapter, we will describe the context of use for the Europeana mobile client.

3. Context of Use

In this chapter, we describe the context of use of mobile access to Europeana, according to the first phase of the human-centred design process. This involves the identification of stakeholders of the mobile Europeana client. The target group will be detailed by describing user profiles and personas identified in previous surveys. We then derive three key scenarios from these descriptions that will serve as a guideline for the development of the Europeana mobile client.

3.1 Stakeholders

For developers and designers alike, it is crucial to understand the target group of the product to be created. Thus, all requirements identified later in this project will be based on the stakeholders identified in this part. For the developments of eMobile, we have identified two primary stakeholders:

1. The most important stakeholders of eMobile are the actual users of Europeana. They form the target group that needs to be supported by eMobile. They will access the Europeana database from their mobile devices and want to use the various functions of Europeana in a mobile context. Furthermore, they demand features that are only available in mobile scenarios, which will be described later in this document. To meet the concerns of Europeana's users, special attention needs to be paid to all interface related aspects when developing eMobile. By using the human-centred design process as process model, as pointed out in chapter 2.1, we will include user feedback in all stages of development.
2. The second important stakeholder is the Europeana Office, which plays an important role as coordinator of the developments of EuropeanaConnect and also formulates demands on the development of the mobile Europeana client. In particular, the Europeana Office needs to integrate the results from Task 3.4 into Europeana and maintain the code after the end of the project. From this, we can derive qualitative demands on the code, which includes proper documentation and testability. Details on these aspects can be found in the requirements definition in chapter 4.

In order to get a better picture of potential Europeana users in mobile scenarios, the target group will be described in more detail in the following.

3.2 User profiles

EuropeanaConnect is embedded in a wider range of projects, aiming at making the rich cultural works of Europe available to the public. One of the projects delivering important fundamentals to EuropeanaConnect is Europeana.Net. In Europeana.Net, five possible user profiles have already been identified. In the EuropeanaConnect description of work, those have been extended by two more profiles. Of the resulting seven profiles, five involve mobile access to the Europeana database. The relevant profiles and aspects for the development of a mobile client are briefly summarized in the following:

1. *General Users* General users are looking for education and entertainment. They need an interesting interface, easy navigation and interesting value-added services. They have experience with basic search services (e. g. Google) but have no specific knowledge about information retrieval.
2. *School Students* School students will access Europeana to gather information for reports or homework. They are focused on reading material. They are experienced with Web 2.0 technologies and need to be entertained while using online services.
3. *Academic Users* Academic users are looking for material for scientific publications, with a focus on reading material. They look for specific information and thus need extended / advanced search functionality.
4. *Expert Researchers* Expert Researchers are also looking for specific reading material. They thus also need extended / advanced search functionality. In addition, they may be willing to pay for special services.
5. *Professional Users (e. g. Librarians)*
   Professional users make use of more sophisticated search functions and need speedy responses by the system. They are experts in information retrieval, but also may add information to the database.

While these profiles already provide valuable information regarding the target group of eMobile, the personas identified in WP 3.2 further enrich these profiles by adding detailed characteristics to the potential users. These will be described in the following.

3.3 Personas

EuropeanaConnect WP 3.2 deals with the definition of so-called *personas*. Personas are concrete, yet virtual representatives of different user groups that help developers design their products closer to the users' real needs. In the following, the identified personas and their characteristics are briefly summarized and put into the context of development of mobile access for Europeana.

1. Strongly navigational user with lack of IT knowledge, that is limited to his / her native language. He / she uses Europeana mainly for hobby and genealogy purposes.
2. Navigational user with lack of IT knowledge and limited language skills. He / She uses Europeana for language education and to send “fun stuff” to friends.
3. Strongly explorative and *demanding* professional or researcher with significant IT knowledge. He / She is a professional networker and uses Europeana for broad subjects, comparative studies, exhibitions and to get information about the history of architecture.
4. Mixed explorative / navigational and educated user with sufficient IT knowledge. He / She is a strong networker, uses material from Europeana for lessons or to plan a trip.
5. Strongly navigational researcher or tourist. He / She is focused on a specific way of reaching his / her goal and is unwilling to learn new methods. He / She uses material from Europeana professionally or plans a trip with the information in the database.
6. Office worker with navigational focus. His / her language skills are limited and he / she tends to sticks to familiar methods. He / she uses Europeana for hobby and secondary purposes.
7. This persona’s approach is strongly explorative. He / She may be a pupil or game player, probably using Europeana for doing their homework. He / She is used to quickly interact with user interfaces with and without using their mobile phone. He / she is focused on personalization and entertainment and loses interest quickly.

8. Enthusiastic and educated user with limited IT skills and a mixed explorative / navigational profile. He / she uses Europeana for exploration and discovery of new things.

The two main lessons learned from the personas definition is that

1. It is necessary to include the user's course of action in the development of user interfaces for EuropeanaConnect. While some users will stick to used paths only, others are likely to show a strictly explorative behaviour.
2. IT knowledge may differ a lot between different users. While some users will be IT experts, others will need significant help using the interface.

We can also draw interesting conclusions from the aims of the individual personas, which will, in addition to the user surveys of Task 3.4 and the user profiles defined in the EuropeanaConnect DoW, serve as a guideline for the definition of requirements in Chapter 4.

3.4 State of the art: The mobile web

Apart from the identification of the target group, another very important aspect of the context of use for eMobile is the technical state of the art in mobile computing in the coming years. To design a mobile client that is ultimately usable by people, it is necessary to study the mobile devices people use in practice to connect to internet services on the go. We will thus present an analysis of the current technical state of the art in mobile computing in this chapter. Based on the current status, we will make a prediction for the time period after EuropeanaConnect, when the mobile client is likely to go live.

With mobile technology evolving at amazing speed, mobile phones even become an alternative to ordinary computer workstations. "Smartphones", offering high performance, large display resolutions and modern input concepts, have already started to become the standard of today's mobile phones. For Europeana, it is thus most important to catch this trend and develop applications that support this new generation of mobile phones. They thus take the biggest part of this analysis, while we still consider older mobile technology as well.

3.4.1 Mobile Operating Systems

The market of mobile operating systems (OS) is currently divided among five major brands: Windows Mobile, Android, Symbian, RIM and iPhone OS. In the following, we present an overview about the different mobile operating systems and discuss their features.

Windows Mobile

Windows Mobile is not device specific. It is not open. It offers direct access to the devices hardware and therefore makes up as a good platform when integrating different kinds of sensors, such as GPS receivers.

Android

Android is an open source mobile OS based on Linux. It is developed by the Open Handset Alliance (OHA) which consists of several carriers, microchip and mobile phone vendors and software producers. Android is device independent and therefore likely to be used in many mobile applications. It is in a very early stage of development though. As of June 2009, only two Android based devices have been released to the public.

Symbian

Symbian is a closed-source OS that runs exclusively on ARM processors, it was developed by Symbian Ltd, which was acquired by Nokia. Since 2008 Symbian OS and its associated libraries, frameworks and user interfaces are maintained by the Symbian Foundation, which plans to release the source code in 2010.

Research in Motion (RIM)

The proprietary OS running on devices manufactured by RIM Ltd. is called BlackBerry OS. It is only available for BlackBerry devices and is focussing on mobile messaging using push-mail in conjunction with a dedicated mail-server to address especially the needs of enterprise customers.

iPhone OS

The iPhone OS is device specific proprietary OS that runs solely on the iPhone. Due to its hardware restrictions there is no physical keyboard, therefore the user interface is based on touch gestures and direct manipulation.

Java

When it comes to incorporating data from sensors, Java is well suited, as it runs in a virtual environment and is therefore separated from the hardware. However, Java has serious performance issues on some devices.

Others / Outlook

In November 2009, Nokia wants to release their first device running *Maemo 5*, an open source, Linux-based OS comparable to Android. Even though Nokia is strongly involved in the development of the Symbian platform, the company announced that they will be using Maemo on their "upper class devices" in the future according (Financial Times Deutschland, 2009).

webOS, developed by Palm Inc., is a Linux-based smartphone platform with proprietary Palm components released in June, 2009. Of the time of writing, it is currently used on only one device, the Palm Pre.

According to Gartner market share forecasts for 2012, Symbian will still be running on 37.4% of all smartphones sold globally. While Android will be used on 18%, Blackberry's share will be 13.9%. On fourth place Gartner forecasts the iPhone OS with 13.6% share followed by Windows mobile with a share of 9%. The remaining 8.1% will be divided among upcoming and individual operating systems (Computerworld, 2009).

3.4.2 Mobile browsers

Mobile browsers are constrained by the limited capabilities of mobile devices. While being stripped-down web browsers in the beginning, newly developed web browsers can handle more recent technologies like CSS 2, JavaScript and AJAX. Although there is a vast variety of mobile browsers, most of them make use of the same layout engine, resulting in a list of only four different engines for the five major mobile operating systems mentioned above (Wikipedia, 2009).

WebKit

Originally created for Mac OS X's Safari browser by Apple Inc., WebKit is now being developed further as open source software by Apple, Nokia, Google and others. Therefore it is used on mobile devices running Android, Symbian or the iPhone OS. It supports JavaScript and the XMLHttpRequest Interface. The mobile Safari version reaches 100 out of 100 points in the Acid3

test (Acid Tests, 2009), which checks a browsers adherence to web standards. This browser is also one of the first mobile browsers to support the Geolocation API, which allows the identification of a users' location via easy to implement API calls.

Internet Explorer Mobile

The Internet Explorer Mobile comes bundled with Windows Mobile per default. Although it offers some of the features of the desktop version of Internet Explorer 6 and 7, it is not based on the same rendering engine. Even though the engine supports JavaScript and the XMLHttpRequest interface, web applications for IE Mobile need some workarounds to support AJAX features, resulting in a failing Acid3 test with a score of 0.

Mango

The proprietary Mango layout engine is used solely in RIMs mobile browser. It reaches 54 out of 100 points in the Acid3 test even though XMLHttpRequest and Javascript are supported, but the latter being turned off by default.

Presto

The Presto engine is used in Opera Mobile, which is available as 3rd party software that can be installed on Windows Mobile and Symbian devices in addition to the built-in browser. It claims a market share that is nearly the same than the iPhone's share (each ~24%) that can be explained with its good support of web standards and Ajax capabilities that result in 100 out of 100 points in the Acid3 test (with the beta version 9.7b1 available at the time of writing).

The forecasts for mobile operating systems estimate a combined marketshare for Symbian, Android and the iPhone OS of 69% in 2012. Based on the fact that their built-in browsers are using the WebKit layout engine the possibility that it will keep a strong market share in the future is very high and therefore allowing the usage of AJAX features and location aware services for EuropeanaConnect. Keeping the capabilities of the other common layout engines in mind there may be a need for two versions of the mobile Europeana portal, one featuring dynamic options like Javascript enabled maps and geolocation services and one more static approach with a limited set of multimedia-based features.

3.4.3 Device capabilities (Resolution and Hardware Features)

Screen resolution

Most mobile phones, which will be dominating the mobile phone market in the future, offer a quite large display resolution. By 2008, 320x240 (QVGA) was the most common resolution for Smartphones. Nowadays there is a significant trend to HVGA resolutions (320x480), and an increasing amount of Windows mobile based capable of resolutions up to 480x800 (WVGA) pixels (artegic AG, 2009). Apple's iPhone, the Palm Pre and most Android based phones come with a HVGA screen resolution, while Windows mobile and Symbian devices use a wider range of screen resolutions.

Modern mobile devices, like the Apple iPhone or Samsungs Omnia II also have orientation sensors that allow detecting whether the device is held horizontally or vertically, thus enabling optimized content for a landscape or portrait orientation. An adaptation to these devices is recommended to avoid zooming and scrolling.

Camera

According to (Tomi Ahonen Consulting, 2009), the most desired feature to drive new phone sales is the inbuilt camera. Although the camera resolution is constantly growing, camera phone pictures often lack image quality, especially in bad lighting situations. They may add additional value to mobile clients though, as they can be used to upload image content to web portals or detect objects seen by the camera.

GPS

Ovum Research states that 75% of all released smartphones in 2nd quarter of 2009 were GPS-equipped (Mobile Marketer, 2009). These devices often use A-GPS (Assisted Global Positioning System), a technology that uses information from the cell phone position and/or the mobile phone network to determine the user's position faster than the "regular" satellite based positioning system. The usage of GPS allows the integration of location based services (LBS) into mobile device applications and websites, e.g. turn by turn navigation or requesting points of interest near the device's user.

The "World GPS Market Forecast" (3B, April, 2009) states that around 70% of the market share for GPS devices in 2013 will be held by GPS-enabled handsets. In addition, ABI Research forecasts that by 2013, low-cost GPS sensors will enable an integration of GPS in nearly all mobile devices by that time (ABI Research, 2009).

In order to create the best possible experience for mobile Europeana users, an adaptive approach would be an interesting option: Depending on the screen resolution a device uses, the user will be presented a slightly different screen layout that makes optimal use of the available display area. The high availability of GPS equipped devices adds the opportunity to incorporate location aware services into EuropeanaConnect.

3.4.4 Protocols

When dealing with transmission protocols for mobile devices, one typically is set to one of two options: WAP with WML as markup language, or HTTP with HTML/CSS as markup languages.

WAP with WML

With the release of version 1.1 of the WAP standard in 1999, mobile phone vendors started to add WAP-Browser to the majority of their devices, while content providers started to offer mobile services like news headlines or sports results. Since data transmission via GPRS or HSCSD was not common, users of WAP-Browsers had to deal with low bandwidths and therefore only limited functionality with these mobile services.

HTTP with HTML/CSS

With the development of efficient layout engines, larger screen resolutions and higher data transfer rates in mobile networks, HTTP with HTML/CSS has taken the place of WAP for mobile internet portals.

As the mobile access channels for EuropeanaConnect are assumed to go live after 2010, it is most likely that the majority of devices used to access EuropeanaConnect will be capable of displaying websites written in HTML via HTTP, allowing the user to access multimedia data like images, movie and sound-clips.

3.5 Summary

Since smartphones are becoming more and more important when it comes to mobile internet access, we will focus on the development on a mobile access channel for Europeana that meets the needs of mobile users with that device class. Because the development of the mobile market is constantly changing, it is important to focus on the layout engines used in modern mobile browsers. By adhering to established web standards (HTML/CSS, W3C Geolocation API) it is possible to create a user experience that is independent of the used operating system and mobile browser. To accomplish this goal, the different hardware capabilities of devices need to be considered, e.g. by adapting the size of a result list to the available screen area and resolution or offering location aware features by using the built-in GPS sensor of modern mobile devices.

4. Requirements Analysis

To gather the requirements on the Europeana mobile client, we rely on several sources of information. In the previous chapter, we analysed the context of use of the mobile client. This includes the identification of the system's stakeholders, the incorporation of results from previous surveys of Europeana.Net and personas defined in EuropeanaConnect WP 3.2. Furthermore, we have presented the current state of the art in mobile computing and gave an outlook about the technical developments of the coming years.

In this chapter, we will start with the presentation of results from a survey with representatives of our project partner, the Royal Library of Denmark. We will present the results from the survey in detail and condense them into concrete requirements for mobile access to Europeana in the following. We will also take into consideration the context of use identified in chapter 3.

4.1 User Survey

To derive requirements directly from representatives of potential Europeana users, we gave out questionnaires to senior staff from our project partner, the Royal Library of Denmark (see chapter 7). The participants are seniors with experience in mobile access or human factors, some with close customer contact on a daily basis.

The questionnaire contained ten questions. Three were related to the experience users had with the current version of the Europeana web portal, mobile devices and usage of the mobile web in general. The other seven were related to mobile access to Europeana.

The participants did also mention aspects not directly related to mobile access, but also to Europeana in general. These will probably be interesting for other work packages as well and are thus also summarized in the following.

Experience with Europeana and the mobile web

It can be noted that all participants had used web services from their mobile device before. The frequency of mobile web access varied from scarce to frequent use. They either already had experience using the ordinary web portal or had made themselves familiar with Europeana before answering the questionnaire.

Mobile Scenarios

To get a more general idea of the context in which a mobile Europeana application would be used, we asked the participants to think of three example scenarios they would think mobile access to Europeana made sense. The answers included

- finding material for a presentation, e. g. images
- comparing an original object to the information inside Europeana
- finding related information to cultural works when at a cultural site
- discussing a cultural object with a colleague
- verification of questions that cannot be clarified using Google when out of office
- collecting soundtracks / videos to enjoy on journeys

Most important features

The participants were asked to denote the three top functions they would expect from a mobile client for Europeana. The main requested feature was the support of different mobile devices, e. g. a presentation of search results or images that fits the screen resolution of the used mobile device. Also, the speed of the application was considered crucial. One participant demanded the ability to enlarge images or get more detail on items on demand.

Location aware Search

We asked the participants whether they would be interested in location aware search functionality. Participant A thinks that location aware search would be a very interesting feature. Participant B pointed out that location aware search would be "nice to have, not need to have", but could probably be a "selling point" for the mobile client. The third was unsure about this question but found location aware functions an advantage to get to the original works.

Mobile use of Europeana

The participants were also asked whether they would think users would access Europeana from their mobile device. They noted that mobile access would not be an obvious feature for Europeana and that they probably would only be using it for short search sessions. Another participant mentioned that a mobile client would probably not make much sense, as the current web portal would already lack some needed functionality. There is obviously significant skepticism towards accessing Europeana on mobile devices. The participants seemingly couldn't imagine that a mobile client would add true value to their Europeana experience. On the other hand, the participants identified various scenarios where a mobile client would make sense and would add true value to their Europeana experience.

This fact primarily shows that the acceptance of a mobile client may be dependent on adding features that are not available in the web portal in mobile scenarios, such as device specific presentation of search results or location aware search functions. The results may also be influenced by experiences with the current Europeana web portal, which from the users' points of view, seems to lack certain critical functionality at the moment.

eMobile "App"

The participants were asked whether they would install a third party application on their mobile device if it would add more features than an ordinary web client. The results on this aspect are ambivalent. One participant would install such an application without worrying, one was skeptical towards a third-party application and one would do so only if it provided added value compared to a web based service. We imply that a web-based frontend that doesn't need to install software on the user's device may thus be the best option for the development of a mobile client, especially when taking into consideration the current state of the art, which shows that the execution of rich web applications on mobile devices is already possible on many devices and is likely to become common in the next years.

General Issues (Not specific to mobile use)

One participant pointed out that the look and feel of the Europeana portal is good, although the purpose of the web site could be unclear to users at first. Another participant was rather frustrated by the usability of the current Europeana web portal and found it hard to use. He / She proposed the constraints of a mobile client should be transferred to the Europeana web portal to make it simpler to use. Also, community and semantic search features were missed in the current web

portal. According to one participant, the interlinking with social websites, such as facebook, should be a top priority. The speed of the current “timeline” function was also criticized. Another aspect concerns the quality of the results: One participant mentioned that Google often returned better results for his / her needs. Also, one participant missed information about the geographic location of the objects in the database.

General Issues (Specific for mobile client)

The participants were also asked if they had general comments about the development of mobile access to Europeana. These were the answers:

- A mobile client should be “simple, sexy and smart”
- The tagging of objects and sending of contents to a social website was considered important
- The language of the user interface could be influenced by the geographic position of the user
- Interactivity of the application was considered important, though hard to implement
- The mobile Europeana client has to return better results than Google

Discussion and conclusion

The survey gives an interesting picture about the image of Europeana and the features users demand of a mobile client for Europeana. The participants gave some comments concerning the improvement of some aspects of the current Europeana web portal, particularly when it comes to quality of the search results, purpose of the web site and speed. Thus, for a mobile client, an easy operation was explicitly demanded by some of the participants. The added value of a mobile client was not obvious to the users at first sight, although they were able to identify numerous scenarios for a mobile Europeana client, including research, educational and fun use of Europeana in mobile context. It seems their opinions may be biased by the current look and feel of the Europeana web portal, which is not optimized for mobile devices at the current time. The most important features identified were the performance of the mobile application and the support of the different capabilities of mobile devices, e. g. different resolutions of the used displays. Also, location aware search features were interesting for the users and were seen as feasible features for a mobile client. Concerning the installation of a third-party application on their devices, the users were ambivalent. One participant would install such an application, while the others were skeptical or didn’t see a need for an additional application. The users were particularly interested in social networking, good search results and, first of all, a simple, fast and interactive mobile interface to Europeana.

4.2 Overview

Along with the consideration of the formerly presented context of use, we can now conclude the requirements of this task in the following. The user requirements are split into three parts:

1. *Functional requirements* that describe the behaviour and features of the mobile Europeana client. To capture the functional requirements, we rely on the specification of use cases.
2. *Non-functional requirements* that specify qualitative aspects of the system. These result from the context EuropeanaConnect is embedded in and include the maintainability of the software code and the scalability of the system.
3. *Constraint requirements* that primarily result from external stakeholders, in our case the Europeana Office. Also, the technical development of the mobile market limits the space of possible features that can be integrated.

The combination of these requirements will form the base for the design of the mobile prototypes to be developed in this task.

4.3 Functional Requirements

The functional requirements presented here define the behaviour of eMobile. We use the well-known approach of formalising the functional requirements in use cases, following a template of (Cockburn, 2001).

If not specified otherwise, the actors in all use cases are a mobile user accessing Europeana from his or her mobile device using the mobile client to be developed in this task (3.4).

UC 1.1 Simple Search

Short description:	The system shall allow the user to do a simple keyword search
Trigger:	User wants to look up information in the Europeana database
Preconditions:	User has entered the simple search screen
Postconditions:	A set of search results is visually presented to the user on his or her mobile device.
Normal flow:	The user enters a search string and starts the search
Alternative flow:	none

UC 1.2 FACETED Search

Short description:	The system shall allow the user to do a faceted search over different categories
Trigger:	User wants to look up specific information in the Europeana database
Preconditions:	User has entered the advanced search screen
Postconditions:	A set of search results is visually presented to the user on his or her mobile device.
Normal flow:	The user enters a search string and starts the search
Alternative flow:	none

UC 1.3 Location Aware Search

Short description:	The system shall allow the user to do a location aware search based on the user's current position
Trigger:	User wants to look for cultural works in the Europeana database in a specific perimeter around his current location
Preconditions:	User is using a mobile browser that supports the W3C Geolocation API. He or she has entered the location aware search screen.
Postconditions:	A set of search results is visually presented to the user on his or her mobile device.

Normal flow:	The user enters a search string and starts the search
Alternative flows:	The user enters no search string and starts the location aware search. The search result displays a list of cultural works around his current location.

UC 2.1 Visualization of Search Results in text-only List

Short description:	The system shall allow the user to visualize results in a text-only perspective
Trigger:	Visualization of Results of UC1.1-1.3
Preconditions:	Searching by the system is finished, results are rendered in gallery-, map- or mixed mode. User selects Text-only mode.
Postconditions:	The result set is visualized in a text-only perspective.
Normal flow:	User has initiated a search. Text-only mode is currently selected.
Alternative flow:	User selects text-only visualization from the results page.

UC 2.2 Visualization of Search Results in gallery list

Short description:	The system shall allow the user to visualize results in an image-only gallery perspective
Trigger:	Visualization of Results of UC1.1-1.3
Preconditions:	Searching by the system is finished, results are rendered in text-only, map- or mixed mode. User selects Gallery mode.
Postconditions:	The result set is visualized in a gallery perspective.
Normal flow:	User has initiated a search, results are displayed after search has finished.
Alternative flow:	User selects gallery visualization from the results page.

UC 2.3 Visualization of Search Results in Mixed list

Short description:	The system shall allow the user to visualize results in a mixed image/text perspective
Trigger:	Visualization of Results of UC1.1-1.3
Preconditions:	Searching by the system is finished, results are ready to render or already rendered in Text-only, map- or mixed mode. Mixed mode is selected (by default or through user selection).
Postconditions:	The result set is visualized in a mixed image / text perspective.
Normal flow:	User has initiated a search, results are displayed after search has finished.
Alternative flow:	User selects mixed mode from the results page.

UC 2.4 Visualization of Search Results in a map

Short description:	The system shall allow the user to visualize results in a map, showing entries in a specified perimeter around his / her current location.
Trigger:	Visualization of Results of UC1.1-1.3
Preconditions:	Searching by the system is finished, results are rendered in gallery-, text- or mixed mode. The mobile device uses a modern browser supporting the W3C Geolocation API. User selects map mode.
Postconditions:	The result set is visualized in a perimeter around the user's current location.
Normal flow:	User has initiated a search, results are displayed after search has finished.
Alternative flow:	User selects map mode from the results page.

UC 3 Visualize details of an item in the search results

Short description:	The system should allow the user visualize details of a selected item in the search results
Trigger:	User wants to see more details of an item
Preconditions:	User has entered the search results screen
Postconditions:	The system renders a page with details of the selected item
Normal flow:	The user selects an item from the search result set for detailed viewing
Alternative flow:	none

4.4 Non-functional Requirements

In contrast to functional requirements, non-functional requirements do not make a statement about the behaviour of the system, but about its quality. They are an essential part of the requirements definition, especially in the context of larger projects as Europeana, in which thousands of users are potentially working with the system each day. In the following, we will thus present the qualitative requirements that should be met by the mobile client to be developed in EuropeanaConnect.

N1 Usability

The usability of the mobile client is a critical aspect that demands special attention. According to DIN EN ISO 9241-11, usability is defined as the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."

In the context of the Europeana mobile client, these demands are detailed as follows:

- The system should allow users to *efficiently* use the Europeana mobile client. The system should allow users to reach their goals without digressions. It should quickly react to the user's actions, be non-distracting and should allow users to operate the system in a linear way.

- The mobile client should support the mobile users of Europeana in *effectively* fulfilling their tasks in a mobile context. It should aid the user in extracting the right results out of the Europeana Database and should assist users in finding the results they need. This includes a clear layout of the display and an unambiguous navigation through the various functions of the system.
- The user's interaction with the system should be *satisfying*, with a strong emphasis on the user's feelings when using the system and after using the system. To reach the goal of satisfaction, users need to be supported in finding the results they need. This includes aspects as a straightforward interface design and the minimization of necessary interactions by the user, as bandwidth and speed of mobile lines are usually limited.

There are several aspects that need to be considered to ensure a high usability of the system. Interface design guidelines as the "ten usability heuristics" by (Nielsen, 1994), the "eight golden Rules" by (Shneiderman, et al., 2004) and usability standards, in particular DIN EN ISO 9241-110 (ISO, 2006) serve as a base for the development of a well usable system.

According to the user centred design process, we will evaluate the usability of the system in a user study as part of work package 3.4.4, after the release of RHINE in M15.

N2 Security

One of the most important non-functional requirements is security. Security requirements come in different forms:

Privacy

The system shall not store any personal information about a certain user that can not be changed by the user him/herself (e.g. personalized search settings or saved queries). It shall not allow unauthorized individuals or programs access to any communication.

Access rights

The system shall verify the identity of all its users before allowing them to use personalized features. The system will therefore use existing authentication mechanisms proposed by the Europeana Office to handle authorization requests. It shall not allow unauthorized individuals or programs access to any stored personal data or allow a user to access account information of a different user.

N3 Scalability

Scalability is a critical issue for all developments in the EuropeanaConnect project. Europeana will become a central service for all Europeans and is therefore likely to experience heavy traffic from day to day. This also holds true for the mobile web client developed in this task. As we pointed out, mobile access to Europeana is likely to be used in a similar frequency than the ordinary web service. It thus needs to be made sure that eMobile will be scalable according to the increasing popularity of Europeana. This aspect needs to be considered when developing the software. Also, the steps necessary to scale eMobile horizontally need to be appropriately documented.

N4 Extensibility

Extensibility is a quality of design that takes possible future advances into consideration and attempts to accommodate them. The system shall therefore be able to allow the addition of features without impact to the existing system functions. The usage of SPRING as a framework,

as recommended by the Europeana Office, will assist in keeping the system flexible and extendable.

N5 Maintainability

The code developed in this task needs to be maintained by external institutions, i. e. the Europeana Office, after the project. To ensure this, we support the development architecture proposed by the Europeana Office, concerning development platforms and tools, as well as programming language and frameworks as good as possible. We will also document all necessary features and parts of the code having in mind the developers of external service providers.

N6 Testability

To ensure a proper testability of the code, we will develop unit tests for all critical parts of the software. Unit tests can be executed automatically to confirm the correct operation of the code after changing parts of the system. We will furthermore test the operation of the system manually to ensure proper operation from a user centric point of view.

N7 Platform Compatibility

As pointed out in chapter 0, the landscape of mobile devices looks quite heterogeneous. A diversity of mobile devices exists, offering different resolutions, browsers and technical features. The system should thus support a wide range of mobile devices and offer optimized versions of the mobile Europeana portal that suit the various mobile devices used. This is also backed by the results from the user survey. All users pointed out that the support of different mobile devices would be one of the key features of mobile access to Europeana.

N8 Performance

In a mobile scenario, performance is a critical aspect, as mentioned by two participants of the survey explained above. Since mobile internet connections still have to deal with lower bandwidths than regular internet connections, one of the main focus points for performance considerations should be the amount of transferred data. It shall only transfer data relevant to his/her query that makes sense in a mobile environment. E.g. a high resolution image should only be loaded if the user wants to view and actively selects it. The system shall respond to a user-query immediately and as fast as possible. Mobile devices still sometimes lack processing power, so displaying hundreds of results could affect the user's experience.

4.5 Constraint Requirements

The result of WP 3.4 will be a prototype of a mobile client for Europeana. Nevertheless, the later integration of some or all results of this WP into Europeana is a primary goal that is being worked on by Task 3.4.5. Because of this, there are some constraints in the form of technical demands that are made by the Europeana office. These are described in detail in the Guidelines for the use of EuropeanaLabs (Siebinga, et al., 2009). In the following, we will describe the different external requirements and how they will be dealt with during the development of the mobile clients.

C1 Development Process

EuropeanaLabs is the official environment for the implementation and testing of new components to europeana.eu. When submitting a new component, the submission has to undergo a specified process that is specified in (Siebinga, et al., 2009). This includes providing a functional specification with use cases and user scenarios. The integration and acceptance of the code will

then be dependent on the Europeana Office. eMobile will be an experimental approach that will not deliver final versions of software, but prototypes that show what is possible in mobile computing at this time. Despite that, the integration with Europeana is still a top priority, and the development of eMobile is dependent on parts of Europeana that will be specified later. Thus, the official development process needs to be taken into account when developing the client.

C2 Programming language

The core of Europeana Europeana.eu is based on Java technology. This is why Java will need to be used as the programming language for the development of the Europeana mobile client as well, as it has to be maintained and integrated by the Europeana Office at a later stage.

C3 Application Server

The Europeana Office requires the deployment into the Tomcat 6 or Jetty application servers. eMobile should thus also support these application servers.

C4 Testing system

For continuous integration purposes, the testability of all code with Junit4 needs to be established. eMobile should thus integrate such tests for all of its code.

C5 Dependency Injection / AOP

To ensure an easy reconfiguration and exchange of parts of the system, the system uses SPRING as a framework for dependency injection and aspect oriented programming. As a special variant for web services, the use of SPRING-MVC is encouraged. eMobile should thus be embedded in the SPRING-MVC environment.

C6 Operating System

The web client will run in a Linux based environment and should thus be compatible with operation on the Linux OS.

C7 Build manager

The Europeana Office requires the use of Maven2 or ApacheAnt as build managers. As Maven2 is the recommended way, eMobile should use Maven as build manager.

C8 RIA Toolkits

For RIA, the use of Google AWT is recommended by the Europeana Office. The development of the rich functions of eMobile should thus be based on this framework, if possible.

C9 Statelessness

Europeana applications need to be scalable by clustering and replication. This is why web applications developed in EuropeanaConnect need to be stateless, which is also enforced by disabling sessions on the servers. eMobile therefore must not rely on sessions but use stateless interaction instead.

C10 External libraries

The Europeana Office proposes the use of already integrated libraries in the development process for the sake of maintainability. eMobile should thus try to use existing libraries whenever possible.

5. Conclusion

In this document, we have presented the requirements for the development of mobile access to the Europeana database. We started with the identification of the context of use for a mobile Europeana client, including the identification of stakeholders, user profiles and personas, which will serve as a guideline throughout the whole development process.

The requirements derived in the following are based on a user survey we conducted with representatives of our project partners, which gave clear insights on the needs of potential Europeana users. The functional requirements, which describe the behaviour of the system, were modelled in use cases, identifying actors, functionality, pre- and postconditions. The non-functional requirements were given a special focus, as aspects like the scalability and performance of the system play a key role in a large project like EuropeanaConnect. Closing with external constraint requirements, a clear guideline was formulated for the development of the design of the eMobile prototypes.

According to those requirements, eMobile should enable users to

- Access information in Europeana from their mobile devices
- Present a mobile version of Europeana in a way optimized for the accessing devices capabilities, considering
    - Colors
    - Resolution
    - Capabilities of the mobile browser (e. g. static or dynamic version)
- Perform location aware searches in Europeana, i. e. search for cultural works around the user's current position

5.1 Outlook

The requirements identified herein form the base for the next steps in development of eMobile. They will deliver the necessary information to develop a design for prototypes of a mobile Europeana web gateway, tailored to the specific needs of mobile users. The support of a broad diversity of mobile devices, as well as the support of GPS sensors, which enable location aware searches in Europeana, will be top priorities. We will consider the specific limitations of mobile devices, including low resolution and screen sizes. Also, we will adapt to the available technology regarding operating systems and mobile browsers to create a well suited environment for Europeana users in mobile contexts. We will also lay the base for the integration into the Europeana framework.

6. References

3B. 2009. *World FPS Market Forecast.* Mumbai, India: Bharat Book Bureau, April, 2009.

ABI Research. 2009. *Global Navigation Satellite Positioning Solutions.* London : Allied Business Intelligence, Inc, 2009.

artegic AG. 2009. *Mobile E-Mail Marketing Studie 2010.* Bonn : artegic AG, 2009.

Cockburn, Alistair. 2001. *Writing effective use cases.* s.l.: Addison Wesley, 2001. ISBN 0-201-70225-8.

Computerworld. 2009. Symbian, Android will be top smartphone OSes in '12, Gartner reiterates. [Online] 13 10 2009. [Cited: 20 10 2009.] http://www.computerworld.com/s/article/9139301/Symbian_Android_will_be_top_smartphone_OSes_in_12_Gartner_reiterates.

Financial Times Deutschland. 2009. Nokia verliert Vertrauen zu Symbian. [Online] 10 08 2009. [Cited: 20 10 2009.] http://www.ftd.de/it-medien/it-telekommunikation/:strategiewende-nokia-verliert-vertrauen-zu-symbian/551805.html.

ISO. 1998. *Ergonomic requirements for office work with visual display terminals - Part 11: Guidance on usability .* s.l. : DIN / ISO, 1998.

- . 2006. *Ergonomics of human-system interaction - Part 110: Dialogue principles.* s.l.: ISO, 2006.

- . 1999. *Human-centred design processes for interactive systems.* s.l. : ISO, 1999.

ITU. 2007. *ICT penetration rates in 2007.* 2007.

Mobile Marketer. 2009. Mobile Marketer. [Online] Mobile Marketer, 06 08 2009. [Cited: 17 10 2009.] http://www.mobilemarketer.com/cms/news/research/3859.html.

Nielsen Company. Q1, 2008. *Mobile Media Marketplace report.* New York, USA : s.n., Q1, 2008.

Nielsen, J. and Landauer, T. K. 1993. *A mathematical model of the finding of usability problems.* Amsterdam, The Netherlands : ACM InterCHI '93, 1993. pp. 206-213.

Nielsen, J. 1994. Heuristic evaluation. [book auth.] J. Nielsen and R.L. Mack. *Usability Inspection Methods.* New York : John Wiley & Sons, 1994.

Rupp, Chris. 2004. *Requirements-Engineering und Management.* München : Hanser Verlag, 2004. ISBN 3-446-22877-2.

Shneiderman, Ben and Plaisant, Catherine. 2004. *Designing the User Interface: Strategies for Effective Human-Computer Interactin.* s.l. : Addison Wesley, 2004. ISBN 978-0321197863.

Siebinga, Sjoerd, Purday, Jon and van der Werf, Bram. 2009. *Guidelines for the use of EuropeanaLabs.* 2009. Version 1.

Tomi Ahonen Consulting. 2009.*Tomi Ahonen Almanac 2009.* s.l.:Tomi Ahonen Consulting, 2009.

Wikipedia. 2009. Mobile Browsers. [Online] 2009. [Cited: 20 10 2009.] http://en.wikipedia.org/wiki/Mobile_browser#Default_browsers_used_by_major_mobile_phone_and_PDA_vendors.

Acid Tests. 2009. Acid3 Test [Online] 2009. [Cited: 22 10 2009] http://acid3.acidtests.org.

7. Appendix A – User Requirements Questionnaire (Template)

europeana
connect

MOBILE ACCESS CHANNELS FOR EUROPEANA

USER REQUIREMENTS QUESTIONNAIRE

OFFIS INSTITUTE FOR INFORMATION TECHNOLOGY
OCTOBER 2010

Information

Europeana is a database containing information about 4.6 million digitized cultural works in Europe, e. g.

- Images - paintings, drawings, maps, photos and pictures of museum objects
- Texts - books, newspapers, letters, diaries and archival papers
- Sounds - music and spoken word from cylinders, tapes, discs and radio broadcasts
- Videos - films, newsreels and TV broadcasts

We (OFFIS Institute for Information Technology, Oldenburg, Germany) are currently developing a ***mobile phone application*** for accessing Europeana. We are currently conducting interviews to better understand the requirements of potential Europeana users. We would thus like to ask you for your help. In this questionnaire, we would like to find out the most important features such an application should have in your opinion.

Please note:

1. To properly answer this questionnaire, it is crucial to understand what Europeana is about. If you have no experience with Europeana yet, please *take some time and accommodate yourself with the Europeana portal at* http://europeana.eu.

2. The questionnaire. Describe all of your thoughts *thoroughly* and be *as detailed as possible*. Use as much space as needed.

3. If you have any questions, please contact me at tobias.hesselmann@offis.de or by phone +49-441-9722-139.

User Profile

First, we would like to ask you for some information about yourself. Please note that all information will be treated anonymously. Your contact information will be used for follow-up questions only.

Name	
Occupation	
Age	
Gender (male / female)	
Phone No.	
Email	
Does your job involve customer contact? If so, to what extent?	

Experience with Europeana and mobile devices

1. Please describe your experience with Europeana and the europeana.eu website in a few sentences

2. How much experience do you have with accessing the internet from your mobile device, e. g. cell phone?

3. Which other internet services have you used on a mobile phone before (e. g. Google, Wikipedia)?

Europeana Features

When answering the following questions, please bear in mind the mobile scenario: You want to access and use the various functions of Europeana with your mobile device, e. g. mobile phone.

4. We are interested in situations users would access Europeana from their mobile devices. Please try to describe 3 different mobile scenarios in a few sentences.
1. 2. 3.

5. What would you think would be *the 3 most important features* of a mobile phone application for Europeana?
1. 2. 3.

6. Which mobile devices do you think users would like to use for accessing Europeana?

7. Would you imagine that users would use their mobile device to search and browse inside the Europeana database? In what way?

8. Would you imagine that *location aware services* would be useful in a mobile client for Europeana (e. g. searching for cultural works or institutions around the user's current position)?

9. Europeana will be accessible through your mobile device via its built-in web browser. However, a standalone application may add additional features to your mobile Europeana experience. Would you accept to have an additional application installed on your mobile device and what would you expect from it?

10. Do you have any other suggestions or comments regarding the Europeana mobile phone application?

Thank you very much for your time. If you have any questions, please get back to tobias.hesselmann@offis.de.